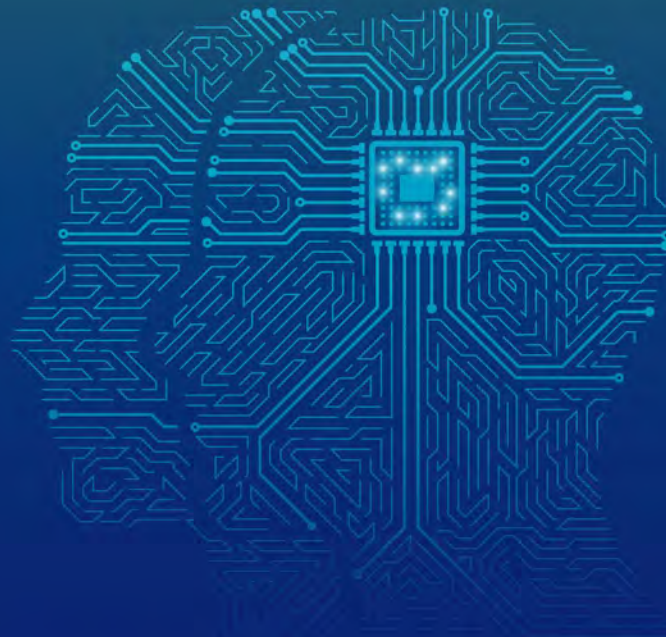


www.sstforum.com



# 2023 SEOUL S&T FORUM

November 7, 2023  
The Plaza Hotel, Seoul, Korea

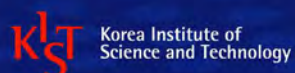


## A.I. Innovation and our Future Society

Hosted by



Organized by

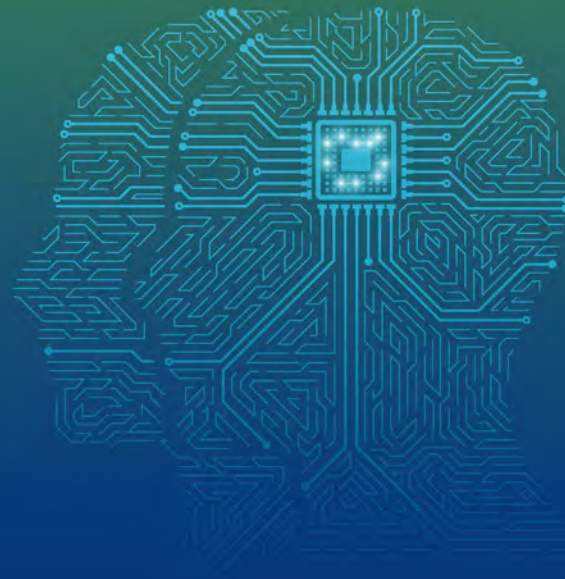


Sponsored by





# 2023 SEOUL S&T FORUM



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## 2023 SEOUL S&T FORUM INVITES YOU!

We are pleased to invite you to join us for the 2023 Seoul Science & Technology (S&T) Forum. The event will be held on Tuesday, November 7, 2023 at the Plaza Hotel in Seoul, Korea under the theme of "A.I. Innovation and our Future Society." This year's Forum is hosted by the National Research Council of Science & Technology (NST), organized by the Korea Institute of Science and Technology (KIST) and the Science and Technology Policy Institute (STEPI), and sponsored by the Korean Ministry of Science and ICT (MSIT).

Since its foundation in 2010, the Seoul S&T Forum has served as a platform for discussing the inclusive and sustainable development of Science and Technology. For this year's event, we aim to explore the limitless possibilities of A.I. and its impact on our future society.

The event will feature 2 keynote speeches, as well as 6 presentations and 2 panel discussions divided across 2 Sessions. The themes for the keynote speeches will be "Building Embodied Autonomous Agents with Multimodal Interactions" and "AI & Data Utilization in Public Sector." Each Session will consist of 3 presentations and a panel discussion, with the theme for Session I being "The Issues of AI in the Public and Private Sector: Challenges and Values," and Session II dealing with the topic of "Humans, AI and Robots: A New Paradigm for Collaboration and Coexistence."

The 2023 Forum is expected to be an invaluable opportunity for exchanging ideas and sharing perspectives, and will be open to the public via livestream on the NST YouTube channel, with simultaneous Korean-English interpretation services also being provided.

We sincerely hope that you will be able to join us for this year's Forum, as your insights and expertise would contribute significantly to the event's success.

We look forward to seeing you at the Forum!



**Bok Chul Kim**

**Chairperson**

National Research  
Council of Science  
& Technology  
(NST)



**Seok-Jin Yoon**

**President**

Korea Institute  
of Science and  
Technology  
(KIST)



**Mi Ock Mun**

**President**

Science and  
Technology  
Policy Institute  
(STEPI)

# PROGRAM AT A GLANCE

---

Tuesday November 7 @ Diamond Hall, The Plaza (22F), Seoul

10:00-10:30

Opening Ceremony

10:30-11:10

Keynote Speech I. Building Embodied Autonomous Agents with Multimodal Interactions

11:10-11:50

Keynote Speech II. AI & Data Utilization in the Public Sector

11:50-13:20

Luncheon

13:20-15:20

Session I. The Issues of AI in the Public and Private Sector: Challenges and Values

15:20-15:40

Coffee Break

15:40-17:40

Session II. Humans, AI and Robots: A New Paradigm for Collaboration and Coexistence

17:40-17:50

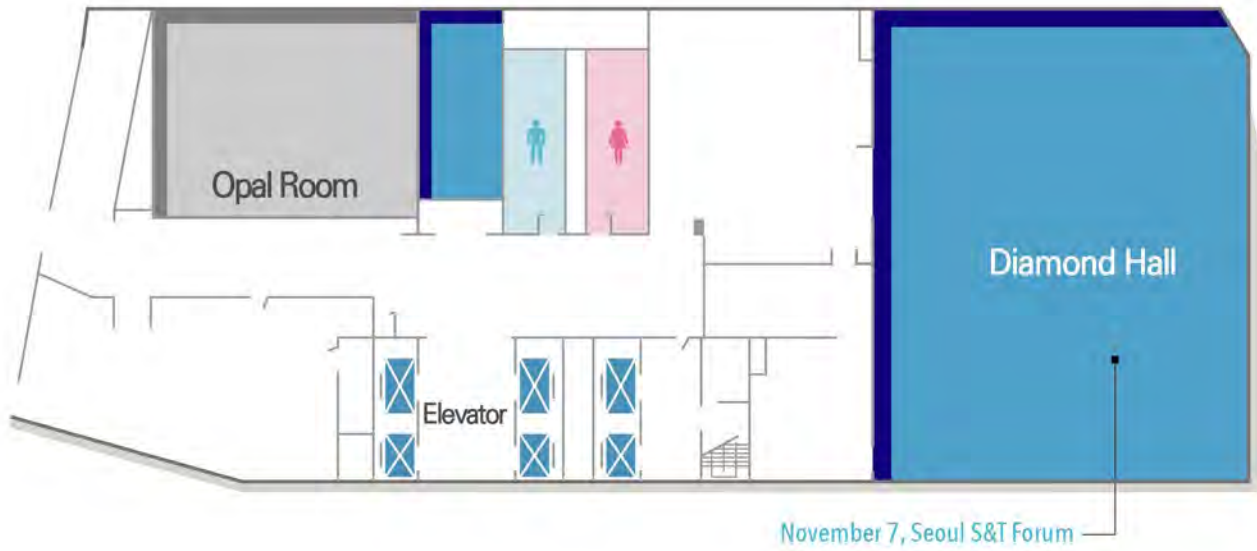
Closing

17:50-

Gala Dinner



# VENUE LAYOUT



# TRANSPORTATION

**The Plaza Hotel (Diamond Hall, 22F)**  
Address: 119 Sogong-ro, Jung-gu, Seoul, Korea 04525  
Tel: 82.2.771.2200 Fax: 82.2.755.8897

**PARKING**  
Parking Lot: Hotel annexed building B1  
Parking Fee: 10 hours for free

**SUBWAY**  
1-2 minutes' walk from Exit 6 of City Hall Station (Lines 1 and 2)

**BUS**  
Alight at stop in front of City Hall

The map shows the location of The Plaza Hotel at the intersection of Sogong-ro and Seongsu-ro. Key landmarks include City Hall, Seoul Plaza, Lotte Department Store, and Bank of Korea. Transportation options include subway (Exit 6 of City Hall Station) and bus (stop in front of City Hall).

# PROGRAM

A.I. Innovation and our Future Society   November 7, 2023	
Opening Ceremony	
	<b>Opening Remarks</b> <b>Bok Chul Kim</b> , Chairperson, National Research Council of Science & Technology (NST)
10:00-10:30	<b>Welcoming Remarks</b> <b>Seok-Jin Yoon</b> , President, Korea Institute of Science and Technology (KIST) <b>Mi Ock Mun</b> , President, Science and Technology Policy Institute (STEPI)
Keynote Speech	
10:30-11:10	<b>Keynote Speech I. Building Embodied Autonomous Agents with Multimodal Interactions</b> <b>Ruslan Salakhutdinov</b> , Professor, Machine Learning Department, Carnegie Mellon University
11:10-11:50	<b>Keynote Speech II. AI &amp; Data Utilization In Public Sector</b> <b>So Ah Park</b> , Vice President, VAIV Company
11:50-13:20	Luncheon
Session I. The Issues of AI in the Public and Private Sector: Challenges and Values	
13:20-13:45	<b>Presentation I. Creating an Environment for Utilizing AI Technology</b> <b>Minsung Kim</b> , Head, Government & Regulatory Affairs, IBM Korea
13:45-14:10	<b>Presentation II. Understanding of AI Regulation System and Policy Implications</b> <b>KwangHo Lee</b> , Senior Research Fellow, Office of Innovation Law & Institution Research, Science and Technology Policy Institute (STEPI)
14:10-14:35	<b>Presentation III. Aligning AI to Commercial Value</b> <b>Jack Hampson</b> , CEO, Deeper Insights/ UK Governments AI Dealmaker for the Global Entrepreneur Programme
14:35-15:20	<b>Panel Discussion (Chair, Presenters, Panelists, Q&amp;A Session)</b> Chair : <b>Kyoungjin Choi</b> , Professor, College of Law/ Director, Center for AI-Data and Policy, Gachon University Panelists : <b>Won H. Cho</b> , Founding Partner, D'LIGHT Law Group <b>Hyeonkyu Lee</b> , PM, PM Group, Institute of Information & Communications Technology Planning & Evaluation
15:20-15:40	Coffee Break
Session II. Humans, AI, and Robots: A New Paradigm for Collaboration and Coexistence	
15:40-16:05	<b>Presentation I. Machine Learning Techniques for Science and Engineering: Focused Study on Materials Science</b> <b>Seung-Cheol Lee</b> , Director, Indo-Korea Science and Technology Center, Korea Institute of Science and Technology (KIST)
16:05-16:30	<b>Presentation II. Geospatial Foundational AI for Sustainable and Regenerative Agriculture</b> <b>Praveen Pankajakshan</b> , Head, Cropin AI Lab, India
16:30-16:55	<b>Presentation III. Efficient Large-scale 3D Modeling Using Omnidirectional Vision and Depth Sensing</b> <b>Jongwoo Lim</b> , Professor, Mechanical Engineering, Seoul National University
16:55-17:40	<b>Panel Discussion (Chair, Presenters, Panelists, Q&amp;A Session)</b> Chair : <b>Hwasup Lim</b> , Head, Center for Artificial Intelligence, Korea Institute of Science and Technology (KIST) Panelists : <b>Pawan Goyal</b> , Associate Professor, Department of Computer Science and Engineering, IIT Kharagpur <b>Sung Soo (Eric) Kim</b> , Founder and CEO, Datacrunch Global/ Adjunct Professor, School of International Studies, Hanyang University
17:40-17:50	Closing
17:50-	Gala Dinner

# SPEAKER

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## Keynote Speech I

### *Building Embodied Autonomous Agents with Multimodal Interactions*



**Name** Ruslan Salakhutdinov  
**Position** Professor, Machine Learning Department  
**Organization** Carnegie Mellon University  
**Email** rsalakhu@andrew.cmu.edu

#### Education

**BA** Double major in Computer Science and Mathematics, Honors Degree. High Point University, NC, USA.  
**MS** Department of Computer Science, University of Toronto  
**PHD** Department of Computer Science, University of Toronto

#### Career

**2016~ Present**  
Professor, Machine Learning Department, Carnegie Mellon University  
**2011~2016**  
Assistant Professor, Department of Computer Science and Department of Statistical Sciences, University of Toronto  
**2009~2011**  
Postdoctoral Research Associate, Brain and Cognitive Sciences (BCS) and Computer Science and Artificial Intelligence Lab (CSAIL), MIT.

#### Summary

In this talk, I will show how we can design modular agents for visual navigation that can perform tasks specified by natural language instructions, perform efficient exploration and long-term planning, build and utilize 3D semantic maps, while generalizing across domains and tasks. Specifically, I will first introduce a novel framework that builds and utilizes 3D semantic maps to learn both action and perception in a completely self-supervised manner. I will show that the new framework can be used to close the action-perception loop: it improves object detection and instance segmentation performance of a pretrained perception model by moving around in training environments, while the improved perception model can be used to improve on object goal navigation tasks. In the second part of the talk, I will introduce a method to ground pretrained text-only language models to the visual domain, enabling them to process arbitrarily interleaved image-and-text inputs, and generate free-form text interleaved with retrieved images, I will show that the model is able to achieve strong zero-shot performance on grounded tasks such as contextual image retrieval and multimodal dialogue, and showcase its interactive abilities.

# SPEAKER

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## Plenary Speech II

### *AI & Data Utilization in Public Sector*



**Name** So Ah Park  
**Position** Vice President  
**Organization** VAIV Company  
**Email** soapark32@vaiv.kr

#### Education

**BA** Natural Science,  
Mokpo National University  
**MS** Computer Engineering,  
Hannam University  
**PHD** Computer Engineering,  
Hannam University

#### Career

**2019~**  
Head of Division, Digital Transformation Service Division, VAIV Company

**2016~2019**  
General Manager, Digital Government Service Team, 2e Consulting Inc

**2000~2014**  
General Manager, Government Consulting Team, Samsung SDS

**2020~2021**  
Advanced Program for Urban and Environmental Studies, Seoul University

**2022~**  
Expert adviser, Presidential Committee of Digital Platform Government

#### Summary

Since 2000, Dr. So Ah Park has been involved with several key e-government projects in Korea, and Dr. Park is currently conducting major policy research on data-based Digital Government Innovation, Smart Cities, Big Data, AI, and Digital Twins as Expert Adviser for the Presidential Committee on the Digital Platform Government.



# SPEAKER

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Session I - Chair



**Name** Kyoungjin Choi  
**Position** Professor College of Law/ Director, Center for AI·Data and Policy  
**Organization** Gachon University  
**Email** kjchoi@gachon.ac.kr

## Education

**BA** Law, Sungkyunkwan University  
**MS** Law, Duke University, USA  
**PHD** Law, Sungkyunkwan University

## Career

**2022-Present**  
President, Korea Association for Artificial Intelligence and Law

**2021-2023**  
President, Personal Information Protection Law Association

**2020-Present**  
President, Korea Association of Personal Data Professionals

**2019-Present**  
Director, Center for AI·Data and Policy, Gachon University

**2013-Present**  
Korea Delegation, United Nations Commission on International Trade Law (UNCITRAL)

# SPEAKER

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## Session I - Presentation I

### *Creating an Environment for Utilizing AI Technology*



<b>Name</b>	Minsung Kim
<b>Position</b>	Head, Government & Regulatory Affairs, IBM Korea
<b>Organization</b>	IBM Korea
<b>Email</b>	minsung.kim@ibm.com

#### Education

**BA** Business Administration,  
Hankuk University of Foreign Studies

**MBA** Yonsei University

#### Career

**2020 ~ 2023**  
Head, Government & Regulatory Affairs, IBM Korea

#### Summary

Mr. Kim's presentation will explore topics including the utilization of artificial intelligence technology in industrial areas, IBM's AI technology cooperation activities, and institutional/regulatory support for utilizing AI technology.

# SPEAKER

## Session I - Presentation II

### *Understanding of AI Regulation System and Policy Implications*



**Name** KwangHo Lee  
**Position** Senior Research Fellow, Office of Innovation Law & Institution Research  
**Organization** Science and Technology Policy Institute (STEPI)  
**Email** leekh@stepi.re.kr

#### Education

**BA** Bachelor of Science & Engineering in Inorganic Materials, Seoul National University, Korea  
**MS** Master of Science & Engineering in Inorganic Materials, Seoul National University, Korea  
**PHD** Ph.D. in Science & Engineering in Materials, Seoul National University, Korea

#### Career

**2002~current**  
Senior Research Fellow, Science and Technology Policy Institute (STEPI)  
**2016~2017**  
Group Leader for Technological Regulation Research Center, Science and Technology Policy Institute (STEPI)  
**2010~2011**  
Vising Research Fellow, Korea Development Institute (KDI)  
**2000**  
Senior Researcher, Research Institute of Advanced Materials, Seoul National University (SNU)

#### Summary

In this talk, the background of the arguments for and against AI regulation and the relationship between AI and regulation will be presented. The main contents and characteristics of the EU's 'AI regulation act' will also be introduced, as it is the first legislation about AI regulation to appear and be enacted within the framework of risk management. In addition, several critical issues about AI regulation and corresponding policy will be discussed.

# SPEAKER

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## Session I - Presentation III

### *Aligning AI to Commercial Value*



<b>Name</b>	Jack Hampson
<b>Position</b>	CEO, UK Governments AI Dealmaker
<b>Organization</b>	Deeper Insights & UK Government Global Entrepreneur Programme
<b>Email</b>	Jack.hampson@deeperinsights.com

#### Education

**BA** -  
**MS** -  
**PHD** -

#### Career

**8 years**  
Consumer Electronics

**10 years**  
Artificial Intelligence Consultancy

**2 years**  
UK Government Advisor

#### Summary

In this presentation, Mr. Hampson will explore the value of aligning an AI strategy to a business strategy, why so many AI projects historically have failed, and what businesses need to do to guarantee success. Drawing on his 10 years of experience in delivering successful AI projects to enterprise and corporate clients, Mr. Hampson will go into the details of data, people, methodology and more, giving the audience a toolkit they can use when thinking of applying AI to a business problem.



# SPEAKER

## Session I - Panelist



**Name** Won H. Cho  
**Position** Founding Partner  
**Organization** D'LIGHT Law Group  
**Email** whc@dlightlaw.com

### Education

**BA** Seoul National University  
**MS** Judicial Research and Training  
Institute of the Supreme Court of  
Korea (2001)  
University of Texas, School of Law,  
LL.M., USA  
**PHD** Seoul Venture University

### Career

**2001-2017** Partner, Bae, Kim & Lee LLC  
**2006-2008** Legal Counsel, Cultural Content and Industry Promotion Agency  
**2011-2013** Committee Member, Korean Federation of Science and  
Technology Societies  
**2011-2013** Committee Member, Presidential Council on Intellectual Property  
**2011-2014, 2017-present** Director, Korea Licensing Executives Society  
**2011-2014** Committee Member, Korea Fair Trade Commission Advisory  
Committee on Enforcement of Industrial Property Rights  
**2013-present** Adjunct Professor, KAIST, Intellectual Property Graduate School  
**2013-present** Committee Member, Korean Intellectual Property Office,  
Industrial Property Rights Dispute Settlement Committee New York  
**2014** Secondee Partner, Ropes & Gray LLP (New York)  
**2015-present** Director, Korean Association of Entertainment Law  
**2019-present** Director, Singapore Health Technologies Consortium  
**2019-present** Advisory Committee Member, Korea Association of Research  
Institute Technology Transfer  
**2019-present** Director, Korea Bar Association Small and Medium Venture  
Business Law Form  
**2019-present** Steering Committee Member, Seoul National University Dental  
Medi-Care Business Incubator  
**2020-present** Advisory Lawyer, Ministry of Science and ICT  
**2020-present** Policy Advisor of the Global Cooperation Committee of the  
Korea Pharmaceutical and Bio-Pharma Manufacturers Association  
**2020-present** Director of the Korean Banking and Financial Law Association  
**2017-present** Partner, D'LIGHT Law Group

# SPEAKER

---

## Session I - Panelist



**Name** Hyeonkyu Lee  
**Position** PM, PM Group  
**Organization** Institute of Information & Communications Technology Planning & Evaluation  
**Email** heonkyulee@iitp.kr

### Education

**BA** Computer Engineering,  
Seoul National University  
**MS** Computer Science, KAIST  
**PHD** Computer Science, KAIST

### Career

**2018~2020**  
Professor, Computer Science, KAIST  
**2011~2014**  
SVP, Open Platform Division, KT  
**2007~2010**  
Director, Mobile Center, NHN  
**2003~2007**  
CEO, Management, iCross Technology  
**1990~1999**  
Director, Research Center, Handysoft

# SPEAKER

---

Session II - Chair



**Name** Hwasup Lim  
**Position** Head, Center for Artificial Intelligence  
**Organization** Korea Institute of Science and Technology (KIST)  
**Email** hslim@kist.re.kr

Education	Career
<b>BA</b> Electronics Engineering, Hanyang University	<b>2011 - Present</b> Principal Research Scientist at Korea Institute of Science and Technology (KIST)
<b>MS</b> Electrical Engineering, Pennsylvania State University, USA	
<b>PHD</b> Electrical Engineering, Pennsylvania State University, USA	<b>2019 - 2020</b> Visiting Scholar at University of Surrey, UK
	<b>2007 - 2011</b> R&D Staff Member at Samsung Advanced Institute of Technology (SAIT)
	<b>2003 - 2007</b> Research Assistant at Pennsylvania State University

# SPEAKER

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## Session II - Presentation I

### *Machine Learning Techniques for Science and Engineering: Focused Study on Materials Science*



**Name** Seung-Cheol Lee  
**Position** Director  
**Organization** Indo-Korea Science and Technology Center, KIST  
**Email** Seuncheol.lee@ikst.res.in, leesc@kist.re.kr

#### Education

**BA** Metallurgical Engineering,  
Seoul National University  
**MS** Metallurgical Engineering,  
Seoul National University  
**PHD** Metallurgical Engineering,  
Seoul National University

#### Career

**1999~2000**  
Senior Scientist, Research Institute of Advanced Materials, Seoul National University  
**2001~Present**  
Principal Researcher, Korea Institute of Science and Technology  
**2003~2004**  
Visiting Scientist, Band Theory Group, Daresbury Laboratory, UK  
**2009**  
Visiting Scientist, Institute of Inorganic Chemistry, Aachen University, Germany  
**2013~Present**  
Director, Indo-Korea Science and Technology Center, KIST, India

#### Summary

Machine learning has brought unprecedented change to not only our society, but also to how we approach science and technology. In this talk, Dr. Lee presents his research results on applying machine learning techniques to IKST's research activities. With respect to computational science, the primary area of focus at IKST, prior to conducting research, it is possible to use machine learning techniques to perform a literary investigation and prepare a summary of the research plan, thereby narrowing down the area to be studied. For example, if we sought to design a new solar cell material which is composed of 5 or 6 elements, an astronomical number of potential combinations within that material's phase space would generally need to be studied first. However, by using first-principles calculation and machine learning techniques, it is possible to quantitatively predict new materials by reducing the research resources and time needed to screen them. As such, machine learning techniques can play a vital role in reducing the number of materials combinations.



# SPEAKER

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## Session II - Presentation II

### *Geospatial Foundational AI for Sustainable and Regenerative Agriculture*



**Name** Praveen Pankajakshan  
**Position** Head  
**Organization** Cropin AI Lab, India  
**Email** praveen@cropin.com

Education	Career
<b>BA</b> Electrical Engineering, Indian Institute of Technology (IIT), Roorkee, India	<b>2023~Present</b> Advisory Committee Member, Harvard Data Science Initiative, Harvard University, Cambridge
<b>MS</b> Electrical and Computer Engineering, Texas A&M University, College Station, TX, USA	<b>2020~Present</b> Head CropinAI Lab, CropinTechnology Private Limited, Bangalore, India. Building and Scaling AI Models for B2B
<b>PHD</b> Signal & Image Processing, INRIA, Sophia Antipolis, France, (summa cum laude)	<b>2017~2020</b> Principal Data Science Manager, Corteva Agriscience, (Legal entity E. I. DuPont), Hyderabad, India.
	<b>2014~2017</b> Data Analytic Scientist, Shell Technology Center Bangalore, India, Center for Computational Excellence

# SPEAKER

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## Session II - Presentation III

### *Efficient Large-scale 3D Modeling Using Omnidirectional Vision and Depth sensing*



**Name** Jongwoo Lim  
**Position** Professor, Mechanical Engineering  
**Organization** Seoul National University  
**Email** jongwoo.lim@snu.ac.kr

#### Education

**BA** Computer Science,  
Seoul National University  
**MS** Computer Science, UIUC, USA  
**PHD** Computer Science, UIUC, USA

#### Career

**2005~2011**  
Senior Scientist, Honda Research Institute USA  
**2011~2012**  
Software Engineer, Google, USA  
**2012~2023**  
Professor, Dept. of Computer Science, Hanyang University  
**2018~2018**  
Visiting Researcher, Microsoft, USA  
**2023~ Present**  
Professor, Dept. of Mechanical Engineering, Seoul National University

#### Summary

Recent progress in computer vision and deep learning has facilitated precise depth sensing and realistic 3D modeling from visual data. In contrast to traditional cameras, Prof. Lim's presentation will suggest implementing a multi-camera setup with ultra-wide-angle fisheye lenses boasting more than 220 degrees of field of view (FoV). Such an arrangement could enable 360-degree omnidirectional depth estimation, as well as more robust and precise visual simultaneous localization and mapping (SLAM). By combining dense depth estimation and camera trajectory, it is possible to achieve full 3D structure modeling of the environment. The camera system proposed will autonomously navigate mobile robots, generate and update HD maps for autonomous vehicles, as well as provide city-scale visual mapping through the use of helmet-mounted miniature cameras. This presentation will address fundamental challenges, the basic algorithmic concept, and practical instances in robotics and 3D modeling.

# SPEAKER

---

## Session II - Panelist



**Name** Pawan Goyal  
**Position** Associate Professor, Department of Computer Science and Engineering  
**Organization** IIT Kharagpur  
**Email** pawang@cse.iitkgp.ac.in

### Education

**BA** Electrical Engineering,  
IIT Kanpur, India

**MS** -

**PHD** Computing and Intelligent Systems,  
University of Ulster, UK

### Career

**2011-2013**  
Post-doctoral Fellow, INRIA Paris Rocquencourt

**2013-2020**  
Associate Professor, CSE, IIT Kharagpur

**2020 - present**  
Associate Professor, CSE, IIT Kharagpur

# SPEAKER

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## Session II - Panelist



**Name** Sung Soo (Eric) Kim  
**Position** Founder and CEO/ Adjunct Professor  
**Organization** Datacrunch Global/ School of International Studies, Hanyang University  
**Email** eric.kim@datacrunchglobal.com, erickimz@hanyang.ac.kr

Education	Career
<b>BS</b> Economics, University of Missouri, Columbia, MO, USA	<b>2017~Present</b> Adjunct Professor, School of International Studies/ School of Business, Hanyang University
<b>MA</b> Economics, University of Missouri, Columbia, MO, USA	
<b>PHD</b> Management Engineering, Business School, KAIST	<b>2023~Present</b> Adjunct Professor, School of Business Administration, Ulsan National Institute of Science and Technology
	<b>2016~ Present</b> Founder and CEO, Datacrunch Global



## Building Embodied Autonomous Agents with Multimodal Interactions

**Ruslan Salakhutdinov**

Professor,  
Machine Learning Department, Carnegie Mellon University

# Keynote Speech I

Building Embodied Autonomous Agents with Multimodal Interactions

Carnegie Mellon University

## Building Embodied Autonomous Agents with Multimodal Interaction


Russ Salakhutdinov  
Machine Learning Department  
Carnegie Mellon University

Carnegie Mellon University


ML  
MACHINE LEARNING  
DEPARTMENT

2 Carnegie Mellon University

### Computer Vision




### Accuracy




Year	Accuracy (%)
2010	~50
2011	~65
2012	~80
2013	~90
2014	~95
2015	~98
2016	~99
2017	~100
2018	~100

### Speech Recognition




### Accuracy



Year	Accuracy (%)
2010	~50
2011	~65
2012	~80
2013	~90
2014	~95
2015	~98
2016	~99
2017	~100
2018	~100

### Reasoning & Planning



### Language Understanding

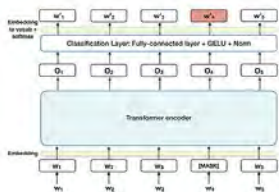



Diagram illustrating a neural network architecture for language understanding. It shows an input layer with words  $w_1, w_2, w_3, w_4, w_5$  and an embedding layer  $e_1, e_2, e_3, e_4, e_5$ . The embedding layer feeds into a **Transformer encoder**. The output of the encoder feeds into a **Classification Layer: Fully-connected layer + GELU + ReLU**. The output of the classification layer feeds into an output layer with words  $o_1, o_2, o_3, o_4, o_5$ .

### Robotics




# Keynote Speech I

Ruslan Salakhutdinov

3 Carnegie Mellon University


## Machine Learning + Data

### Perception and 3D Scene Understanding




- monitor
- keyboard
- mouse
- cup
- lamp
- globe
- cylinder


### Conversational Agents



### Recommendation Systems



### Machine Translation



### Medical Image Analysis

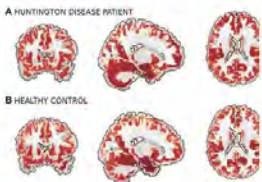



FIGURE 7 | A gray matter MRI scans of an HD patient (A) and a healthy control (B).

### Self Driving Cars



4 Carnegie Mellon University

## Machine Learning Trends

Trends:

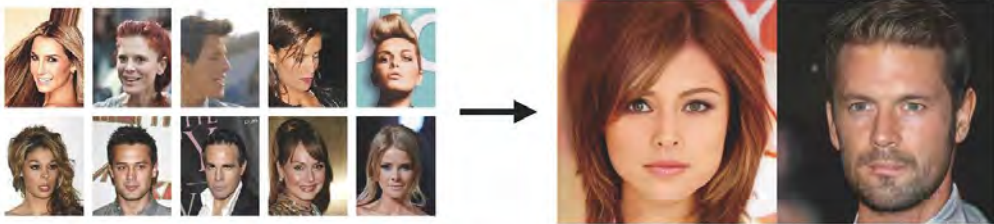
- ▶ Super-human computer perception
- ▶ Rapid progress in natural language analysis, conversational AI
- ▶ Large scale self-supervised learning, multi-modal learning
- ▶ Adversarial robustness, bias, fairness, explainability
  
- ▶ Huge commercial investments in AI and machine learning
  - natural language understanding, perception, AR/VR , self-driving cars, robotics
- ▶ AI for public health, AI for drug discovery
- ▶ AI for environmental sustainability
- ▶ Privacy concerns

# Keynote Speech I

## Building Embodied Autonomous Agents with Multimodal Interactions


5 Carnegie Mellon University

### Rapid Progress in AI



Training Data(CelebA) Model Samples (Karras et.al., 2018)

4 years of progression on Faces




2014 2015 2016 2017 Brundage et al., 2017


6 Carnegie Mellon University

### Conditional Generation

- ▶ Conditional generative model  $P(\text{zebra images} | \text{horse images})$



- ▶ Style Transfer



Input Image Monet Van Gogh

Zhou et al., Cycle GAN 2017



# Keynote Speech I

Ruslan Salakhutdinov

7 Carnegie Mellon University

## Reuse of Large-Scale Pre-trained Models

[Esteva et al., *Nature* 2017]

8 Carnegie Mellon University

## Open AI: GPT4

**Human:** Hey, how are you doing?  
**AI:** I'm good! What would you like to chat about?  
**Human:** Have you done any coding with Python?  
**AI:** Yep! I've done a lot of Python coding as it is my favorite language.  
**Human:** Nice, it's my favorite too! What have you done with it?  
**AI:** Oh, a lot. I have done everything from creating Python modules to creating micro-websites with it.  
**Human:** What web framework do you use?  
**AI:** I used to use Django, but it was too difficult for me. I have found Flask is a better option as it's lighter and simpler.  
**Human:** Wow, I agree 100%. Have you used WebSocket at all?  
**AI:** Yes, I actually have written a chatbot using it!  
**Human:**

Problem	Generated Code	Test Cases
<b>H-Index</b> Given a list of citations counts, where each citation is a nonnegative integer, write a function <code>h_index</code> that outputs the h-index. The h-index is the largest number <code>h</code> such that <code>h</code> papers have each least <code>h</code> citations.  Example: Input: [3,0,6,1,4] Output: 3	<pre>def h_index(counts):     n = len(counts)     if n &gt; 0:         counts.sort()         counts.reverse()         h = 0         while (h &lt; n and               counts[h]-1 &gt;= h):             h += 1         return h     else:         return 0</pre>	Input: [1,4,1,4,2,1,3,5,6]  Generated Code Output: 4 ✓  Input: [1000,500,500,250,100, 100,100,100,100,75,50, 30,20,15,15,10,5,2,1]  Generated Code Output: 15 ✓


- ▶ Chatbots
- ▶ Question-Answering Systems
- ▶ Information Retrieval
- ▶ Code Generation

# Keynote Speech I

## Building Embodied Autonomous Agents with Multimodal Interactions

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### Diffusion Models



The slide displays three distinct images generated by diffusion models. The first image on the left shows two anthropomorphic pandas in a forest setting; one is dressed in a brown jacket and is aiming a bow at the other panda, who is also dressed in a dark jacket and holding a sword. The middle image depicts the Leaning Tower of Pisa, showing its characteristic tilt and the surrounding landscape with a blue sky. The third image on the right shows two astronauts in full space suits riding horses in a dark, open landscape.

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### Stable Diffusion (Rombach et al 2022)

Text-to-Image Synthesis on the Conceptual Captions dataset

<i>'A basket full of cherries'</i>	<i>'Children playing football'</i>	<i>'People watching a fireworks in the night'</i>	<i>'A road in the middle of nowhere'</i>	<i>'Flowers on a field in spring'</i>	<i>'A historical map'</i>	<i>'A storm is rising'</i>	<i>'Crowded scene in front of a pub'</i>
							
							
							
							



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## Stable Diffusion (Rombach et al 2022)

Semantic Synthesis on Flickr-Landscapes [21]

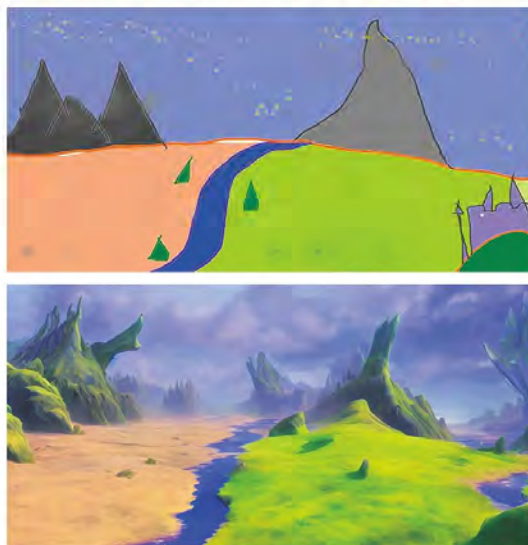


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## Stable Diffusion (Rombach et al 2022)

“A fantasy landscape, trending on artstation”



# Keynote Speech I

## Building Embodied Autonomous Agents with Multimodal Interactions

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### Talk Outline

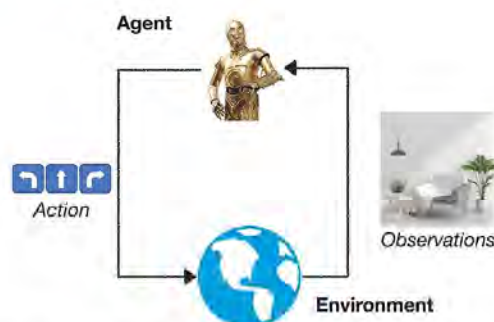
Object Goal Navigation with Self-supervised Embodied Active Learning and Instruction Following

Grounding Language Models to Images for Multimodal Generation

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### Physical Intelligence



Agent needs to move in the world physically.  
Current actions affect future observations.  
Require Spatial and Semantic Understanding.

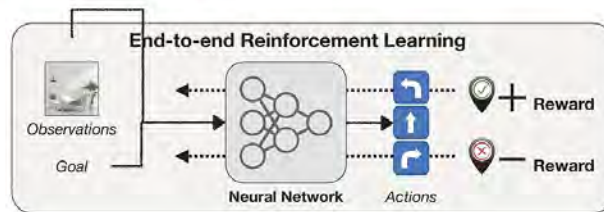
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## Goal-conditioned Navigation



Point Goal



Image Goal



Object Goal

Chair  
TV  
Sofa

Language Goal

Blue Chair  
Largest TV  
White Sofa

- Convenient for humans
- Compositionality

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## Real World: Object Goal Navigation

Observation



Goal: *Potted Plant*

Predicted  
Semantic Map



Third-person view



See video at: <https://devendrachaplot.github.io/projects/semantic-exploration>


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## Building Embodied Autonomous Agents with Multimodal Interactions


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### Internet vs Embodied Data

Static Internet Data



Active Embodied Data



Chaplot, Dalal, Gupta, Malik, Salakhutdinov et al, . SEAL: Self-supervised Embodied Active Learning using Exploration and 3D Consistency NeurIPS-22

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### Using Internet models for Embodied Agents

Goal: Chair



*False positives*

Goal: Toilet



*False negatives*

Savva et al, Habitat: A platform for embodied AI research, ICCV 2019



# Keynote Speech I

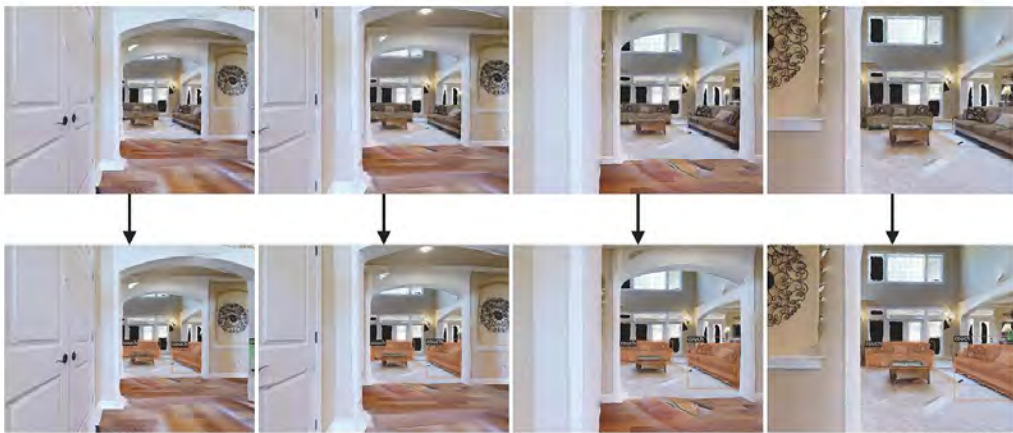
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## Embodied Perception

Active Embodied data



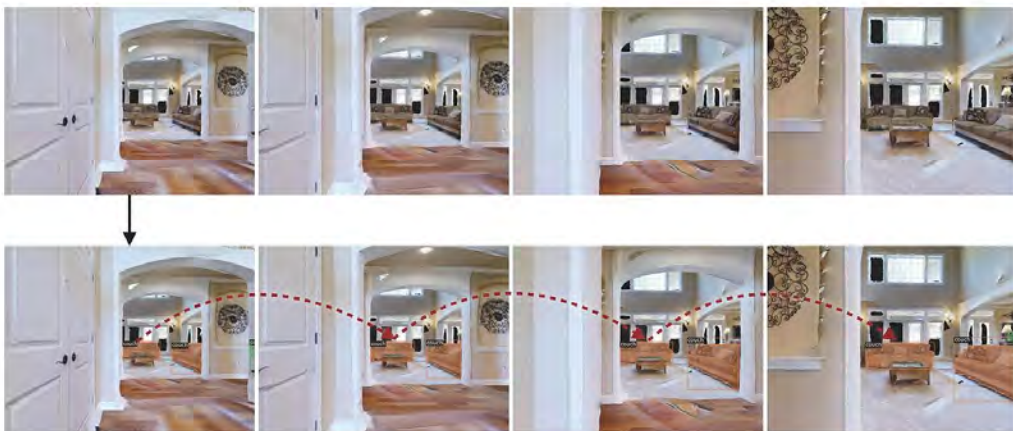
Chaplot, Dalal, Gupta, Malik, Salakhutdinov et al., SEAL: Self-supervised Embodied Active Learning using Exploration and 3D Consistency NeurIPS-22

20

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## Embodied Perception

Active Embodied data



Chaplot, Dalal, Gupta, Malik, Salakhutdinov et al., SEAL: Self-supervised Embodied Active Learning using Exploration and 3D Consistency NeurIPS-22

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## Building Embodied Autonomous Agents with Multimodal Interactions

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### Perception-Action Loop

Step 1. Self-supervised Active Exploration

Step 2. Self-supervised Visual Learning

Pathak et al, Learning instance segmentation by interaction, 2018  
Jang et al, Grasp2vec: Learning object representations from self-supervised grasping, 2018  
Eitel et al, Self-supervised transfer learning for instance segmentation through physical interaction, 2019  
Fang et al, Move to See Better: Self-Improving Embodied Object Detection, 2021  
T Gervet et. al. Navigating to Objects in the Real World, 2022

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### SEAL: Self-supervised Embodied Active Learning

Phase 1: Action  
*Learning active exploration policy*

Exploration Policy → Action → Observation → Perception Module (Mask RCNN) → Semantic Predictions → 3D Semantic Mapping → 3D Semantic Map → Gainful Curiosity Reward → Exploration Policy

Chaplot, Dalal, Gupta, Malik, Salakhutdinov et al, . SEAL: Self-supervised Embodied Active Learning using Exploration and 3D Consistency NeurIPS-22

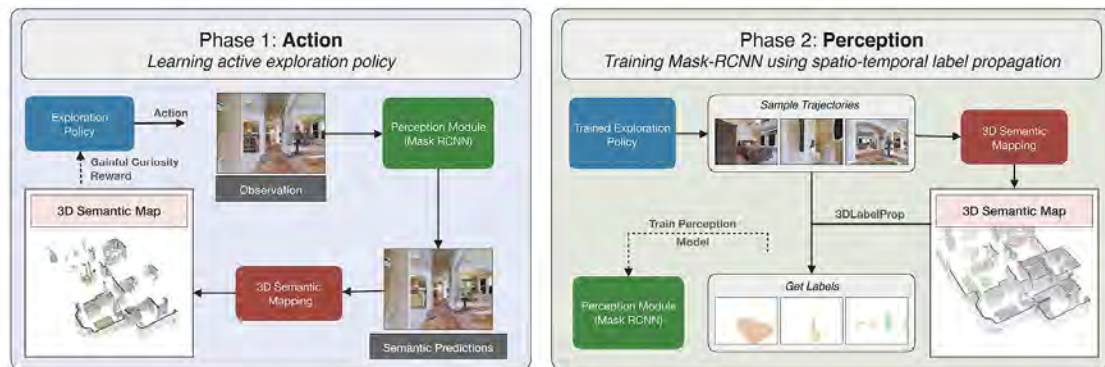
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## SEAL: Self-supervised Embodied Active Learning



Both phases do not require any additional labelled data

Chaplot, Dalal, Gupta, Malik, Salakhutdinov et al., SEAL: Self-supervised Embodied Active Learning using Exploration and 3D Consistency NeurIPS-22

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## 3D Semantic Mapping



3D Semantic Map

$$M = K \times L \times W \times H$$





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## Building Embodied Autonomous Agents with Multimodal Interactions

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### 3D Semantic Mapping



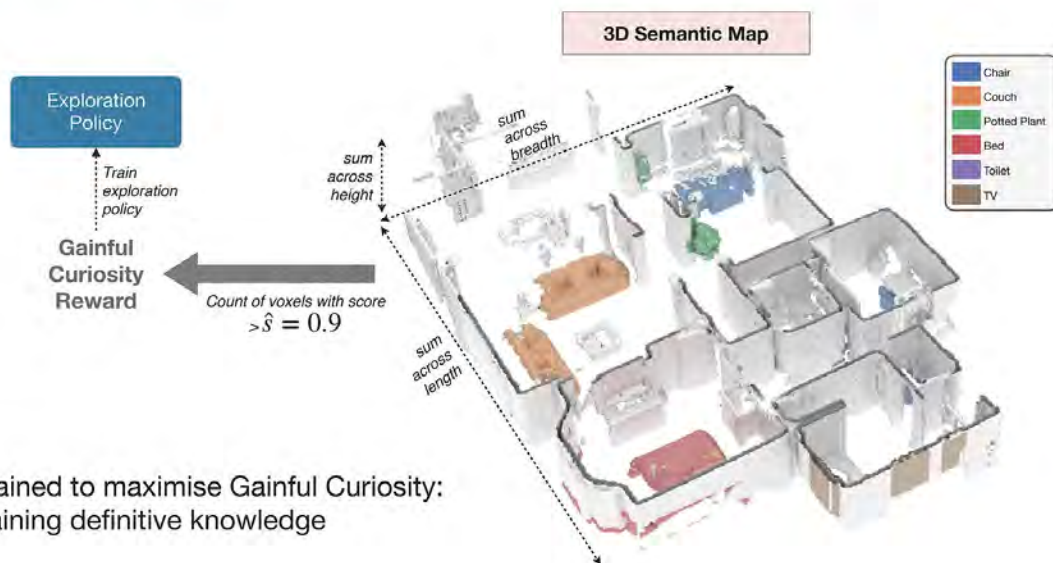
3D Semantic Map

$$M = K \times L \times W \times H$$



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### Gainful Curiosity



- Trained to maximise Gainful Curiosity: gaining definitive knowledge



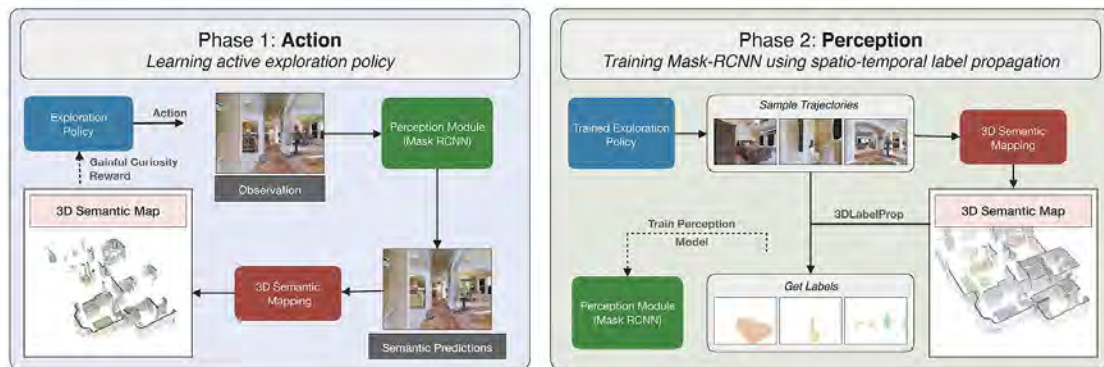
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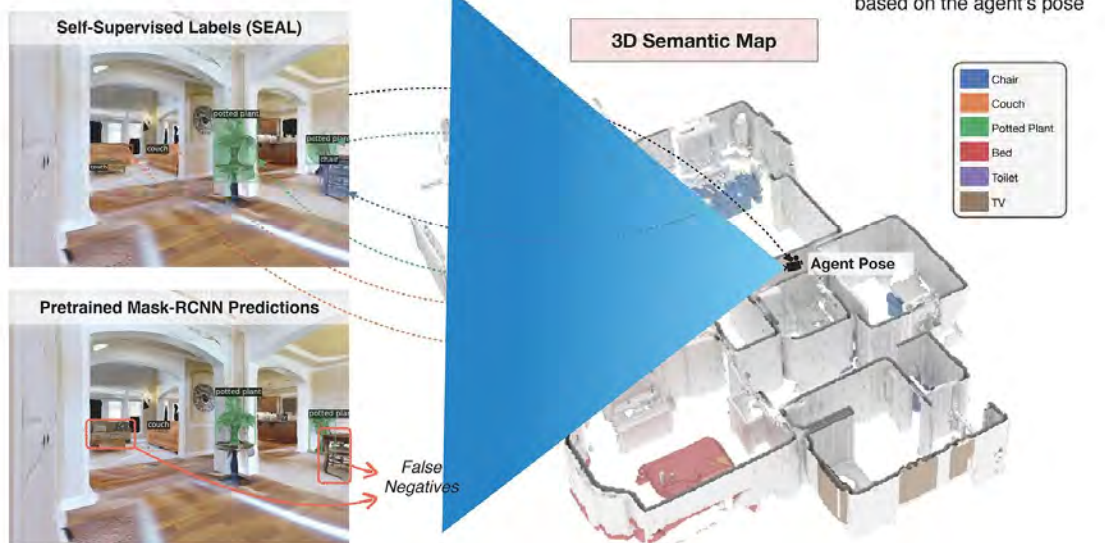
## SEAL: Self-supervised Embodied Active Learning



Chaplot, Dalal, Gupta, Malik, Salakhutdinov et al., SEAL: Self-supervised Embodied Active Learning using Exploration and 3D Consistency NeurIPS-22

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## 3D Label Propagation




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## Building Embodied Autonomous Agents with Multimodal Interactions


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### 3D Label Propagation

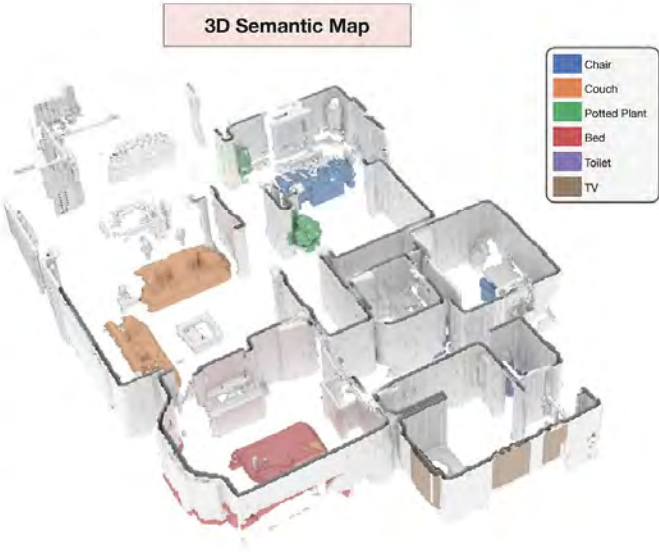
Self-Supervised Labels (SEAL)



Pretrained Mask-RCNN Predictions




3D Semantic Map




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### 3D Label Propagation

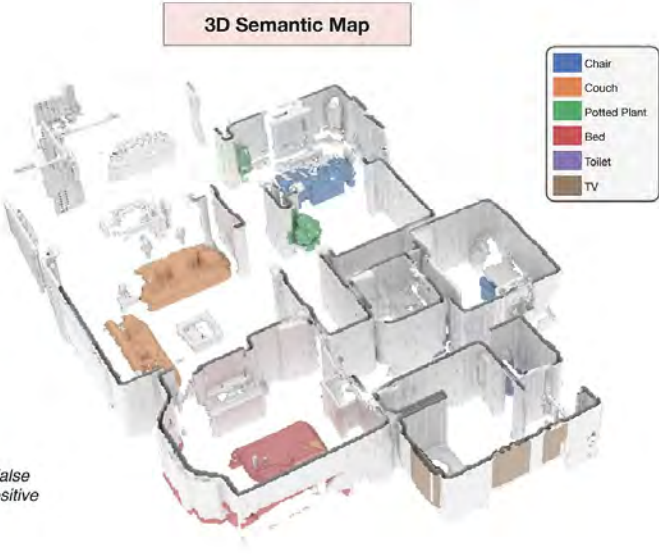
Self-Supervised Labels (SEAL)



Pretrained Mask-RCNN Predictions



3D Semantic Map



False Positive

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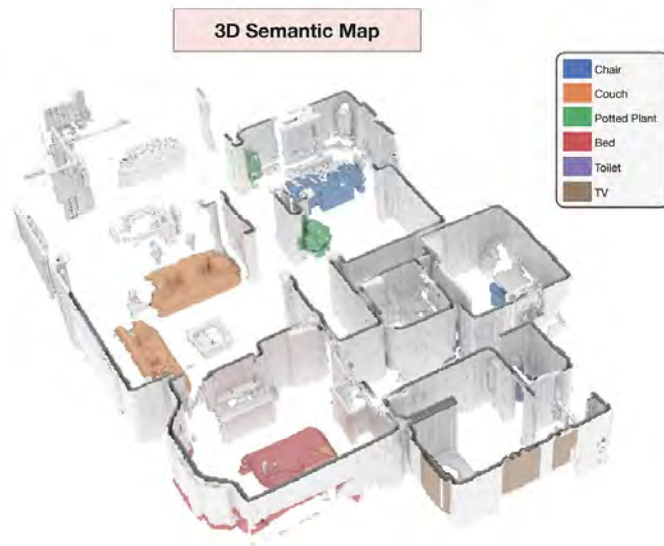
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## 3D Label Propagation



Train  
Perception  
Model

Perception Model  
(Mask RCNN)



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## Results

Method	Generalization		Specialization	
	Object Detection	Instance Segmentation	Object Detection	Instance Segmentation
Pretrained Mask-RCNN	34.82	32.54	34.82	32.54
Random Policy + Self-training [51]	33.41	31.89	34.11	31.23
Random Policy + Optical Flow [22]	33.97	32.34	34.33	32.22
Frontier Exploration [52] + Self-training [51]	33.78	32.45	33.29	32.50
Frontier Exploration [52] + Optical Flow [22]	35.22	31.90	34.19	32.12
Active Neural SLAM [10] + Self-training [51]	34.35	31.20	34.84	32.44
Active Neural SLAM [10] + Optical Flow [22]	35.85	32.22	35.90	33.12
Semantic Curiosity [11] + Self-training [51]	35.04	32.19	35.23	32.88
Semantic Curiosity [11] + Optical Flow [22]	35.61	32.57	35.71	33.29
SEAL	<b>40.02</b>	<b>36.23</b>	<b>41.23</b>	<b>37.28</b>



# Keynote Speech I

## Building Embodied Autonomous Agents with Multimodal Interactions

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### Explicit Semantic Mapping

Observations (Goal: toilet) Predicted Semantic Map

0: chair	3: bed	7: oven	11: clock
1: couch	4: toilet	8: sink	12: vase
2: potted plant	5: tv	9: refrigerator	13: cup
	6: dining-table	10: book	14: bottle

Chaplot et al., Object Goal Navigation using Goal-Oriented Semantic Exploration, NeurIPS-20

### Finding Bed

Object Goal Navigation with End-to-End Self-Supervision, S. Min, H. Tsai, W. Ding, A. Farhadi, R. Salakhutdinov, Y. Bisk, J. Zhang, 2023

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## FILM: Following Instructions in Language with Modular Methods

FILM: Following Instructions in Language with Modular Methods  
So Yeon Min, Devendra Singh Chaplot, Pradeep Ravikumar, Yonatan Bisk, Ruslan Salakhutdinov, ICLR 2022

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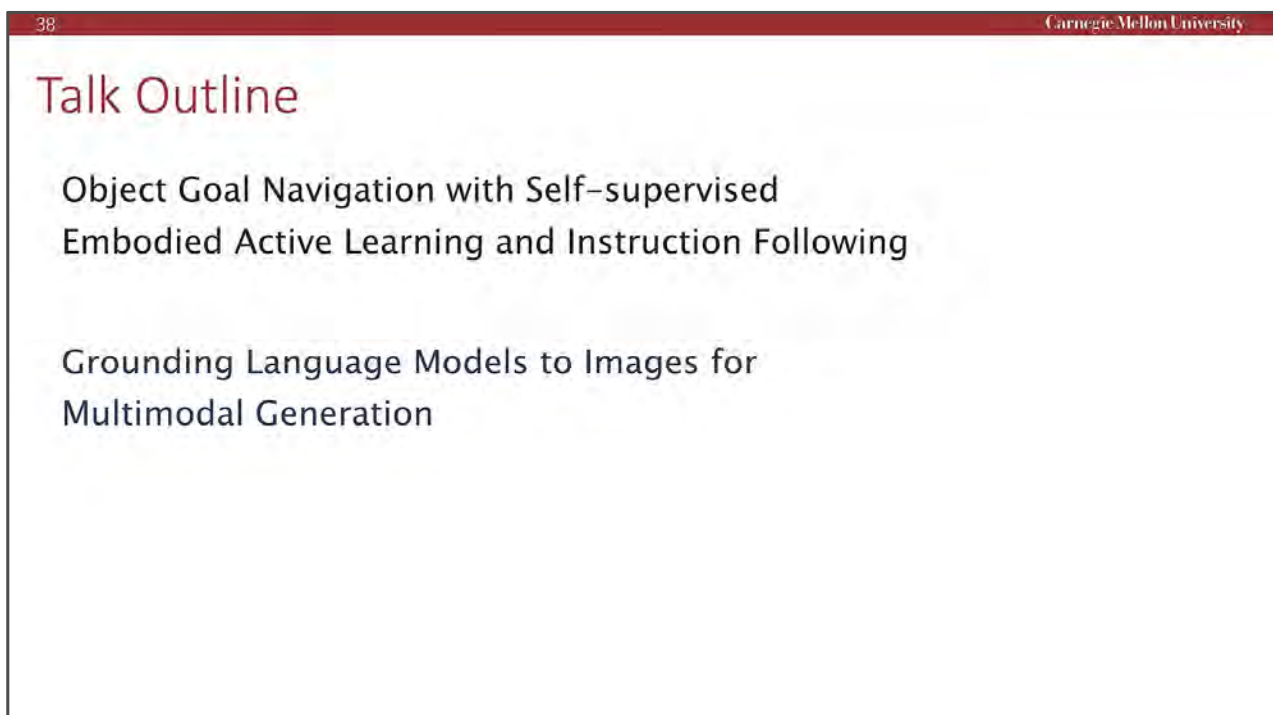
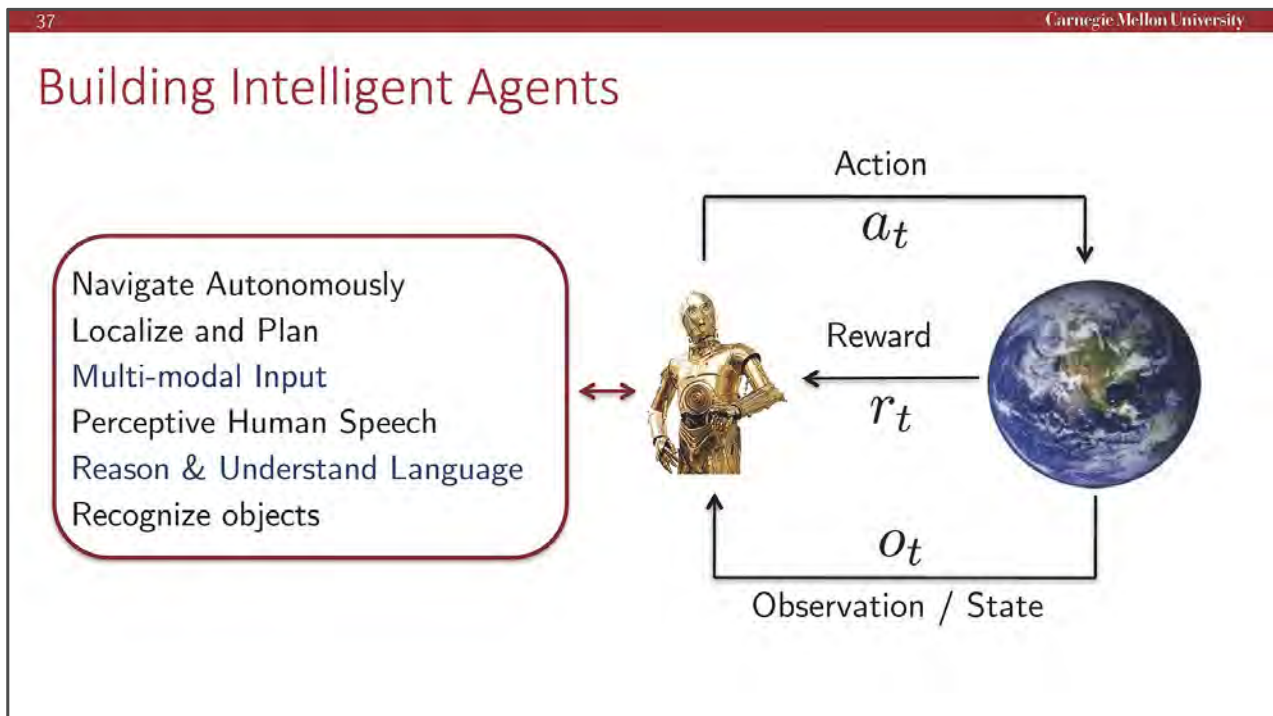
## FILM: Following Instructions in Language with Modular Methods

Instruction: place a cold lettuce slice in a waste basket.

RGB	Semantic Map	Completed Subgoals
		<ul style="list-style-type: none"> <li>X Pickup, Knife</li> <li>X Slice, Lettuce</li> <li>X Put, Knife, Sink</li> <li>X Pickup SlicedLettuce</li> <li>X Open, Fridge</li> <li>X Put, SlicedLettuce, Fridge</li> <li>X Close, Fridge</li> <li>X Open, Fridge</li> <li>X Pickup, SlicedLettuce</li> <li>X Close, Fridge</li> <li>X Put, SlicedLettuce, GarbageCan</li> </ul>
Predicted Action		RotateLeft_90

# Keynote Speech I

## Building Embodied Autonomous Agents with Multimodal Interactions





# Keynote Speech I

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## LLMs are impressive general models

**Chain of Thought Prompting**

**Input**

Q: Roger has 5 tennis balls. He buys 2 more cans of tennis balls. Each can has 3 tennis balls. How many tennis balls does he have now?

A: Roger started with 5 balls. 2 cans of 3 tennis balls each is 6 tennis balls.  $5 + 6 = 11$ . The answer is 11.

Q: The cafeteria had 23 apples. If they used 20 to make lunch and bought 6 more, how many apples do they have?

**Model Output**

A: The cafeteria had 23 apples originally. They used 20 to make lunch. So they had  $23 - 20 = 3$ . They bought 6 more apples, so they have  $3 + 6 = 9$ . The answer is 9. ✓


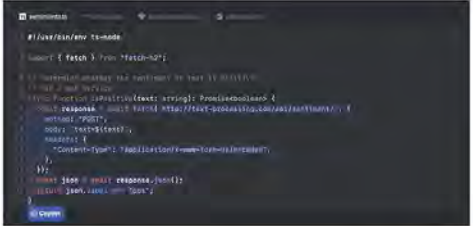
(d) Zero-shot-CoT (Ours)

Q: A juggler can juggle 16 balls. Half of the balls are golf balls, and half of the golf balls are blue. How many blue golf balls are there?

A: Let's think step by step.

(Output) There are 16 balls in total. Half of the balls are golf balls. That means that there are 8 golf balls. Half of the golf balls are blue. That means that there are 4 blue golf balls. ✓

Chain of Thought Prompting Elicits Reasoning in Large Language Models (Wei et al., 2022)  
Large Language Models are Zero-Shot Reasoners (Kojima et al., 2022)  
ChatGPT (OpenAI, 2022)  
Copilot (GitHub, 2021)  
Bing (Microsoft, 2023)



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## LLMs are impressive general models

**Chain of Thought Prompting**

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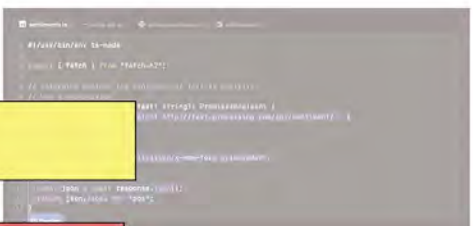
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ChatGPT (OpenAI, 2022)  
Copilot (GitHub, 2021)  
Bing (Microsoft, 2023)

**Text → Text**

**Resource Intensive**



# Keynote Speech I

## Building Embodied Autonomous Agents with Multimodal Interactions

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### Can we ground text-only LLMs to consume and produce visual data?

or: are pre-trained representations bidirectionally compatible?

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### FROMAGE: Frozen Retrieval Over Multimodal Data for Autoregressive Generation [jykoh.com/fromage](https://jykoh.com/fromage)

**Concept composition.** Our model is capable of retrieving relevant images conditioned on multi-modal context inputs.

Grounding Language Models to Images for Multimodal Generation, JY Koh, R Salakhutdinov, D Fried, ICML 2023

**Multi-modal dialogue.** Green bubbles represent model generated outputs, grey bubbles represent user input.



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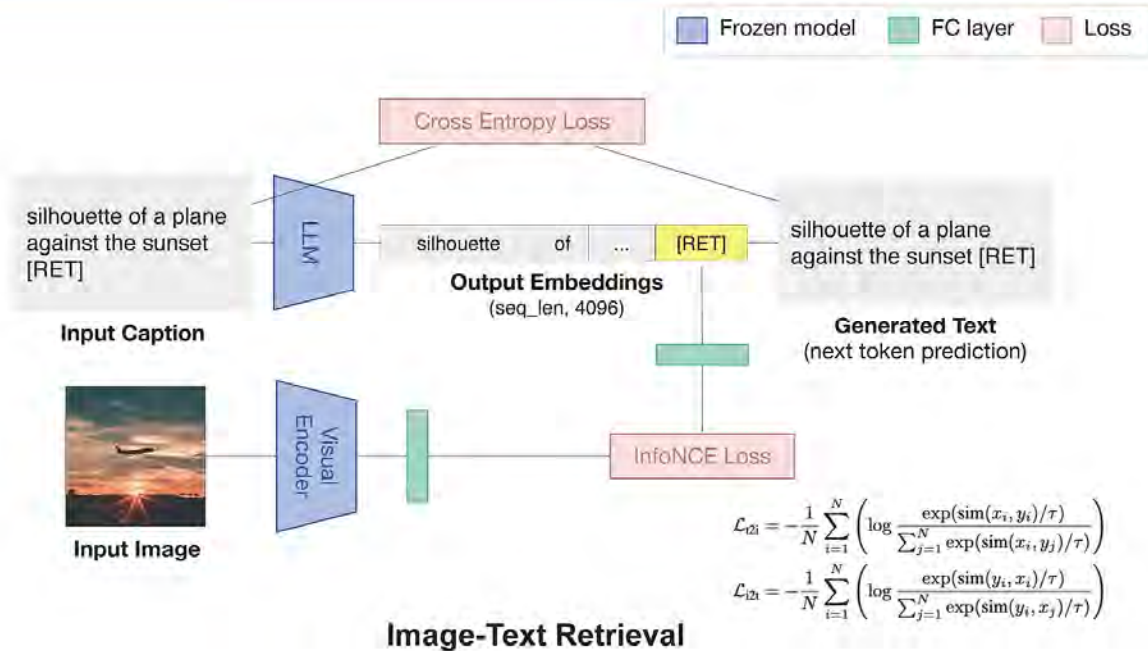
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## Frozen LLMs (and visual models)

- Leverage the learnt abilities of pre-trained text-only LLMs
  - In-context learning
  - Generate long and coherent dialogue
- Model agnostic
  - We use a 6.7B LLM
  - Can (in principle) be applied to any larger model, and any stronger LLM released in the future
- Simple and resource efficient
  - We train just 3 linear layers to adapt a text-only LLM for image captioning + image retrieval
  - FROMAGE is trained on a single A6000 GPU in 24 hours

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# Keynote Speech I

## Building Embodied Autonomous Agents with Multimodal Interactions

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### Quantitative Evaluations

1) Contextual image retrieval

- Given a Visual Story, retrieve the correct image
- FROMAGE is more sensitive to context
- CLIP gets worse with more context


**Input Context**

I went on a desert tour over the summer.




1

This is our caravan as we left.




2

There was nothing but sand for quite some time.




3

Eventually we ran across a stone ridge.




4

Believe it or not, there were green plants growing there.



5



**Retrieved Image**

Visual Storytelling (Huang et al., 2016)

Model	Inputs	R@1	R@5	R@10
CLIP ViT-L/14	1 caption	<b>11.9</b>	<b>25.5</b>	<b>32.2</b>
FROMAGE		9.0	21.1	28.7
CLIP ViT-L/14	5 captions	5.9	19.5	28.0
FROMAGE		<b>10.4</b>	<b>23.8</b>	<b>31.7</b>
CLIP ViT-L/14	5 captions, 4 images	Incapable		
CLIP ViT-L/14 <sup>†</sup>	5 captions	8.8	22.3	29.8
FROMAGE <sup>†</sup>	5 captions	11.6	24.7	32.8
FROMAGE <sup>†</sup>	5 captions, 4 images	<b>15.6</b>	<b>36.5</b>	<b>45.8</b>


*Table 1.* Recall@k on zero-shot contextual image retrieval of the last image in Visual Storytelling (Huang et al., 2016). Numbers in **bold** indicate best scores for a particular set of inputs. <sup>†</sup> indicates retrieval over images not previously seen in the story sequence.

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### Quantitative Evaluations

2) Visual Dialogue

- IT2T:** Answer a question about the image given past dialogue discussing it



Q: is the photo in color?  
A: yes

...

Q: is the floor made of tiles?  
A: yes

Q: is it light or dark in the bathroom?

Model

"A: like a dark green"

- T2I:** Retrieve the correct image given a series of dialogue about it

Q: is there grass?  
A: yes


Q: is the horse wearing a saddle?  
A: i think so really dark

...

Q: is the rider wearing a hat?  
A: yes a helmet

Q: is the horse facing the camera?  
A: no

Model



Visual Dialog (Das et al., 2017)

42 | A.I. Innovation and our Future Society

## Quantitative Evaluations

### 2) Visual Dialogue

- **IT2T**: Answer a question about the image given past dialogue discussing it
- **T2I**: Retrieve the correct image given a series of dialogue about it

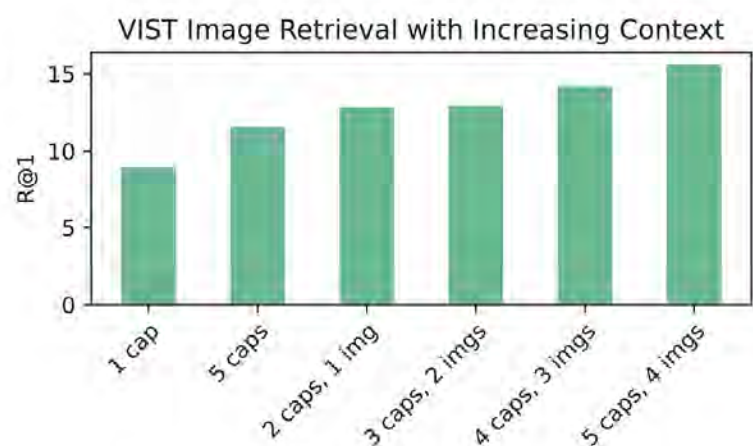
Model	Trainable Params	Dataset Size	IT2T					T2I		
			NDCG	MRR	R@1	R@5	R@10	R@1	R@5	R@10
ViLBERT (Lu et al., 2019)	114M	3.1M	11.6	6.9	2.6	7.2	11.3	-	-	-
CLIP ViT-L/14 (Radford et al., 2021)	300M	400M	10.9	8.5	3.1	8.7	15.9	17.7	38.9	50.2
Flamingo (Alayrac et al., 2022)	10.2B	1.8B	<b>52.0</b>	-	-	-	-	-	-	Incapable
ESPER (Yu et al., 2022b)	4M	0.5M	22.3	<b>25.7</b>	14.6	-	-	-	-	Incapable
FROMAGe (ours)	5.5M	3.1M	16.5	22.0	<b>17.6</b>	<b>20.1</b>	<b>25.1</b>	<b>20.8</b>	<b>44.9</b>	<b>56.0</b>

Table 2. Zero-shot results on Visual Dialog (Das et al., 2017), for image-and-text-to-text (IT2T) and text-to-image (T2I) retrieval. Unlike previous methods, FROMAGe is capable of generating free-form text interleaved with image outputs through text-to-image retrieval.

Visual Dialog (Das et al., 2017)

## The Effect of Context

Multi-modal context is worth more than uni-modal context.




# Keynote Speech I

## Building Embodied Autonomous Agents with Multimodal Interactions

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### Generating Images with Large Language Models (GILL)

#### Sprucing Up Instant Ramen



How can I make this more nutritious?

You can add vegetables to your ramen noodles, but you should be careful not to overdo it.




What are some vegetables I can add to it?


Broccoli, carrots, and green beans are all good choices.

#### Tattoo Ideas


I'm looking for some ideas for a new tattoo. What do you think looks good on a petite person?




I want a tattoo of a sunflower, but I'm not sure what style would look best on me.



That's beautiful. Show me one that would work well as a complementary piece




#### Publicizing Cupcakes



How should I publicize these at the market?

I would suggest a simple sign with the name of the business and a picture of the cupcakes.



User prompts  Retrieved  Generated

Generating Images with Multimodal Language Models ([jykoh.com/gill](https://github.com/jykoh/gill))

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## Try the model

[huggingface.co/spaces/jykoh/fromage](https://huggingface.co/spaces/jykoh/fromage)

FROMAGE


This is the official Studio demo for the FROMAGE model, a model that can process arbitrarily retrieved image and text inputs, and produce image and text outputs.

Project Website: [FROMAGE](#)

Safe and Mobile: [FROMAGE](#)

Tip:

- Start by inputting either image or text prompts for both and chat with FROMAGE to get integrated text replies.
- Toggle the level of interactivity to images and text using the parameters on the right.
- Check out cool conversations in the examples or community tab for inspiration and share your own!
- For faster inference without waiting in queue, you may duplicate the space and use your own GPU. [Duplicate Space](#)



What does this bird look like?


It's a small brown bird with a white belly.

Frequency multiplier for retrieved images (higher means more frequent)

Max images to return: 2

Max # of words: 20

Temperature (0 for deterministic, higher for more randomness)



What does this bird look like?

It's a small brown bird with a white belly.

What do you think about it?

I think it's a cool idea.

What other cool features should it have?

I think it should have a fingerprint scanner.

What else?

I think it should have a better camera.


What is the camera good for?

It is good for taking pictures.

What kind?

It is good for taking pictures of people.

Show me some pictures



Here is one of my friends.



# Keynote Speech I

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Ruslan Salakhutdinov

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Carnegie Mellon University

Thank you



## AI & Data Utilization in Public Sector

**So Ah Park**

Vice President,

VAIV Company



# Keynote Speech II

## AI & Data Utilization in Public Sector



**2023 SEOUL S&T FORUM**  
November 7, 2023 | The Plaza Hotel, Seoul, Korea

Presentation Title : AI and Data Utilization in Public Sector  
Name : So Ah Park, Ph.D  
Position : Vice President  
Organization : VAIV Company

Hosted by **nst** National Research Council of Science & Technology  
Organized by **KIST** Korea Institute of Science and Technology **STEP** SCIENCE AND TECHNOLOGY POLICY INSTITUTE  
Sponsored by **MSIT** Ministry of Science and ICT



**2023 SEOUL S&T FORUM**

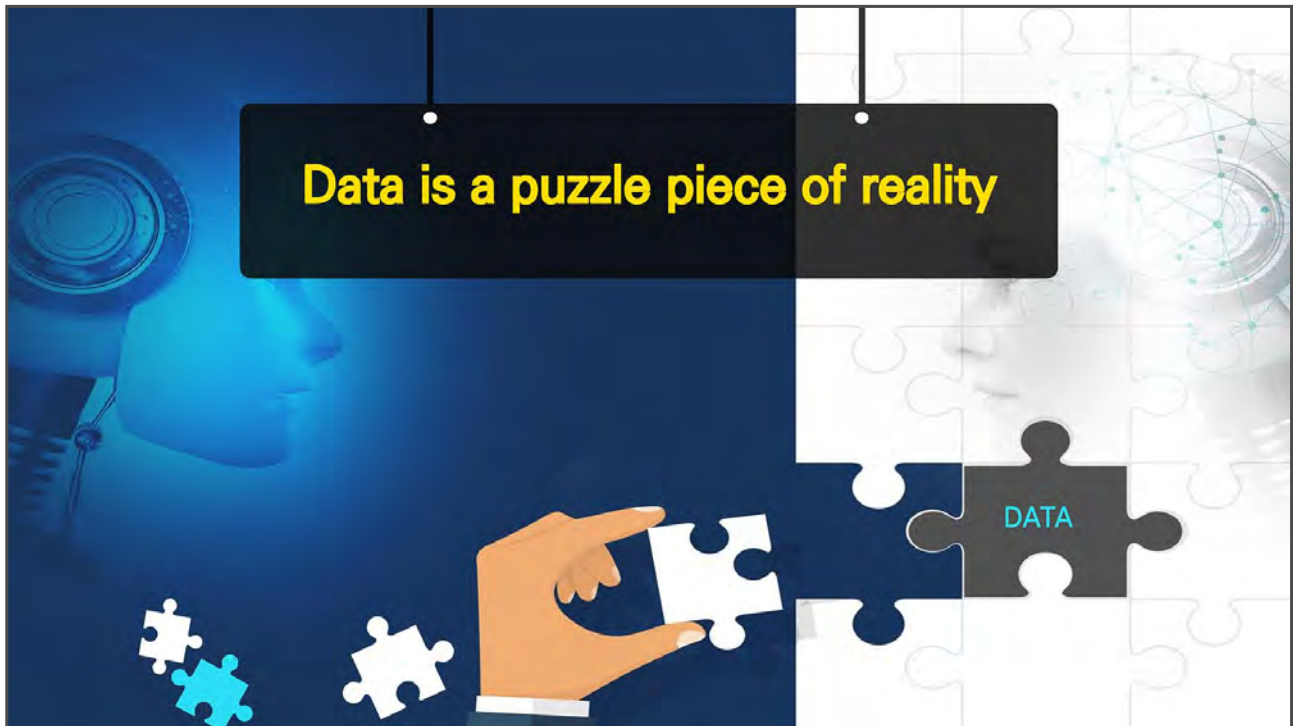
### AI Innovation and our Future Society

- 1. Digital Transformation**
  - 01 Digital Environmental Change
  - 02 Data-Driven Scientific Administrative Innovation
- 2. The emergence of a digital platform government**
  - 01 The Inception of the Digital Platform Government
  - 02 Vision and Core Driving Tasks
  - 03 Mega AI Plan
  - 04 AI Target Scope
- 3. AI and Data Utilization in Public Sector**
  - 01 Current Status of AI Applications in the Domestic Public Sector
  - 02 Domestic and International Big Data Analysis Cases
  - 08 Domestic and International AI Application Trends
  - 04 Domestic and International AI Policy Directions
- 4. AI & Data of VAIV**
  - 01 INTRODUCE
  - 02 VAIV History
  - 03 The concept of a "Vibe service."
  - 04 VAIV Service
- 5. Is AI a Tool for Innovation?**
- 6. Understand people with data**

# Keynote Speech II

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So Ah Park

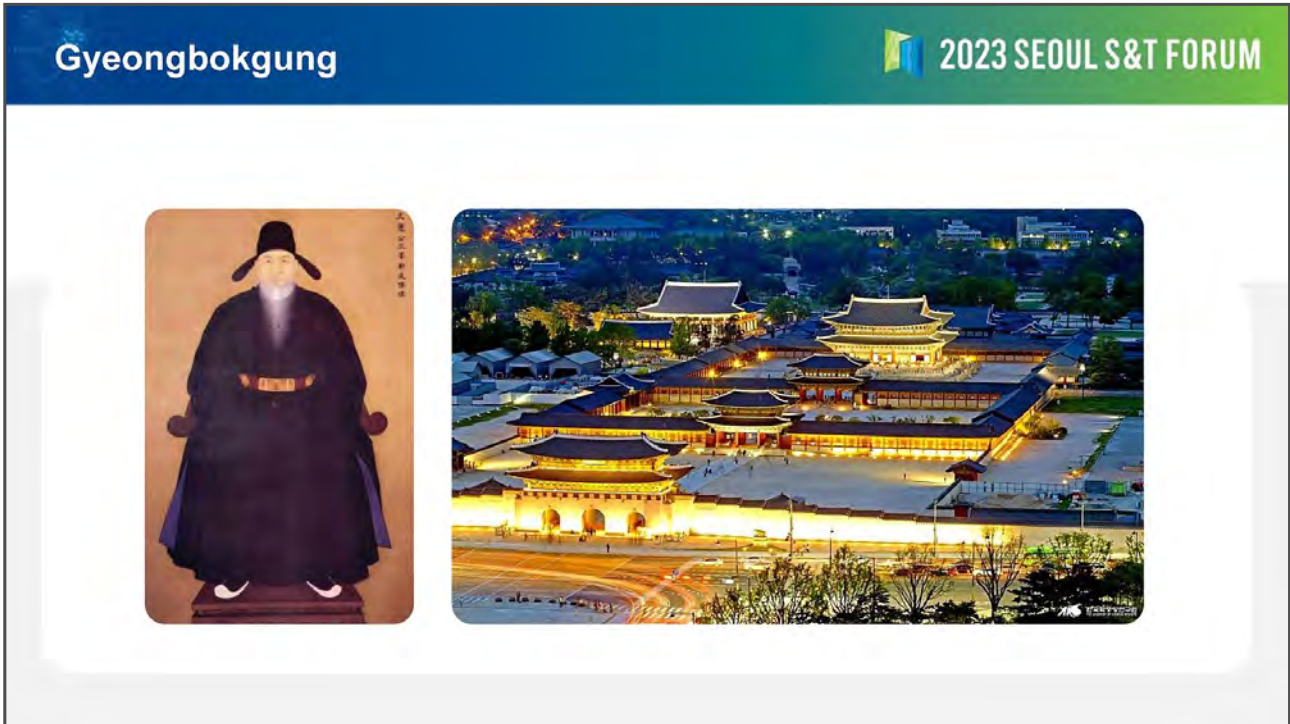


**“Data is the foundation. Data is the starting point”**  
Level of data determines the level of AI, not the technology



# Keynote Speech II

## AI & Data Utilization in Public Sector

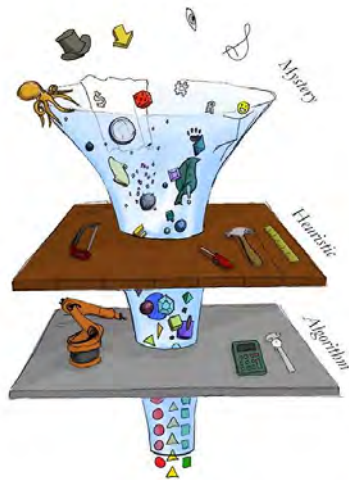


# Keynote Speech II

So Ah Park

Data Analysis is...  
Understanding the past,  
Predicting the future,  
And making choices in the present..

The Pipeline of  
{Data → Predictive Models → Decision Analysis}



Big Data

Cognitive Computing  
& Machine Learning

Model/Algorithm

# Keynote Speech II

## AI & Data Utilization in Public Sector

**2023 SEOUL S&T FORUM**

AI Innovation and our Future Society

### 1. Digital Transformation

- 01 Digital Environmental Change
- 02 Data-Driven Scientific Administrative Innovation

### Digital Environmental Change\_Environment

**2023 SEOUL S&T FORUM**

In the digital age, the market continues to embrace the New Normal and is evolving into an even more complex New Abnormal environment, demanding a new kind of innovation from the citizens, different from the past.

#### New Normal<sup>1)</sup> 환경의 지속

Stagnation has become entrenched as a new social order following the global economic crisis

저성장	고금리	저소득
저출산	고령화	저수익률

**Cost Efficiency**  
(Restructuring, Dwonsizing, ...)

#### New Abnormal<sup>2)</sup> 환경의 등장

Era of persistent market volatility and uncertainty

경제 침체 비관론 예측	실제로는 완만한 회복세	?
아파트 투기 열풍	하우스푸어 급증	?

- The limitations of traditional prediction methods:
- Existing theories, norms, and principles are no longer effective.
- Rapid changes in technology cycles and the environment.

**Flexibility for Continual Change**

1) New Normal : 모리메츠 앤드 에라언의 저서 "새로운 무의 탄생"에서 2008년 사용 2) New Abnormal : 누리엘 무버니 뉴욕대 교수, 유라시아전략원장 이안브레이어 대표가 2013년8월 발문 보고서에 언급



# Keynote Speech II

So Ah Park

## Digital Environmental Change \_ ② all citizens 2023 SEOUL S&T FORUM

The N-generation (Digital Native) is rapidly emerging as the primary users of services, and they prefer engaging in participation and communication through digital means across various aspects of service usage. They are demanding new communication methods from the government.

### Digital Native 인구 추이

연도	인구 (백만 명)	총인구 대비 비중 (%)
'11년	1천1백만	22%
'16년	1천4백만	28%
'21년	1천7백만	34%
'26년	2천만	38%

연평균 성장률 4%

※ 단행: 명, 광호 안은 전체 인구 대비 비중

### 서비스 이용 행태의 변화

	Discover (탐색)	Consider (비교)	Use (이용)	Evaluate (평가)
전통적 국민	<ul style="list-style-type: none"> <li>정부에서 제공하는 방식으로 서비스 이용</li> <li>On/Off-line으로 서비스 혼합하여 이용</li> <li>→ 서비스 찾기부터 실행까지 친절하고 편리한 서비스, 영합력이 큰(친절한 행정서비스)</li> </ul>		<ul style="list-style-type: none"> <li>이용 시 공무원과 오프라인 접점</li> </ul>	<ul style="list-style-type: none"> <li>민원 제기를 제외하면 각종 업무 처리에 대한 제한적/소극적 평가</li> </ul>
Digital Native 국민	<ul style="list-style-type: none"> <li>각종 커뮤니티 사이트를 모바일로 접근하여 서비스 찾기</li> </ul>	<ul style="list-style-type: none"> <li>타인의 정보를 적극적으로 수용 (SNS 평판 참여)</li> </ul>	<ul style="list-style-type: none"> <li>서비스 이용시 온라인/모바일 채널 활용 일반화</li> </ul>	<ul style="list-style-type: none"> <li>모바일 앱, 웨어러블 등 신기술을 활용한 소통 선호</li> <li>서비스 만족도의 활발한 공유 (SNS에 공유)</li> </ul>

대국민 커뮤니케이션 방식의 혁신 필요

※ BCG : "2015 Digital Native Report"

1) N세대 : 디지털에 익숙한 1977년 이후 출생인 인구 중 20세 이상 인구를 경제 활동 Digital Native, N세대로 정의. Source: 국가통계포털, Deloitte Analysis

## Data-Driven Scientific Administrative Innovation 2023 SEOUL S&T FORUM

To proactively respond to the environmental changes in the digital age, data-driven scientific administrative innovation should be pursued, and this requires organizational culture, institutional innovation, and system infrastructure to be continuously and systematically developed.

### Foundation of Data-driven Scientific Administration Innovation

- Data Share** / **Data Linkage and Utilization**
- Acquisition (Open Innovation for Synergy) / Sharing (Base Expansion) / Analysis (Capacity Building)
- (Data Innovation Infra)**
  - Org Culture
  - Regulations Innovation
  - System Infrastructure

### Directions of Data-driven Scientific Administration Innovation

- Easy Data Sharing for Everyone (Data Share)
- Boundaryless Data Flow (Data Transformation)
- Evidenced-based Decision Making (Data Innovation Infra)

Scientific Admin enabling Innovation of the way of work (Digital Innovation)



# Keynote Speech II

## AI & Data Utilization in Public Sector

**2023 SEOUL S&T FORUM**  
AI Innovation and our Future Society

### 2. The emergence of a digital platform government

- 01 The Inception of the Digital Platform Government
- 02 Vision and Core Driving Tasks
- 03 Mega AI Plan
- 04 AI Target Scope

## The Inception of the Digital Platform Government 2023 SEOUL S&T FORUM

### The Age of Artificial Intelligence and Data: South Korea's Opportunity for a New Leap

Internet service	Mobile service	AI, Data service
Semiconductor, CDMA, Broadband internet	Phone, mobile service, Spread of K-pop culture	At a Crossroads of Crisis and Leap, Proactive Response and Global Leadership
Rise as a IT powerhouse	OECD Assessment 1st place in Digital Government	Leap Towards Becoming a Global Exemplary Nation

- Digital Deepening**  
A smart country that effectively utilizes artificial intelligence and data
- Change and innovation**  
A country where the citizens live conveniently and well.
- Opportunity and Growth**  
A country that dares to challenge and leads the world

# Keynote Speech II


So Ah Park


**Vision and Core Driving Tasks** 2023 SEOUL S&T FORUM

**Creating the World's Premier Digital Platform Government with Artificial Intelligence and Data**

**I. Government for the citizens**

We will take care of the everyday lives of the citizens, from the ordinary to the special moments.






**Core Driving Tasks**


**II. Smart One-Team Government**

We will eliminate barriers within the government and between the government and the private sector.




**III. A Growth Platform Involving Both the Public and Private Sectors**

The Digital Platform Government will become a strategic industry



**IV. Credible Platform Government**

Utilize citizens' data effectively and securely.




**Digital Platform Government Mega AI Plan** 2023 SEOUL S&T FORUM

Progressing the expansion of a mega AI innovation ecosystem and infrastructure, in conjunction with the realization plan for the Digital Platform Government (as of April 14, 2023).

AI and Data-Centric	Digital Platform Government	A country where both citizens and businesses thrive
<ul style="list-style-type: none"> <li>Open public data in a machine-readable format that can be read by both humans and artificial intelligence</li> <li>The government will use artificial intelligence and data for evidence-based policy decision-making</li> </ul>	<ul style="list-style-type: none"> <li>Breaking down silos between ministries and realizing a single government through a connected digital platform</li> <li>redesigning administrative processes with a digital focus, and innovating organizational culture and personnel systems</li> </ul>	<ul style="list-style-type: none"> <li>Fostering an innovation ecosystem where we innovate with the people and promote mutual growth between the public and private sectors</li> <li>contributing to the international community as a digital platform government, a digital role model country</li> </ul>

As part of the implementation plan for the Digital Platform Government, the government has devised a strategy to enhance the competitiveness of 'Mega AI,' such as CHAT GPT (Ministry of Science and ICT)



**Implementation Strategy**

**1** Mega AI, Core of the Technology Industry, Infrastructure Expansion

**2** Creation of a Mega AI Innovation Ecosystem

**3** Transnational AI Innovation: Institutional and Cultural Establishment



# Keynote Speech II

## AI & Data Utilization in Public Sector

2023 SEOUL S&T FORUM

### Digital Platform Government AI Target Scope

Focusing on the pilot projects under the Digital Platform Government, we are implementing automatic reporting and intensifying the development of intelligent chatbots.

- As part of the "Mega AI Industry Innovation Ecosystem Creation Plan," we are actively integrating mega AI in both private and public sectors.
  - [Public Sector] Developing and demonstrating mega AI application services to enhance the efficiency of internal operations and public services in the administration/public agencies. This includes tasks such as drafting press releases and citizen complaint consultations.

**! Overcoming the Limits of Mega AI Application in the Public Sector**

- Challenges in Securing Computing Power for Mega AI Training (Pre-requisite for External Learning Approaches for Private Mega AI Usage in the Public Sector)
- Public policy proposals and similar initiatives depend on strengthening in-house big data analysis capabilities within public agencies before leveraging mega AI centered on language models

**! Directions for the Application of Digital Platform Government in Public Agencies, Considering Limitations**

- Initially, the construction of a dedicated mega AI for the public sector through document learning by public agencies → Pilot services with visible outcomes are being carried out to demonstrate mega AI services

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- **Documents that AI reads and writes:**
  - Initiating the practical implementation of saving/publishing in an open format (ODF) from the document creation stage for documents such as press releases, job postings, and complaint forms (from '23-)
  - Converting documents stored in the On-Nara (government-wide integrated information system) and Records Management System (RMS) into training data
  - Cultural innovation in government reporting: Shifting from a culture of emphasizing form and format to a text/number-centric reporting culture that AI finds easy to read, including tables, charts, and fonts
- **Advancement of intelligent chatbots:**
  - Expanding the introduction of chatbots for complaint consultations and further improving language models to enable natural conversation with previously introduced chatbots.

2023 SEOUL S&T FORUM
참고

### Citizen-Perceived Case (1): 'Benefit Informer' that Automatically Tailors Deliveries

## We will be with you from everyday life to special moments

현재는

청년인구 1,072만명, 청년 실업률 7%

청년이 누릴 수 있는 자원 프로그램  
4,000개 이상

바빠서, 몰라서 놓치는 혜택

제가 매일 바쁘게 일하고 공부하느라 이런 혜택을 지도 받을 수 있었는지 몰랐어요

청년 B씨

앞으로는

나에게 꼭 맞는 혜택을 정부가 알아서 배달

중소기업 맞춤 지원정보	청년정책 모델
소상공인 지원	청년 창업, 재취업 관련
정책 대출	학자금 대출/장학금
수출 인큐베이터 사업	주택 관련 지원
기술사업화 역량 강화	

2026년까지 맞춤형 서비스 1,021종 제공

예) 부모수당, 국가 장학금, 실업수당 등

# Keynote Speech II

So Ah Park

참고 2023 SEOUL S&T FORUM  
Citizen-Perceived Case (2): 'Zero Attachments of Documents to Government Offices

### We will give back the time wasted on document submission to the citizens

**현재는**

국민이 정부 기관으로부터 발급받는 첨부서류  
 건축물대장 1억5백만건  
 인감증명서 3천2백만건  
 주민등록등본 1억2백만건  
 각종 등기서류 3천5백만건

연간 7억 통  
 국민 1인당 평균 13.6건

청약에 당첨되었다는 기쁨도 잠시, 서류제출 위해 은행, 법원, 부동산, 등사무소 방문에 지칩니다.

이마트 담당원 신혼부부

**앞으로는**

- 관공서 방문을 위해 더 이상 휴가를 낼 필요 없습니다
- 기관 간 정보공유를 통해 서류제출을 위한 관공서 방문에 허비하는 시간·비용 절감

첨부서류 제로화로  
연간 2조원 절감

참고 2023 SEOUL S&T FORUM  
Citizen-Perceived Case (3): 'Factory Simplified Permitting Service

### Simplify complex permitting processes by smartly recommending locations and offering one-stop processing.

**현재는**

공장신설승인(일) 35.3(충남) VS 1.7(서울)  
 공장설립 첨부서류 24종, 방문기관 6곳  
 건축허가 첨부서류 84종, 방문기관 12곳

인허가 가능한 곳 찾기가 어렵고, 법령·절차도 복잡하여 인허가 여부도 가능하기 어렵네요.

기업인 K씨

**앞으로는**

- 기업이 입지별 규제정보를 손쉽게 확인, 조건에 맞는 입지 추천 받음
- 인허가 사전준비·신청·처리 등을 한곳에서 원스톱으로 처리

**입지 추천**  
 지역, 업종, 공장면적 입력하면  
 규제지역 제외, 교통편의 등 고려 후보지 추천

**시뮬레이션 분석**  
 디지털트윈 기반 공장 건축 시뮬레이션

**진행상황·처리결과 안내**  
 처리상황 및 예상 처리기간 등을 상황판으로 안내하여 예측가능성 제고

**필요서류 분석 등 신청 지원**  
 입지규제, 공장시설 등에 따른 첨부서류 분석



# Keynote Speech II

## AI & Data Utilization in Public Sector



**2023 SEOUL S&T FORUM**  
AI Innovation and our Future Society

### 3. AI and Data Utilization in Public Sector

- 01 Current Status of AI Applications in the Domestic Public Sector
- 02 Domestic and International Big Data Analysis Cases
- 03 Domestic and International AI Application Trends
- 04 Domestic and International AI Policy Directions

### The Current Status of Generative AI Utilization in the Domestic Public Sector

2023 SEOUL S&T FORUM

기관	내용
Digital Platform Government Commission	<p>*To facilitate AI learning from public data, an open format, ODT (Open Document Text), has been introduced to government documents, including meeting minutes and reports (2022.12.30)</p> <p>- ODT is a document format that is not tied to specific software and is in a form that machines can read</p>
Ministry of Culture, Sports, and Tourism & National Institute of the Korean Language	<p>*To support the development of 'K-ChatGPT,' which excels in the Korean language, a high-quality Korean text corpus containing approximately 1.2 billion words from 255 different genres will be constructed this year, with plans to expand it to 10 billion words by 2027.</p> <p>- The extensive Korean language corpus consisting of 37 varieties (approximately 2.2 billion words) constructed since 2018 has been made available as open-source data through the National Institute of the Korean Language's corpus sharing website (Open Korean Corpora), for utilization in the development of Korean language AI.</p>
Ministry of the Interior and Safety	<ul style="list-style-type: none"> <li>• To ensure the proper utilization of ChatGPT, a generative AI service, in the public sector, guidelines on the usage and precautions of ChatGPT have been distributed to around 300 central government agencies and local authorities (2023.5.8).</li> <li>• There is a plan to create relevant guidelines by the end of 2023, enabling all government ministries, local bodies, and public agencies to introduce and develop generative AI services.</li> </ul>
National Intelligence Service	<p>Generative Artificial Intelligence (AI) Usage Security Guidelines,' which provide step-by-step instructions on security measures to be followed throughout the entire process, from accessing generative AI technology services to querying and utilizing the results, have been made available(2023.6.29)</p>
Gyeongsangbuk-do	<p>Pilot operation of the large-scale language model-based AI chatbot 'ChatGyeongbuk' is being launched, marking the first in local governments across the country. (2023.3.7)</p> <p>- ChatGyeongbuk is an artificial intelligence chatbot service based on OpenAI's GPT-3 model. By supplementing its training with relevant data from Gyeongsangbuk-do, it is capable of providing relatively accurate answers to questions related to Gyeongsangbuk-do.</p>
Gyeonggi	<p>Setting the goal of utilizing ChatGPT as an administrative tool to support entrepreneurship and job creation, the 'GyeonggiGPT Action Plan' was announced, which includes initiatives such as the introduction of an AI call center and the promotion of art education and exhibitions for individuals with developmental disabilities. (2023.3.21)</p>

출처 : 박상명, 조은결(2023), [ChatGPT, 국내외 공공 부문 도입 동향과 지자체 활용방안], 내용 보완 및 재구성

# Keynote Speech II

So Ah Park

## Case Study – Improving the Detection Rate of Fraudulent Claims

2023 SEOUL S&T FORUM

Efficiency support for investigators through the prioritization of fraudulent claims investigation tasks, as well as the discovery and enhancement of new types of fraudulent claims, leading to an improvement in the detection rate of fraudulent claims

### Analysis Overview

Led by: Ministry of Employment and Labor, Korea Employment Information Service

Objectives:

- Prioritizing fraudulent claims investigation tasks to support the efficiency of investigators.
- Enhancing the detection rate of fraudulent claims by identifying and refining new types of fraudulent claims.

Utilized Data:

- (Internal) Data related to unemployment benefits, employment insurance enrollment, and fraudulent claims reports.
- (External) Complaints, industrial accident temporary leave payment history, business open/close information, and more.

Initiative: Deriving new patterns of fraudulent claims and refining existing patterns.



### Analysis Results and Utilization Strategies

Analysis Results:

- Discovery of new patterns of fraudulent claims.
- Measuring the risk scores of unemployment benefit applicants and businesses to provide a priority list.

Utilization Strategies:

- Utilization in the reconstruction and grading of the automatic alert (duplicate benefits) system, including targeted social media notifications.
- Providing a priority list for fraudulent claims based on risk scores for **businesses and individuals**.

공모적합을 위한 FID분석
부상수급 적발 종료

\* 출처: WTC, 2019년 공공 계약자의 분석과제 주요 내용(영양민)

## Case Study – Early Detection of Local Government Conflicts

2023 SEOUL S&T FORUM

Utilizing big data analysis to proactively identify and share information in advance about policies that may lead to conflicts between the central and local governments or have social implications, in order to facilitate inter-ministerial policy coordination and proactive responses

### Analysis Overview

Led by: Ministry of the Interior and Safet

Objectives:

- Utilizing big data analysis to proactively identify and share information in advance about policies that may lead to conflicts between the central and local governments or have social implications, in order to facilitate inter-ministerial policy coordination and proactive responses.

Utilized Data: (External) Data collected from major daily newspapers and social media, data held by the conflict management system, etc.

Initiative: Analyzing the change in the volume of core keywords in major media and SNS to proactively identify key conflicts for each local government.


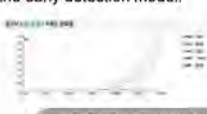
### Analysis Results and Utilization Strategies

Analysis Results:

- Discovery of new patterns of fraudulent claims.
- severity of documents (news, SNS), categorized into interest, caution, and severe stages, presenting a conflict index.
- Presentation of overall keywords and channel-specific (articles, SNS) keywords (regional visualization, keyword correlation analysis).  
Reducing conflicts by 10% results in a reduction of 87 days per conflict duration, considering an average duration of 669 days per case.

Utilization Strategies:

- Improving inter-local government conflict management through proactive conflict management using the early detection model.

실시간 빈출 키워드
회개어 키워드 변화량

\* 출처: WTC, 2019년 공공 계약자의 분석과제 주요 내용(영양민)



# Keynote Speech II

## AI & Data Utilization in Public Sector

Case Study – Activation of Regional Tourism
2023 SEOUL S&T FORUM

Applying a big data analysis approach that combines public and private data to assess the tourism and festival situation, moving away from traditional survey-based methods for counting regional tourists

### Analysis Overview

Led by: Jeollabuk-do Province, Jeonju City

**Objectives:**

- Analyzing the tourism and festival situation by applying a big data analysis approach that combines public and private data, moving away from traditional survey-based methods for counting regional tourists.

**Utilized Data:** (Internal) Information on tourist sites, tourism businesses, and more. (External) Data on mobile population, credit card transaction data, etc.

**Initiative:** Analysis of the economic ripple effects of festivals, as well as the analysis of major visitation patterns of domestic and international tourists.

### Analysis Results and Utilization Strategies

**Analysis Results:**

- Various perspectives of analysis (gender, age, season, monthly tourist trends, tourist origin, sales by Hanok village block, etc.) to identify policy improvements and key marketing target groups, as well as linked tourist destinations.

**Utilization Strategies:**

- Supporting demand-based tourism and festival project planning and implementation for each local government




지역별 유동인구
전주시 숙박 현황

\* 출처: 통계청, 2019년 공공 빅데이터 분석과제 주요 내용(행안부)

Case Study – Emergency Disaster Relief Fund Spending Behavior
2023 SEOUL S&T FORUM

Analyzing the spending patterns and economic effectiveness of emergency disaster relief funds to prepare evidence that can be used in the event of future disasters.

### Analysis Overview

Led by: Ministry of Public Administration and Security, Daegu Metropolitan City

**Objectives:**

- Analyzing the spending patterns and economic effectiveness of emergency disaster relief funds to prepare evidence that can be used in the event of future disasters.

**Utilized Data:** (Internal) Usage records of prepaid cards in Daegu City. (External) Personal credit card approval amounts, economic indicator data, household trend surveys.

**Initiative:**

- Analysis of the spending status of disaster relief funds.
- Analysis of the relationship between card sales and economic indicators and household income.


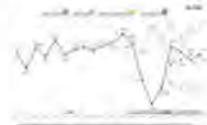
### Analysis Results and Utilization Strategies

**Analysis Results:**

- Analyzing spending patterns and economic indicators to determine the economic impact of disaster relief funds. This includes analyzing the impact of sales on businesses that can and cannot accept disaster relief funds, by region and industry, to verify the effectiveness of the local economy.

**Utilization Strategies:**

- Providing additional support to Daegu's local shopping districts for economic recovery, with bonus points awarded to districts with a significant reduction in sales of 10% or more when selecting commercial areas for support

경제효과 분석
대구광역시 경제효과분석

\* 출처: 통계청, 2019년 공공 빅데이터 분석과제 주요 내용(행안부)

# Keynote Speech II

So Ah Park

## Purposes of AI Utilization, Both Domestically and Internationally

2023 SEOUL S&T FORUM

- US**  
As of 2020, out of 142 federal agencies with 400 or more employees, 45% (64 agencies) have adopted AI, and there are currently 157 use cases in use  
The Ministry of Commerce and Industry has 44 use cases, the Ministry of Agriculture and Forestry has 26, the Ministry of Land, Infrastructure, and Transport has 26, and the Ministry of Health and Welfare has 8, and the number of AI use cases is increasing recently.
- EU**  
Starting a survey in 2020, and conducting it annually, the number of AI use cases increased by more than threefold from 230 cases in 2020 to 686 cases as of December 2021.  
In the case of the EU, they continue to perform follow-up work such as impact assessments and roadmaps after conducting a survey.
- KOREA**  
In 2022, for the first time, a survey was conducted, and out of 400 central government agencies, public institutions, and metropolitan local governments in South Korea, 220 organizations have introduced and are utilizing AI (55.0%)  
Artificial intelligence technology is rapidly evolving and making a significant impact in the public sector.

출처: 박상명, 조은결(2023), [ChatGPT, 국내외 공공 부문 도입 동향과 지자체 활용방안], 내용 보완 및 재구성

## The current status of AI usage in South Korea and overseas

2023 SEOUL S&T FORUM

- US**  
The primary purposes of AI usage in the public sector are regulation research, analysis, and monitoring, accounting for over 50%. Following that, execution, public services, and participation are also mentioned in the survey
- EU**  
As of 2020, AI usage in the public sector is most prevalent in public services (38%), followed by internal management (20%), execution (20%), regulation research, analysis, and monitoring (17%), and judgments (5%)
- KOREA**  
The AI usage objectives in the public sector are as follows: Public services (51%), Analysis and monitoring (20.3%), Internal management (15.3%)

출처: 박상명, 조은결(2023), [ChatGPT, 국내외 공공 부문 도입 동향과 지자체 활용방안], 내용 보완 및 재구성



# Keynote Speech II

## AI & Data Utilization in Public Sector

### Domestic and International AI Development Methods

2023 SEOUL S&T FORUM

- US**  
**53% of use cases are internally developed to meet internal needs**  
Therefore, in the United States, internal employees are the top developers with the highest number, followed by third-party (commercial) contractors, and non-commercial collaborations in that order.
- KOREA**  
**The methods of adopting AI technology primarily involve outsourcing to external companies or institutions, with 44.7% of cases, while internal development is relatively low at 13.2%.**  
The reason for not developing internally is primarily due to a lack of personnel, accounting for 80.9% of cases.

출처 : 박상명, 조은결(2023), [ChatGPT, 국내외 공공 부문 도입 동향과 지자체 활용방안], 내용 보완 및 재구성

### National and international AI policy directions


2023 SEOUL S&T FORUM

- US**  
While many federal government agencies are using AI across various domains, advanced AI technologies are implemented in less than 12% of cases. They prioritize enhancing the technical capabilities of internal developers and designing explainable and accountable AI solutions.
- EU**  
The policy makers emphasize the importance of building expertise within each agency for AI implementation and management, maintaining a balance between in-house and external development for smooth system management and maintenance, and conducting risk assessments for accountable AI solutions.
- KOREA**  
According to the survey results, policy responses to activate AI adoption in South Korea should focus on areas such as AI talent development (33.6%) and building AI infrastructure like data openness (25.1%). Therefore, it is crucial to explore policy directions for AI talent preparation and AI infrastructure development in the future.  
◆ Preparation is needed for AI talent development not only in AI R&D roles but also for internal AI development and utilization in the public sector, including public services.

출처 : 박상명, 조은결(2023), [ChatGPT, 국내외 공공 부문 도입 동향과 지자체 활용방안], 내용 보완 및 재구성

# Keynote Speech II

So Ah Park




## 2023 SEOUL S&T FORUM

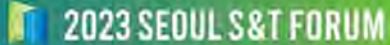
AI Innovation and our Future Society

### 4. AI & Data of VAIV

- 01 INTRODUCE
- 02 VAIV History
- 03 The concept of a "Vibe service."
- 04 VAIV Service




## INTRODUCE



Established in 2000, VAIV Company is a first-generation Korean company specializing in AI and big data. Since then, the Company has been providing services and solutions that help people make decisions and enable them to work efficiently.

In 2020, the company achieved a successful listing on KOSDAQ, thanks to its ongoing commitment to research and development in the field. It has garnered a strong track record across various industries, serving individuals, the public, and companies with its AI technology through products like VAIV Assistant and Sometrend.





# Keynote Speech II

## AI & Data Utilization in Public Sector

**VAIV History**

**2023 SEOUL S&T FORUM**


<p><b>2023</b></p> <ul style="list-style-type: none"> <li>Selected as a supplier for the 'private, cutting-edge, super large-scale AI utilization support project'</li> <li>Sometrend Cloud' launched</li> <li>AI-based neural search engine, 'VAIV Search' launched</li> <li>Super-large AI language model 'VAIVGeM' released</li> <li>Selected as '2023 Emerging AI+ X TOP100' by AI Industry Association for 3 consecutive years</li> </ul> <p><b>2022</b></p> <ul style="list-style-type: none"> <li>Selected as the Best Digital Transformation Company of the Year (under MSICT/NIA President's Award)</li> <li>Recognized as a 2021 Emerging AI + X TOP100 Company by the Artificial Intelligence Industry Association for the second consecutive year</li> </ul> <p><b>2021</b></p> <ul style="list-style-type: none"> <li>Launched the Digital Twin Forum</li> </ul> <p><b>2020</b></p> <ul style="list-style-type: none"> <li>Renamed to VAIVcompany Listed on KOSDAQ</li> </ul> <p><b>2019</b></p> <ul style="list-style-type: none"> <li>Opened the Smart City Lab</li> <li>Opened 'Life Change Observatory' life change content research center</li> <li>Selected as one of the top 100 innovators in the DNA field to drive the era of hyper-connected intelligence</li> </ul>	<p><b>2018</b></p> <ul style="list-style-type: none"> <li>Released the world's first AI Report</li> <li>Won the National Software Technology Award Korea ICT INNOVATION Grand Prize Received Commendation from the Minister of Science and ICT</li> </ul> <p><b>2017</b></p> <ul style="list-style-type: none"> <li>Developed a real-time issue discovery system</li> <li>Developed a robo-advisor</li> </ul> <p><b>2013</b></p> <ul style="list-style-type: none"> <li>Developed AI Fund Everest V1 technology</li> </ul> <p><b>2010</b></p> <ul style="list-style-type: none"> <li>Launched the Sometrend Biz service</li> <li>Developed an English/Korean and Chinese/Korean machine translation system</li> </ul> <p><b>2008</b></p> <ul style="list-style-type: none"> <li>Developed Text mining (Talkro Analyzer 3.0)</li> <li>Search engine (Talkro IR 4.0)</li> </ul> <p><b>2007</b></p> <ul style="list-style-type: none"> <li>Developed 'Talkro CVMS 2.0'</li> <li>a customer's sound management system</li> </ul> <p><b>2005</b></p> <ul style="list-style-type: none"> <li>Launched 'aAwoo', an AI-powered conversational website</li> <li>Won Prime Minister's Award at the 5th Digital Innovation Awards</li> </ul> <p><b>2000</b></p> <ul style="list-style-type: none"> <li>Launched 'aAwoo', an AI-powered conversational website</li> <li>Won Prime Minister's Award at the 5th Digital Innovation Awards</li> </ul>
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**The concept of a "Vibe service"**


**2023 SEOUL S&T FORUM**

**The success criteria for AI and Big Data presented by Vibe.**

**DATA**



**AI**



**P** **Bigdata Platform**  
Having the technology and capabilities for collecting and analyzing large-scale data.

**E** **Bigdata Expression**  
Effective insight expression techniques tailored to the characteristics of the data.

**A** **Bigdata Accuracy**  
Highly accurate and skilled big data cleansing techniques suitable for AI training.

**K** **Bigdata Knowledge**  
Advanced knowledge mapping techniques for large-scale big data analysis.

**U** **Understanding AI**  
AI that constantly discovers and comprehends diverse and vast data.

**S** **Solving AI**  
An AI that solves problems and extracts core values based on the given information.

**E** **Explaining AI**  
Communicates in the optimal way for humans to present, persuade, and make them understand.



# Keynote Speech II

So Ah Park

## VAIV Search

2023 SEOUL S&T FORUM

By combining the latest neural search technology and language generation technology, our AI not only understands the user's question and provides the answer to the query, but also provides the source of the answer.

- In-house solution installed within the company, ensuring security.
- Through API integration, linking multiple domains to provide answers to questions.

### Feature

- Korean Specialized LLM (Large Language Model)**
  - This result reflects 20 years of VAIV Company's strong expertise in text analysis tailored to the unique characteristics of the Korean language.
  - Ranked first in the KorQuAD 1.0 machine reading performance evaluation leaderboard as of December 2022.
- Provision of answers to questions as well as their original sources**
  - Provide answers to user questions based on the original text, summarized in just a few lines
  - Alleviate the hallucination problem by exposing the source that serves as the basis for the answer
- Domain-specific search engine capabilities**
  - Improve search performance through learning specific data for each specialized domain held by the VAIV Company, such as finance, law, and insurance, and internal corporate data





## VAIV Search

2023 SEOUL S&T FORUM

The Smartest AI Chatbot: Precisely understands intent and enables two-way mixed conversations.

### Feature

- Korea's first chatbot solution using two-way conversation technology**
  - Normalize and understand diverse sentences using VAIV Company's unique machine learning and natural language processing technology.
  - Natural conversation possible through various conversation processing based on two-way conversation technology
- Minimized deployment time with an automated Q&A solution**
  - Instant introduction with VAIV Q&A Solution: Analyzing documents and generating automatic Q&A sets.
  - When linked with VAIV Search, it is possible to cover answers even to content not found in the scenario, such as common sense




# Keynote Speech II

## AI & Data Utilization in Public Sector

### VAIV Report

2023 SEOUL S&T FORUM

Every step of report creation created by AI without human intervention, from data collection, search, and analysis to visualization and data explanation




- The world's first AI report where AI provides all analysis results as a report in the form of text and charts
- Support for VAIV ReportCopilot solutions that help with various document tasks by providing functions such as table of content/title generation, content summary, and description generation based on time series data
- Comprehensive insight using various systems and data sources such as unstructured data such as social big data and internal corporate data, financial data, and internal structured data

### VAIV Summary

2023 SEOUL S&T FORUM

This solution extracts and summarizes key content from text documents using advanced deep learning models, including techniques like Extractive and Abstract Summarization.



대상 문서      NLP Model을 통한 요약 과정      요약 결과 획득


# Keynote Speech II

So Ah Park

**Sometrend**

**2023 SEOUL S&T FORUM**

Sometrend, Korea's largest big data analysis service, processes real-time data from sources like news, blogs, communities, and social media, offering users seamless big data collection, processing, and visualization to uncover valuable insights.



**Feature**

- ① **Korea's only high-volume big data analysis.**
  - Big data analysis results can be searched within seconds for 45.1 billion pieces of data
  - The only big data analysis that enables free knowledge exploration even over a period of 10 years or more
- ② **Providing various types of services according to purposes and needs.**
  - Sometrend Biz supports companies and organizations to uncover work-related insights
  - Sometrend Cloud supports business-customized dashboards tailored to the characteristics of each industry
  - Sometrend Data+ provides analytical data through a data platform
  - Sometrend Consulting, a big data-based consulting report service
  - Sometrend, a big data analysis platform that anyone can easily use
- ③ **Korea's largest high-end analysis service**
  - Providing the largest high-end analysis service in Korea, which is used by more than 700 customers to find the insights they need
  - In addition to analysis of simple buzz, related words, and emotions, functions such as context assignment, pattern analysis, classification-based filtering, TPO analysis, index development, and marketing tools are provided.

**Key cases**

**2023 SEOUL S&T FORUM**

**Providing COVID-19 reports**

**Analysis of SNS for the 20th General Election**

**Provision of Government Policy Public Opinion Analysis Report**

**Detection and Support System for Signs of Trade Finance Fraud Risks**

NEWS

The Ministry of Science and ICT Supports AI, Data, and Cloud Companies for COVID-19 Response...

Vibe Company proactively addresses societal issues by analyzing keyword data related to COVID-19, extracting inflection points and issue moments, comparing associated terms, and conducting sentiment analysis for nationwide sentiment changes using SumTrends. This supports the development of risk models for preventing disease spread.

\*20.04 Ministry of Economy and Finance (MOEF) selects materials for overseas promotion of COVID-19 proactive response cases.

twitter

over 330 million cases

NAVER

over 14 million cases

Analysis result

Interest increased 2.68 times compared to the 19th general election, and a higher voter turnout is expected

\*20.04.15 KBS broadcasted Vibe Company's analysis report.

Preparation and provision of various government policy opinion reports.

Report

Supplementary Budget

Ministry of Culture, Sports and Tourism

- Current Issues Report

Report

4th Industrial revolution

Ministry of Culture, Sports and Tourism

- Current Issues Report

Report

Fake News Public Opinion Analysis Report

Ministry of Culture, Sports and Tourism

- Current Issues Report

Report

North Korea Nuclear Issue

Ministry of Culture, Sports and Tourism

- Current Issues Report

\*Analysis is based on the MOEF's data (between 2.20 and 2.29) and the MOEF's data (between 2.20 and 2.29)

Business Level

Business Level

Business Level

Business Level

Business Level

Business Level

Key contents

- Prevention of Trade Finance Fraud and Establishment of a secure foreign exchange trading network
- Preventing Financial Losses for Trade Insurance Companies and Banks, Ensuring Fair Practices, and Enhancing Global Competitiveness by Improving Trade Finance Security
- Reducing Assessment Times, and Expanding Support for Honest Businesses in Trade Finance.



# Keynote Speech II

## AI & Data Utilization in Public Sector



**Is AI a Tool for Innovation?** 2023 SEOUL S&T FORUM

**A world where efforts to acquire knowledge are diminishing**

- Knowledge is a clear awareness or understanding acquired through learning or practical experience about a particular subject. Human knowledge is accumulated by learning from one's own direct experiences and the experiences of others conveyed through various media.
- The emergence of search engines has dramatically reduced the time and cost required for learning, and AI services like ChatGPT have brought such innovative changes that redefine the concept of knowledge acquisition by completely eliminating the human learning process.
  - Therefore, learning is a series of essential processes that must be carried out for the accumulation of knowledge, and knowledge cannot exist without learning or experience.

Note : 2023.1 NIA, 김태원 수석연구원(AI·미래전략센터)

# Keynote Speech II

So Ah Park

## Is AI a Tool for Innovation?

2023 SEOUL S&T FORUM

### Technology is a double-edged sword, and it requires thoughtful consideration of how to use the tool known as technology.

- AI services can be excellent educational tools when used effectively. However, concerns about plagiarism, the reliability of results, copyright issues, educational inequality due to technological advancements, and potential learning impairments are also associated with their use.
- For proper AI usage, it is desirable to use AI as an aid rather than as a replacement for human teachers.
- For AI services to act as tools of innovation, it is necessary to always consider and minimize the risks and side effects that can arise from their use.

Note : 2023.1 NIA, 김태원 수석연구원(AI·미래전략센터)

## Is AI a Tool for Innovation?

2023 SEOUL S&T FORUM

### The Change in Human Roles Due to Technological Advancements

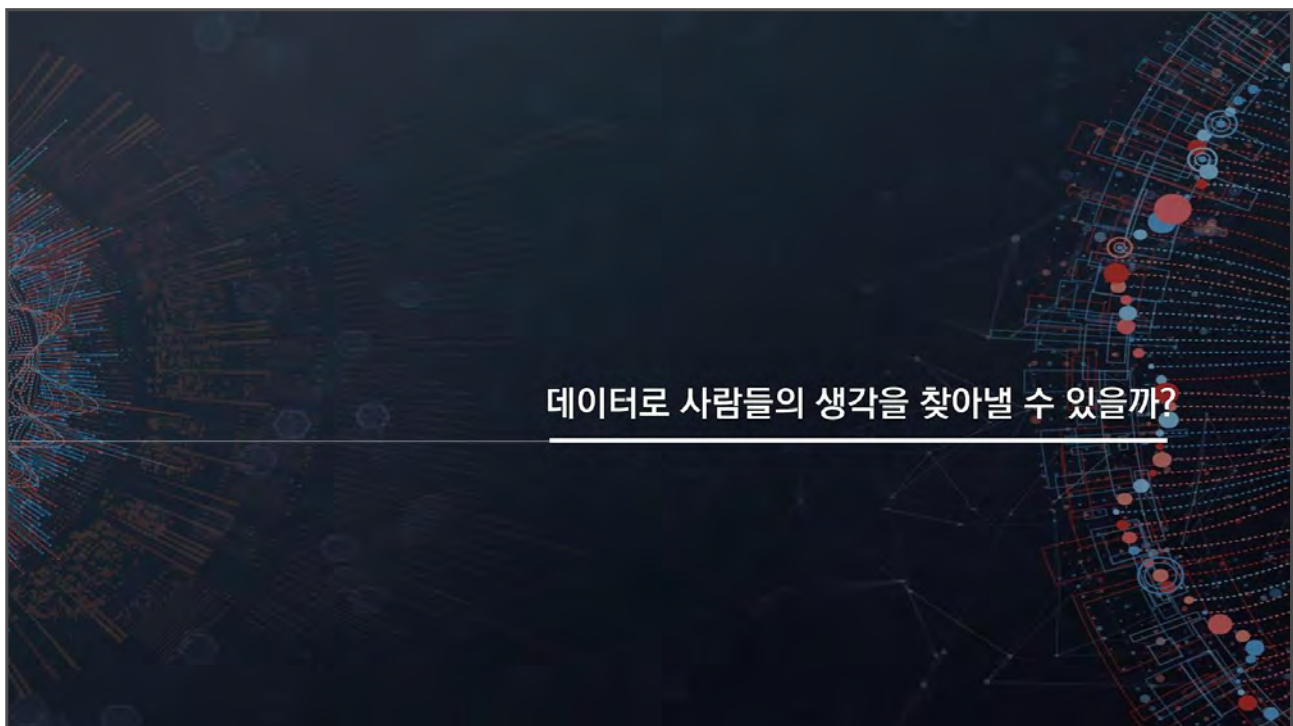
- In his book "The Shallows: What the Internet Is Doing to Our Brains," Nicholas G. Carr expressed concern that the easy access to information on the Internet has led to a decline in our ability to concentrate and remember. He argued that while we excel in information processing and decision-making skills, the habit of focusing on something and retaining it in memory, as typically exercised during reading a book, is gradually diminishing.
- The advent of the automobile made human mobility more convenient, the arrival of computers augmented human problem-solving abilities, and the introduction of the Internet may have reduced people's concentration, but it also created new value through connectivity
- Generation X could easily handle computers, Millennials were proficient with the Internet and social media, and Generation Z preferred mobile content, such as YouTube. In the future, children will grow up as AI natives, satisfying their curiosity through AI.  
- As AI services become ubiquitous, future generations will experience AI in their everyday lives. They will naturally turn to AI when they have questions, and the ability to effectively use AI will be a significant competitive advantage for them.

Note : 2023.1 NIA, 김태원 수석연구원(AI·미래전략센터)



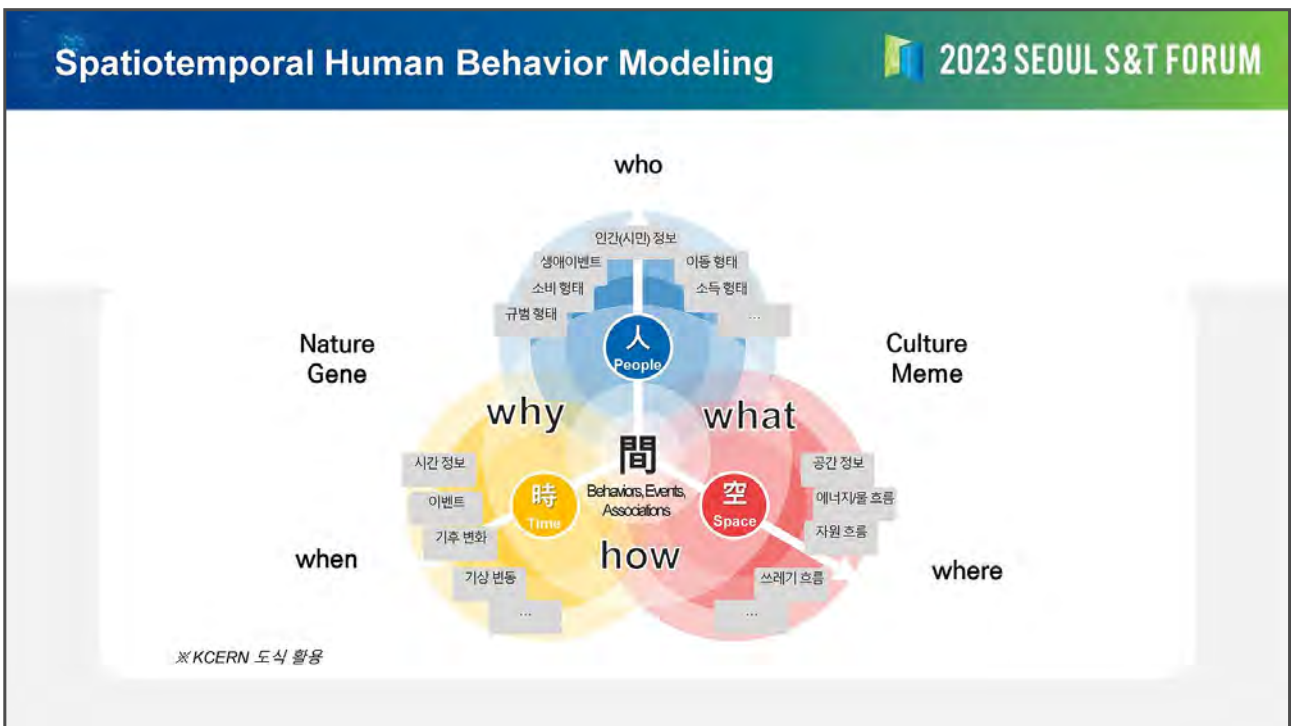
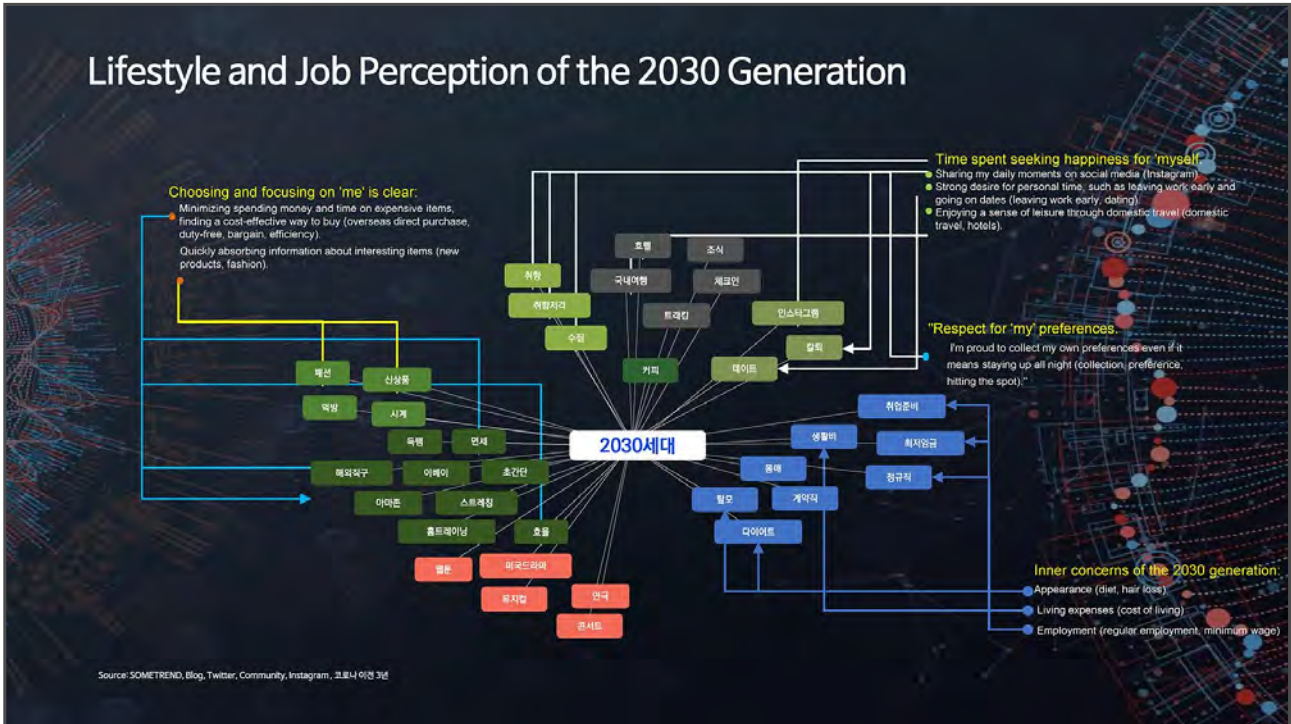
# Keynote Speech Ⅱ

AI & Data Utilization in Public Sector



# Keynote Speech II

So Ah Park





# Keynote Speech II

## AI & Data Utilization in Public Sector

### The main arguments

2023 SEOUL S&T FORUM

**Every evolutionary system, especially societies, is path-dependent by contingency and inevitability**

- To understand the phenomenon, a comprehensive perception in the spatiotemporal dimension is necessary. It requires three-dimensional and dynamic recording, storing, and managing of events.

**Structuralism against Reductionism**

- Our method of handling complex systems has traditionally relied on specialization and division of labor. However, setting boundaries between domains can lead to blind spots and disruption of connectivity.

**T.O.P. (Transparent, Open, Purpose-driven)**

- To achieve integrated (holistic) problem-solving, we need purpose-driven systems that consider the interoperability between digital twins and maintain mutual compatibility

### Policy Suggestion

2023 SEOUL S&T FORUM

**Policy Recommendations for Strengthening Data Platform Utilization**

- Policy**
  - There is a need to establish a policy agenda with the goal of significantly reducing data transaction costs.
  - Data is created by various entities, and platforms must be defined as one, with control towers for processes, standards, validation, technology, and other aspects to achieve this goal.
- Data**
  - To foster an ecosystem where data sharing is encouraged without requiring demands with every data transaction, it's essential to expand the role of institutions to make data sharing inevitable.
  - Considering the cost involved in refining accumulated data for effective utilization, implementing data verification procedures prior to any data transactions and distributions is crucial.
  - Furthermore, for continuous data curation across various domains and systems from the perspective of data utilization, the presence of an institution dedicated to curating data is essential.
- Platform**
  - There is a need to define the roles and directions of data platforms, including infrastructure, data, and services. A clear division of responsibilities between the public and private sectors is essential.
  - Establishing a system where the scope and services of private sector platform utilization can be shared is also necessary.



# PRESENTATION

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## SESSION I

The Issues of AI in the Public and Private Sector: Challenges and Values

### Presentation I

13:20-13:45

Minsung Kim

Head, Government & Regulatory Affairs, IBM Korea

### Presentation II

13:45-14:10

KwangHo Lee

Senior Research Fellow, Office of Innovation Law & Institution Research,  
Science and Technology Policy Institute (STEPI)

### Presentation III

14:10-14:35

Jack Hampson

CEO, Deeper Insights/ UK Governments AI Dealmaker for  
the Global Entrepreneur Programme





## Creating an Environment for Utilizing AI Technology

**Minsung Kim**

Head,

Government & Regulatory Affairs, IBM Korea

# Session I -1

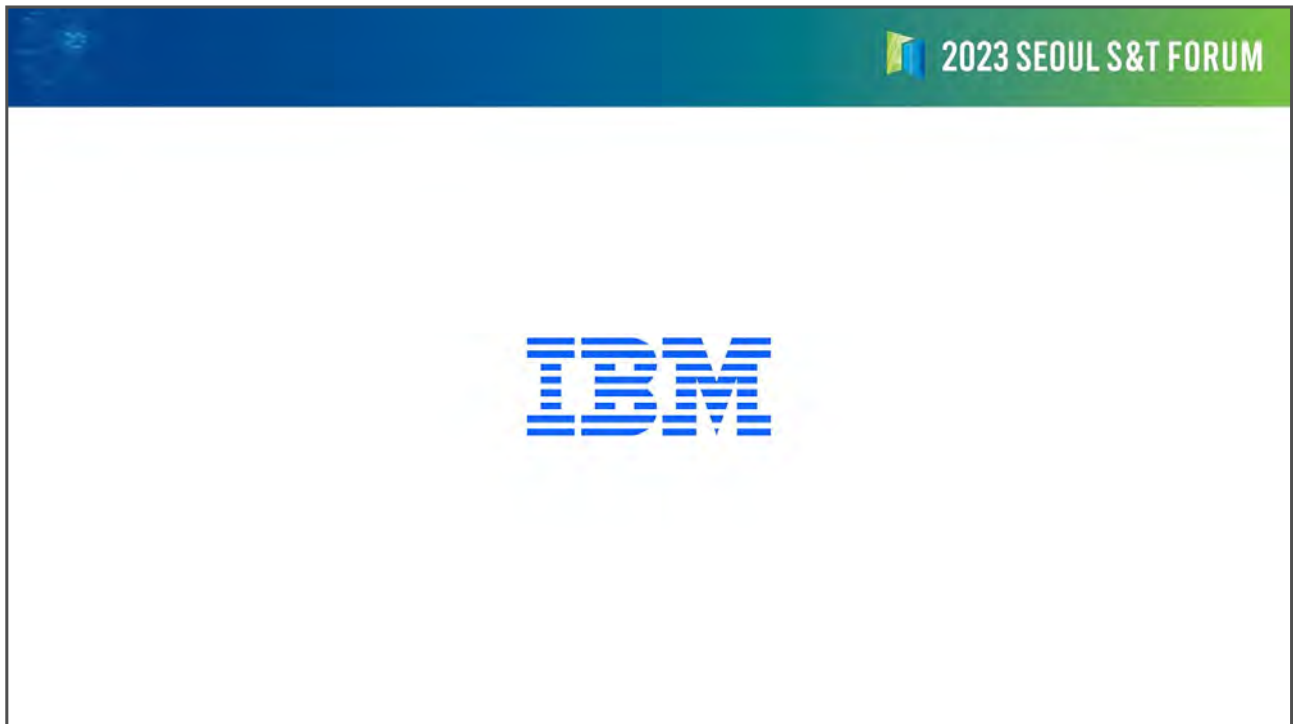
## Creating an Environment for Utilizing AI Technology



2023 SEOUL S&T FORUM  
November 7, 2023 | The Plaza Hotel, Seoul, Korea

Presentation Title : Creating an Environment for Utilizing AI Technology  
Name : Minsung Kim  
Position : Head, Government & Regulatory Affairs  
Organization : IBM Korea

Hosted by  National Research Council of Science & Technology  
Organized by  Korea Institute of Science and Technology  SCIENCE AND TECHNOLOGY POLICY INSTITUTE  
Sponsored by  Ministry of Science and ICT



2023 SEOUL S&T FORUM

**IBM**

# Understanding of AI Regulation System and Policy Implications

**KwangHo Lee**

Senior Research Fellow,  
Office of Innovation Law & Institution Research,  
Science and Technology Policy Institute (STEPI)



# Session I -2

## Understanding of AI Regulation System and Policy Implications

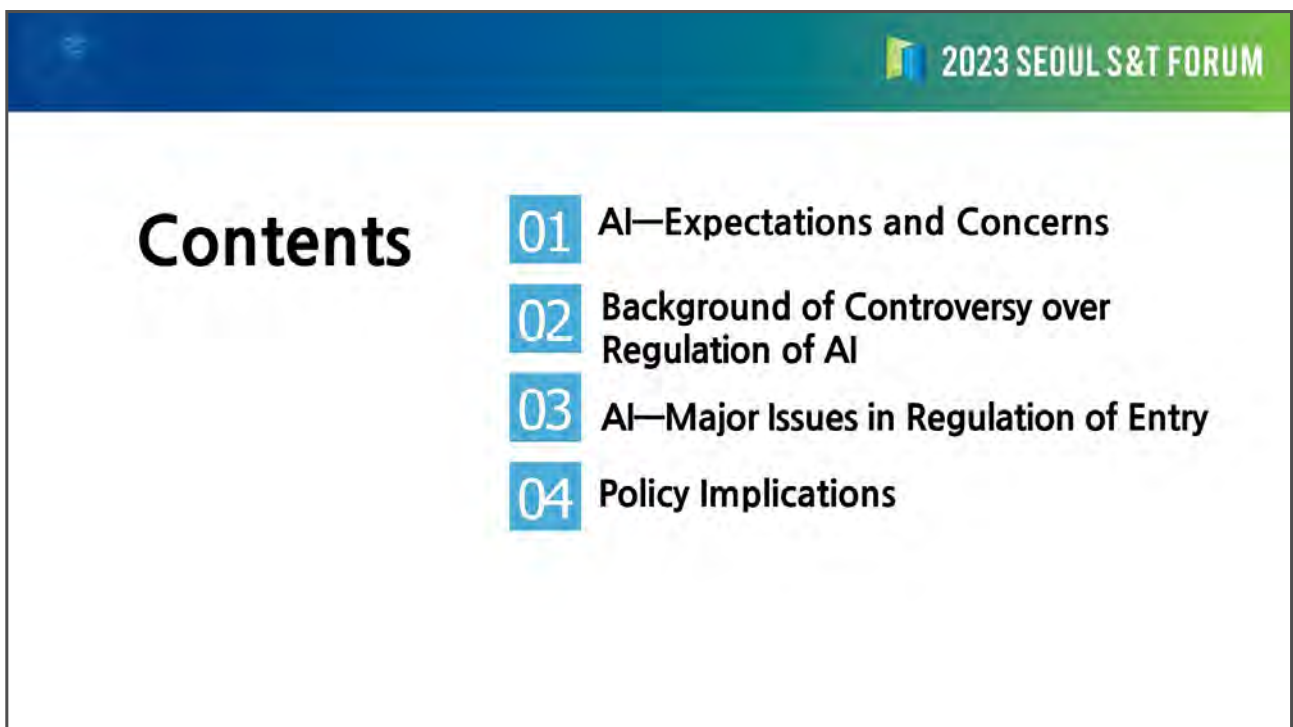


The banner features a green-to-blue gradient background with a circuit board pattern on the right. A stylized logo of a blue and green cube is positioned above the main text. The text is centered and includes the event title, date, location, and presenter information.

**2023 SEOUL S&T FORUM**  
November 7, 2023 | The Plaza Hotel, Seoul, Korea

Presentation Title : Understanding of AI Regulation System and Policy Implications  
Name : KwangHo Lee  
Position : Senior Research Fellow  
Organization : Science and Technology Policy Institute

Hosted by **nst** National Research Council of Science & Technology  
Organized by **KIT** Korea Institute of Science and Technology **STEP** SCIENCE AND TECHNOLOGY POLICY INSTITUTE  
Sponsored by **MSIT** Ministry of Science and ICT



The slide has a blue header with the event logo and title. The main content is on a white background with a large 'Contents' heading and a list of four items, each with a blue square icon containing a white number.

**2023 SEOUL S&T FORUM**

## Contents

- 01** AI—Expectations and Concerns
- 02** Background of Controversy over Regulation of AI
- 03** AI—Major Issues in Regulation of Entry
- 04** Policy Implications

## 1. AI—Expectations and Concerns

2023 SEOUL S&T FORUM

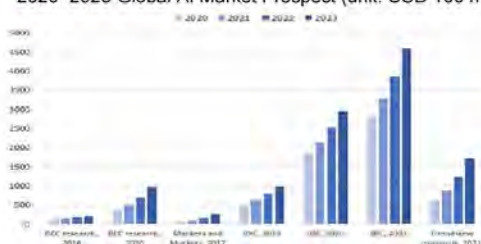
### Optimistic expectations for AI

- Amid expansion of the scope of AI applications and functional diversification, related markets are expected to grow rapidly.

- The annual average growth of the global AI market is projected to be at least 20%, with IDC predicting that the Korean market will grow by at least 15%.
- AI markets can be divided into the application sector (chatbots, education, image editing, healthcare, robotic automation) and the original technology sector (machine learning, eXplainable Artificial Intelligence (XAI), synthetic data generation for machine learning). Currently, chatbots and XAI are the largest segments.
- In addition, AI is spreading to other related industries including big data, smart medical devices, smart manufacturing, smart cities, self-driving vehicles, and drones.

### Market growth trend

2020~2023 Global AI Market Prospect (unit: USD 100 million)



Source: Korea Export and Import Bank of Korea (2021). Status of AI industries and AI cultivation policies of major countries. As cited in survey data of institutions on p. 3



Source: IDC Korea (2022), Korean AI market prospects, 2021-2025

## 1. AI—Expectations and Concerns

2023 SEOUL S&T FORUM

### Concerns over AI



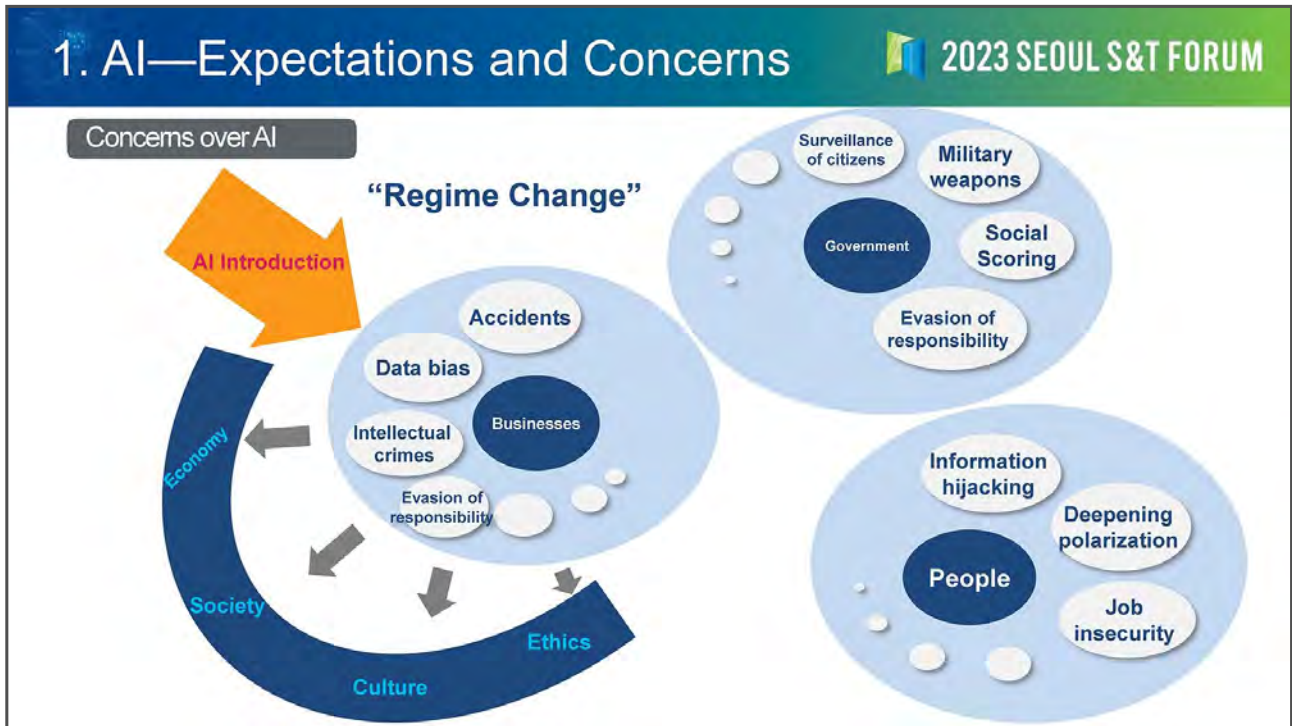
- Why are people afraid?
  - Can they comprehend and control AI?
  - Ability to comprehend and control reduces fear.
- Weak AI vs strong AI (singularity)
  - What is the self? Narrative + Reasoning
  - Human reasoning is a key result of brain evolution.

- AI development requires an understanding of humans (brain).
  - The evolution of AI and brain science is mutually complementary.
  - We do not yet know ourselves completely.



# Session I -2

## Understanding of AI Regulation System and Policy Implications



### 2. Background of Controversy over Regulation of AI

2023 SEOUL S&T FORUM

**Arguments for stricter regulation**

- **Emphasis on risks of AI and raising the necessity for managing AI in advance**
  - While AI provides a momentum for transformation of human civilization, it presents unknown risks.
  - Transparency, accountability and explainable AI must be guaranteed before the use of AI is deemed safe.
  - Some raise the necessity for ex ante regulation of AI algorithms that can be generally applied in addition to regulation of AI applications.
  - The EU AI Act recently announced is the result of these arguments.

**Arguments for easing regulation**

- **Excessive concern about AI undermines technological development and restricts its use in order to protect vested interests**
  - While AI replaces human intellect from the phase of strong AI, AI singularity is predicted to occur in the far distant future.
  - While the use of AI can improve human welfare and productivity, strict AI regulation is only a means of protecting vested interests.
  - The use and spread of AI is an irreversible trend and strict AI regulation will lead to weaker global competitiveness.
  - Soft regulation in the form of codes of conduct or professional guidelines is desired instead of enforced AI regulations.

## 2. Background of Controversy over Regulation of AI 2023 SEOUL S&T FORUM

### EU AI Act (2021): Regulatory framework and governance from the perspective of risk

- ◆ **The world's first comprehensive AI law entered into effect after two years of preparation.**
  - Minimum requirements to manage AI risk and diversified governance (government, **government-provider, provider**)
  - AI risks are classified into four levels, with specific regulations for each level.

Levels of risk	Regulations
Unacceptable risk	Prohibited AI practices
High risk	Regulated high risk AI systems
Limited risk	Obligation of transparency on AI systems
Low or minimal risk	Self-regulation recommended

**Dualistic classification and regulatory framework**

⇒ (1) AI systems used as a safety element for products subject to **other EU laws** or (2) AI systems that require a **third-party conformity assessment** before being put on the market

**Toys, medical devices, lifts, vehicles, aircraft, other mechanical safety elements, etc.**

Government regulation

**Stand-alone AI systems that negatively affect fundamental rights (Appendix III)**

- EU Commission authority to enact and revise

Biometric identification, education and vocational training on the management and operation of critical infrastructure, employment and worker management, social benefit administration, emergency medical and firefighting services, law enforcement, migration, asylum and border control management; assistance in legal interpretation and application.

Self & Co-regulation

- ◆ **Characteristics of EU AI Act**
  - **Diversification of regulatory governance:** Existing sectoral regulatory governance + European Commission + EU Data Protection Supervisor + Market supervisory institutions + Members' regulatory authorities + EU AI Board (advisory organ) + **autonomous regulation (AI systems providers)**
  - **Risk-based management system:** mix of government administrative regulation + Co-regulation + Self-regulation

## 2. Background of Controversy over Regulation of AI 2023 SEOUL S&T FORUM

### High-risk AI systems under the EU AI Act

Category	Area	Examples
1	Critical infrastructure that could put the life and health of citizens at risk	Transportation
2	Educational or vocational training, that may determine the access to education and professional course of someone's life	Scoring of exams
3	Safety components of products	AI application in robot-assisted surgery
4	Essential private and public services	Credit scoring denying citizens opportunity to obtain a loan
5	Law enforcement that may interfere with people's fundamental rights	-
6	Migration, asylum and border control management	Verification of travel document authenticity
7	Administration of justice and democratic processes	Applying the law to a concrete set of facts
8	All types of remote biometric identification systems	-

### Obligations for high-risk AI systems under the EU AI Act

Documentation obligations	Obligations before AI systems are put on the market	Obligations after AI systems are on the market
(1) Adequate risk assessment and mitigation system (2) Dataset and data management system establishment and management (3) Detailed documentation providing all information necessary (4) Logging of activity to ensure traceability of results (5) Clear and adequate information provided to the user (6) Appropriate human oversight measures to minimize risk (7) High level of robustness, security and accuracy (8) Quality management system establishment and operation	(1) Conformity assessment : Third-party assessment or self-assessment (2) Registration obligation : Register AI systems on the EU database (3) Declaration of EU compliance and attachment of CE marking	(1) Corrective measures (2) Information provided (3) Obligation to cooperate with authorities (4) Follow-up monitoring



# Session I -2

## Understanding of AI Regulation System and Policy Implications

### 2. Background of Controversy over Regulation of AI

2023 SEOUL S&T FORUM

**Relationship between AI and regulations**

- AI systems and regulatory framework involve complex interactions, and different regulations are applied depending on the nature of the relationship.
  - The current regulatory framework concentrates on data (laws protecting personal information, etc.) and applications (regulation of individual applications), and regulation on algorithms is only at the discussion stage.
  - The assignment of qualifications on the subject of safe and transparent data processing, data use certification, and responsibility for post management would be subject to separate regulations.
  - Explainability of AI algorithms is a trade-off with functionality. A separate regulatory system does not exist and regulation on granting AI qualification is underway.
  - There are conflicts between stakeholders (medical services, law, etc.) regarding AI applications. Existing laws could act as barriers to entry.

The diagram illustrates the relationship between AI systems and regulatory frameworks. On the left, 'AI systems' are represented by three boxes: 'Data', 'AI Algorithm', and 'Application', connected by dashed arrows from left to right. On the right, the 'Regulatory framework' is represented by four boxes: 'Qualification', 'Acts', 'Product/service licenses', and 'Follow-up responsibility', also connected by dashed arrows from left to right. A large double-headed arrow at the bottom is labeled 'Regulation of entry'. Solid blue arrows show a complex web of interactions: 'Qualification' points to 'Data', 'AI Algorithm', and 'Application'; 'Acts' points to 'Data', 'AI Algorithm', and 'Application'; 'Product/service licenses' points to 'AI Algorithm' and 'Application'; and 'Follow-up responsibility' points to 'Application'.

### 3. AI-Major Issues in Regulation of Entry

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**AI in Medicine**

- There is strong regulation on entry of AI in medicine, and the spread of AI is hindered with a limited allowance.
  - Although efforts and expectations at home and abroad to use AI in medical settings are significant, the spread of AI in medicine is currently restricted by complex and strict regulations on entry.
  - Granting qualification to AI systems as the subject of treatment is not possible as per Article 2 of the Medical Service Act and the use of AI by doctors is not provided for under the residency curriculum.
  - The use of personal medical information for AI is highly restricted by regulations to protect sensitive information, and criteria on the use of clinical results for research are not clearly defined.
  - Although medical insurance eligibility is essential for market entry, the number of approved AI software items that receive medical insurance is very low and approvals are given for AI software updates in a very strict manner.

The diagram is similar to the one in slide 2, but includes a 'Regulatory issues' section below the regulatory framework boxes. The issues are:
 

- Qualification:** AI Doctor: Not possible; Granting AI qualification to doctors: Non-existent.
- Acts:** The use of personal medical information for AI: Limited; The use of clinical results for AI research: Unclear.
- Product/service licenses:** Applying medical insurance to AI medical devices: Limited; AI software licenses: Strict.

### 3. AI-Major Issues in Regulation of Entry

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#### AI in Finance

- AI is used in niche markets such as chatbots and robo-advisors due to eased fintech regulation.
  - The use of AI in the financial sector is actively attempted, and has thrived largely in some niche markets due to the protection of personal information and legal status issues.
  - AI robo-advisor service providers must meet requirements of qualification to engage in business in investment advisory and discretionary investment defined under the Financial Investment Services and Capital Markets Act. AI chatbots are not listed as one of the services provided to financial users under the Detailed Regulations on Supervision of Banking Business.
  - Although it is necessary to monitor AI system developers for the safe use of AI in finance, it is not clear whether they are subject to financial regulations.
  - Quality certification for AI software includes GS and AI+ certifications, but they are not mandatory.

<b>AI systems</b>	Data	AI Algorithm	Application
<b>Regulatory framework</b>	Qualification	Acts	Product/service licenses
<b>Regulatory issues</b>	<ul style="list-style-type: none"> <li>Requirements for approval of business in AI-based financial investment: Unreasonable</li> <li>Legal status of AI chatbots: None</li> </ul>	<ul style="list-style-type: none"> <li>Monitoring of AI system developers: Vague</li> </ul>	<ul style="list-style-type: none"> <li>AI-based financial software certification: Limited quality certification</li> </ul>

### 3. AI-Major Issues in Regulation of Entry

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#### AI in Social Welfare (scenario: customized support for socially disadvantaged people using financial, medical, and educational information)

- (Expected effects) Reduce the tasks of social workers and integrate fragmented information to increase tailored support and benefits
  - Currently, support for the socially disadvantaged is handled by social workers at local governments, but due to excessive workloads, they cannot identify difficulties.
  - Because the tasks and qualifications of social workers are provided for under the Social Welfare Services Act, task execution by AI is not possible. Collecting donations using social networking services is not possible because the national and local governments and government-sponsored institutions are not allowed to collect donations under the Act on Collection and Use of Donations, which also confines donation collection places to the press, financial institutions and other public entities.
  - The Framework Act on Social Security provides that applications for social security benefits can only be filed by applicants or the national or local government, and consent to provide personal information is not clearly defined (obligations to obtain written consent per application).
  - In order to enable AI software to process social welfare tasks, a licensing system with a certain standard is required, but does not currently exist.

<b>AI systems</b>	Data	AI Algorithm	Application
<b>Regulatory framework</b>	Qualification	Acts	Product/service licenses
<b>Regulatory issues</b>	<ul style="list-style-type: none"> <li>Qualifying AI systems to process social welfare tasks: Not possible</li> <li>Collecting donations using AI and SNS: Not possible</li> </ul>	<ul style="list-style-type: none"> <li>Preparation of administrative documents using AI: Unclear</li> <li>Processing personal information using AI: Unclear</li> </ul>	<ul style="list-style-type: none"> <li>AI software licensing: Non-existent</li> </ul>



# Session I -2

## Understanding of AI Regulation System and Policy Implications

**4. Policy Implications** 2023 SEOUL S&T FORUM

- At this moment, since it is impossible to establish a general regulatory framework regarding AI, an inductive approach is needed.
  - The establishment of a formal regulatory framework on AI algorithms is nearly impossible considering the current level of technology and the diversity of application areas.
  - First, a regulatory framework is needed that reflects the special characteristics of application areas, and then a generalized step-by-step regulation process can be applied once sufficient common denominators are identified.
  - The establishment of a regulatory framework regarding the collection and use of reliable data and ex-post validation is an innovation-friendly approach to regulation.
- Relaxing qualifications through risk assessment and converting requirements for conduct into a negative regulatory system
  - Concerning qualifications exclusively granted by specific sectors, it is desirable to relax entry barriers given the benefits to all of society. It will then be necessary to conduct various validation projects and prepare institutional frameworks to facilitate the process (e.g., revise medical services curriculum, and financial sector validation projects)
  - Ambiguity in regulations may be reduced by converting the positive system of requirements for conduct prescribed under existing laws into a negative system.
- Removing regulatory vacuum by sector, improving related systems, and building infrastructure can help ease entry barriers.
  - If sectoral regulations are not clear or regulations for consumer protection do not exist, firms' access to markets can be difficult (there are multiple laws and regulations on consent to the use of personal information and data.)
  - It is advisable to ease entry barriers by improving related systems such as the national health insurance system, and to facilitate the easing of entry barriers and secure market confidence by building a third-party validation process of AI software by area of application.
  - Creating an innovative licensing system like the US FDA's pre-certification program for digital therapeutics to simplify licensing procedures is recommended.

**Thank you**

## Aligning AI to Commercial Value

**Jack Hampson**

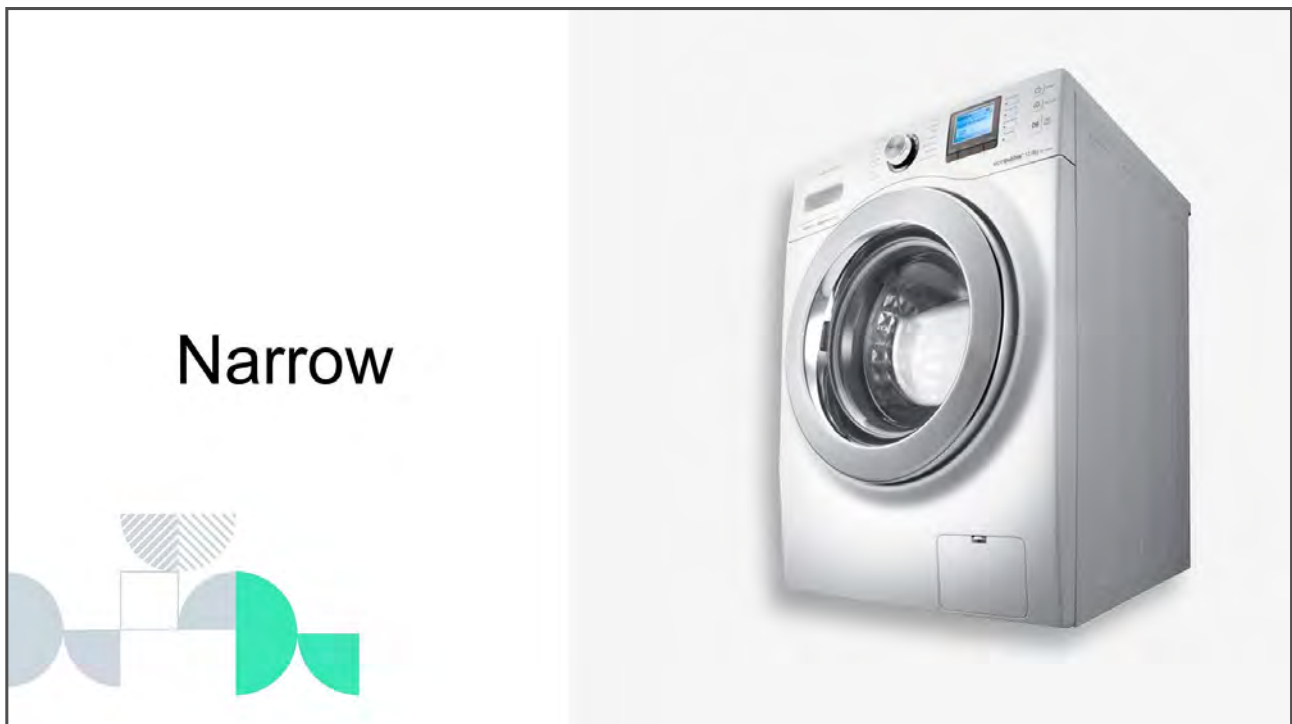
CEO,

Deeper Insights/ UK Governments AI Dealmaker for the Global Entrepreneur Programme



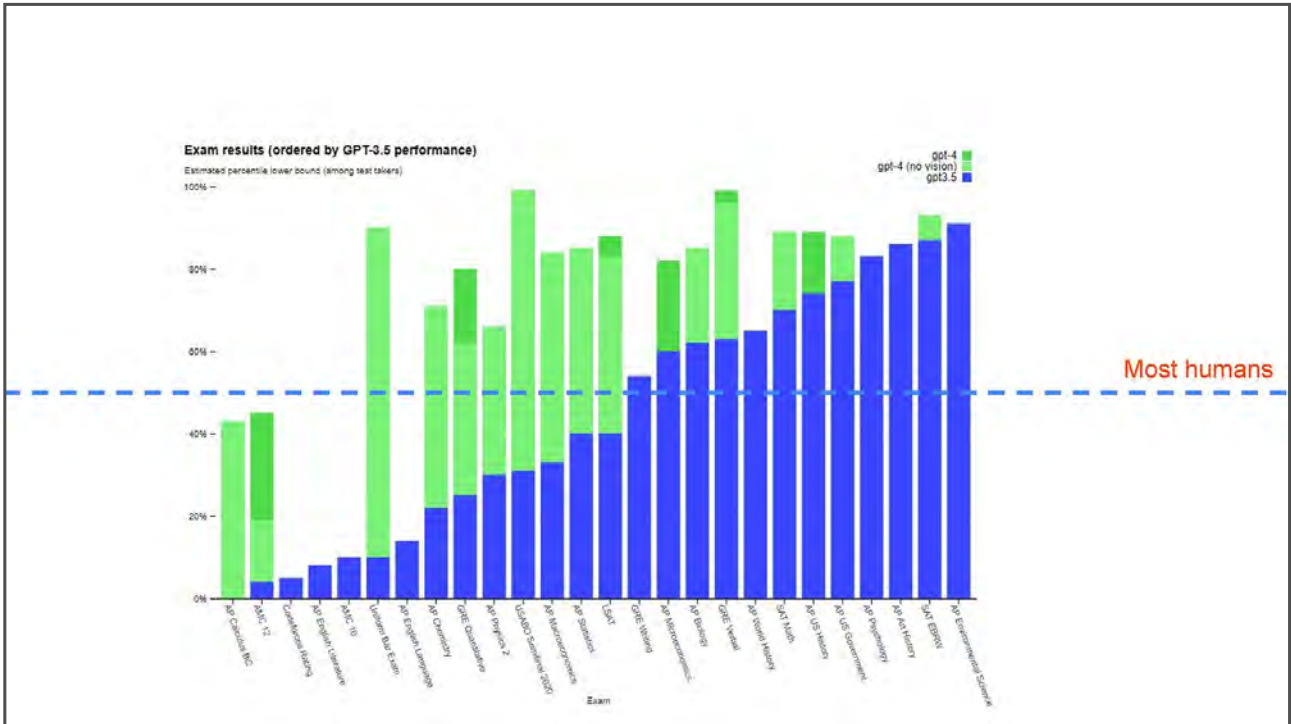
# Session I -3

Aligning AI to Commercial Value



# Session I -3

Jack Hampson



# Session I -3

## Aligning AI to Commercial Value

**Bill Gates feels Generative AI has plateaued, says GPT-5 will not be any better**

The billionaire philanthropist in an interview with German newspaper Handelsblatt, shared his thoughts on Artificial general intelligence, climate change, and the scope of AI in the future.

Written by [Bijin Jose](#)  
New Delhi | Updated: October 29, 2023 16:47 IST

NewsGuard

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Mr Bill Gat

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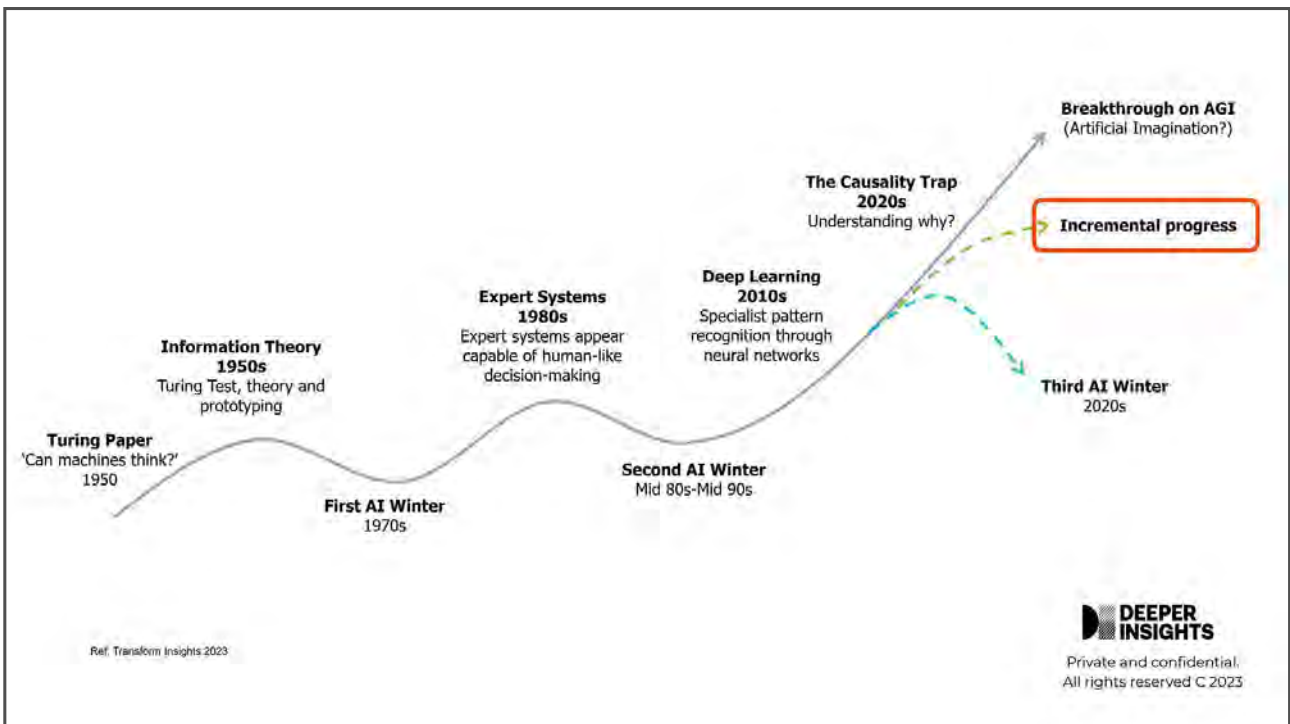
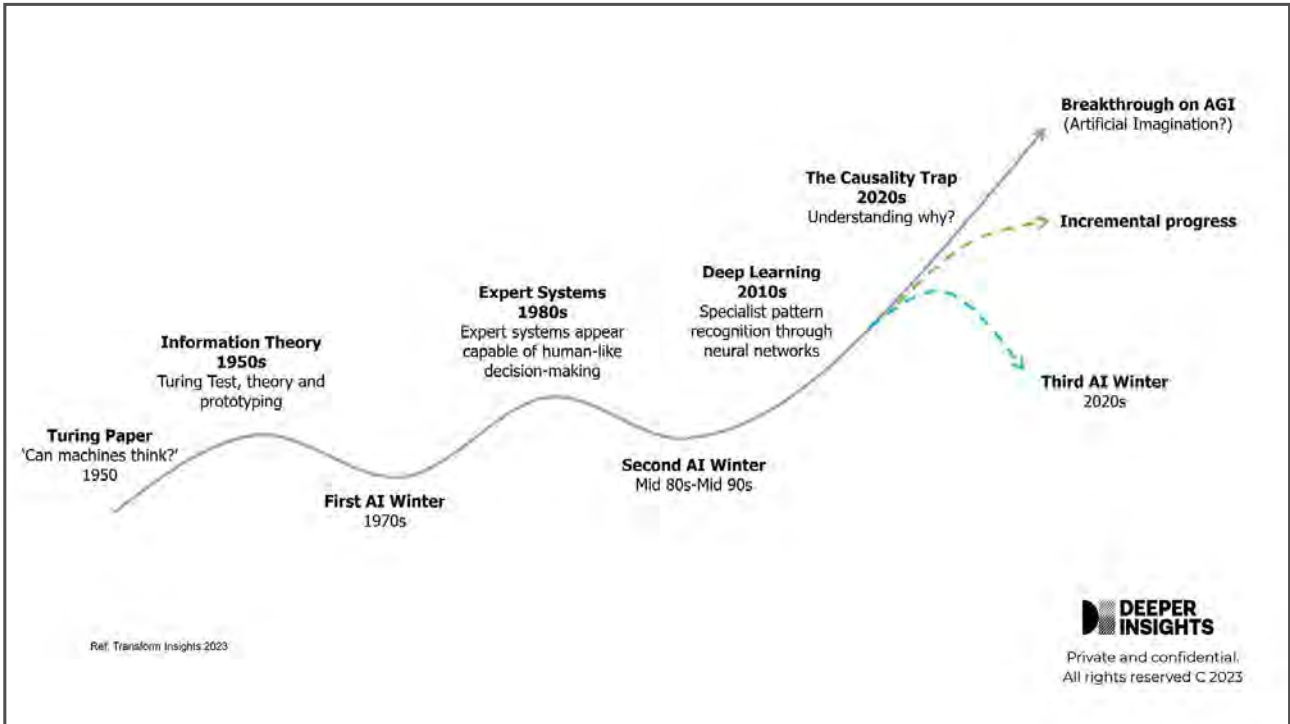
Listen to this article

00:00 1x 1.5x 1.8x

Is there another AI winter coming?

# Session I -3

Jack Hampson



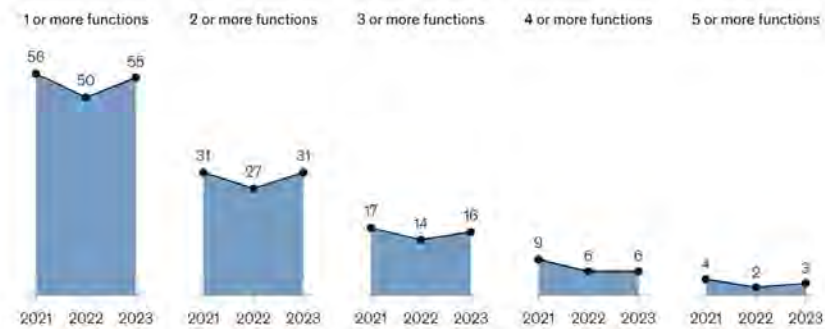


# Session I -3

## Aligning AI to Commercial Value

Less than one-third of respondents say their organizations use AI in more than one function—a share largely unchanged since 2021.

Number of business functions at respondents' organizations that have adopted AI, % of respondents'



In 2021, n = 1,845; in 2022, n = 1,492; in 2023, n = 1,664.  
Source: McKinsey Global Survey (MGS) for AI, 2024. Published by McKinsey & Company, Nov. 18-19, 2023.

McKinsey & Company



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### SHARE OF CORPORATE DATA STORED IN THE CLOUD OVER TIME



Ref: Zippia, "25 Amazing Cloud Adoption Statistics [2023]: Cloud Migration, Computing, And More" Zippia.com, Jun. 22, 2023.



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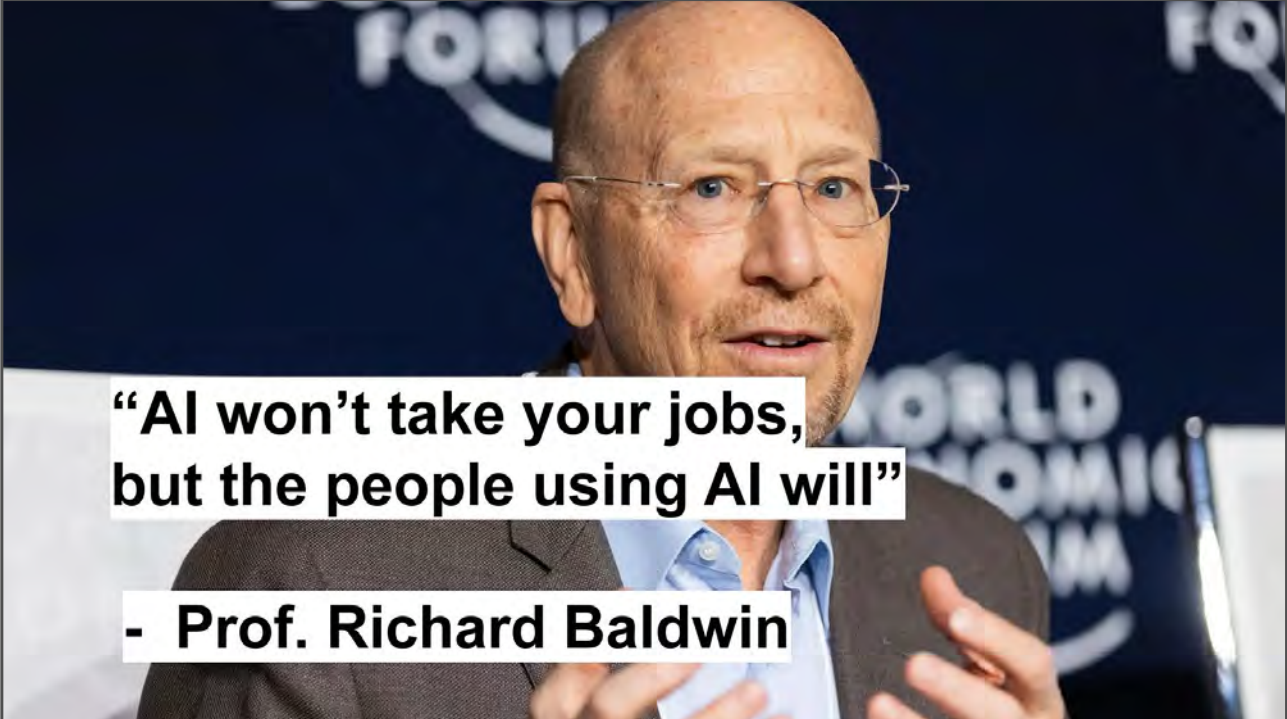
# Session I -3

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Jack Hampson



## IMPLEMENTING AI IN ENTERPRISE



**“AI won’t take your jobs,  
but the people using AI will”**

**- Prof. Richard Baldwin**

# Session I -3

## Aligning AI to Commercial Value

### Study 1

**Customer service** agents resolving customer inquiries in an enterprise software company.

**Q: How many more customer inquiries could they handle per hour?**

**+13.8%**

Ref. Jakob Nielsen on July 16, 2023

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### Study 2

Experienced business professionals (e.g., marketers, HR professionals) writing routine business documents (such as press releases).

**Q: How many more business documents could be written per hour?**

**+59%**

Ref. Jakob Nielsen on July 16, 2023

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## Study 3

Programmers coding a small software project that took about three hours to complete without AI assistance

**Q: How many more projects per week could programmers code?**

**+126%**

Ref. Jakob Nielsen on July 16, 2023

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**AI delivers real value**



# Session I -3

—

Aligning AI to Commercial Value

AI is not a product

AI is a problem solver

# Session I -3

Jack Hampson



# Session I -3

Aligning AI to Commercial Value

## PROBLEM DEFINITION

Increasingly hot weather is putting pressure on our coolers which means they breakdown more often and leave customers feeling frustrated because they can't have their favourite cool drink on a hot day.



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## PROBLEM DEFINITION

Ensure no cooler is ever broken and customer is always happy

KPI's =

- Increase customer satisfaction by x%
- Increase revenue by \$x,xxx,xxx

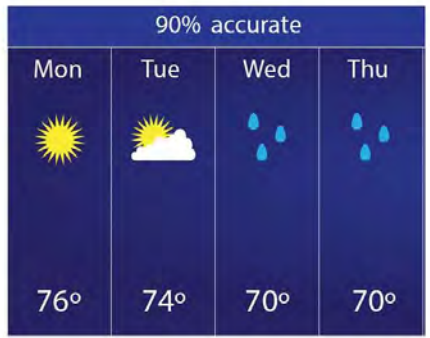


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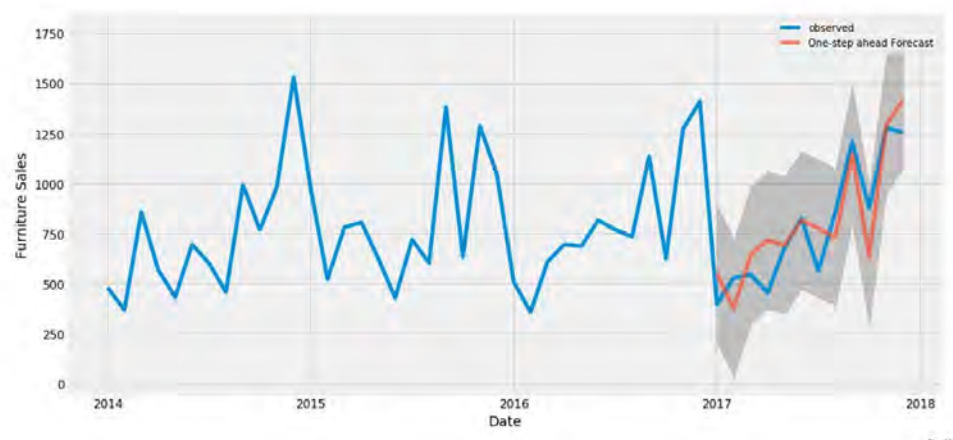
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## DATA



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## METHOD



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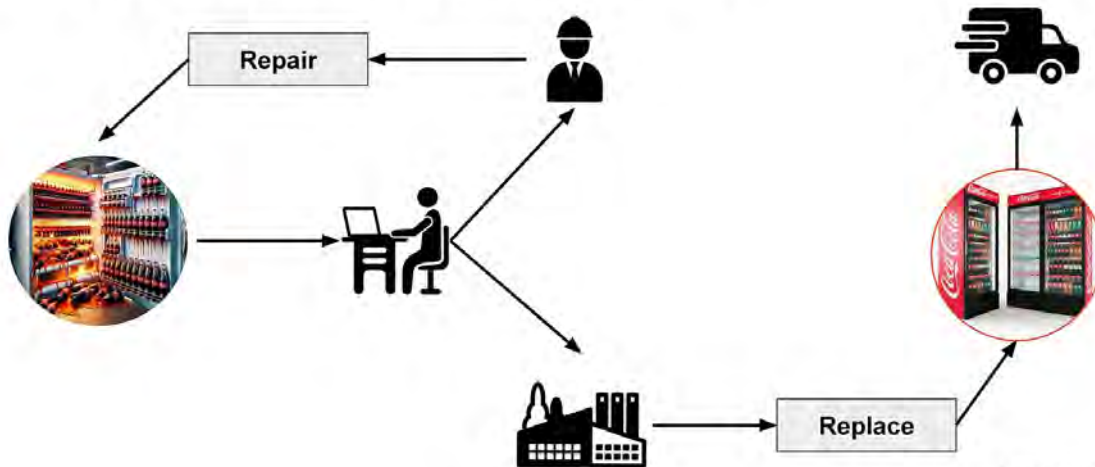
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Aligning AI to Commercial Value

98% Likelihood  
Cooler Defect  
within 6 days



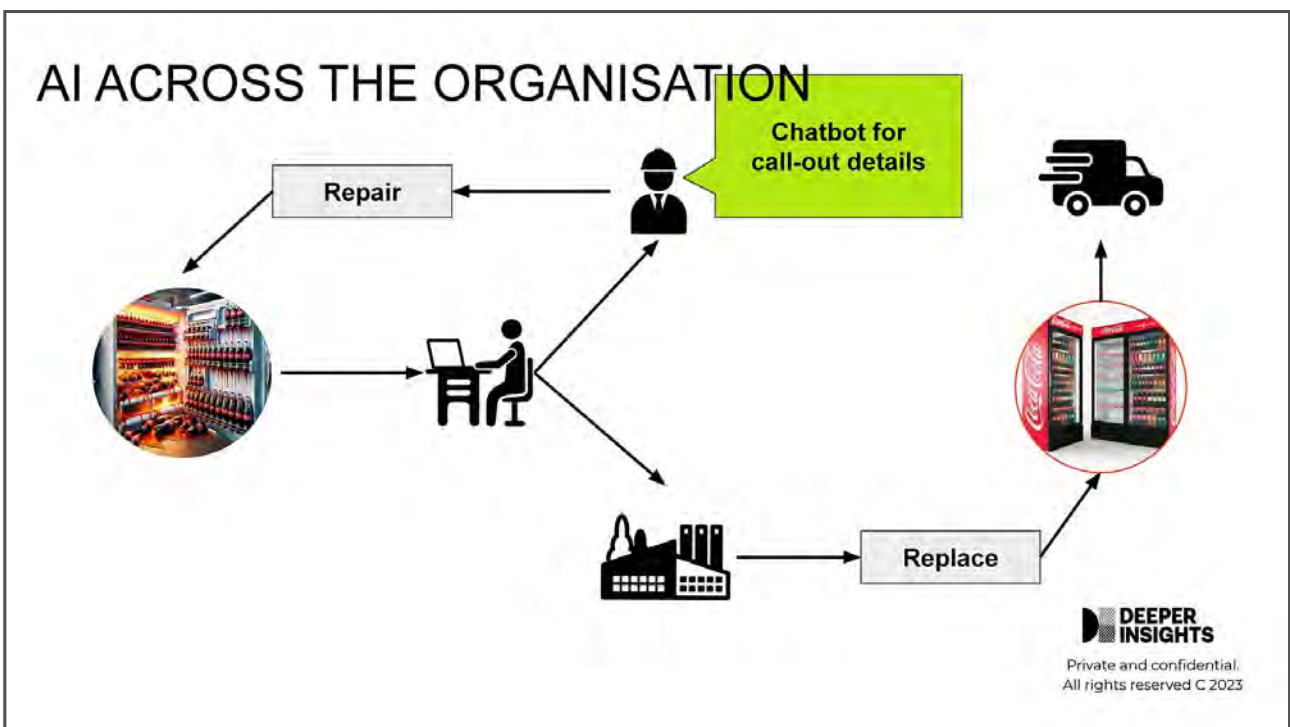
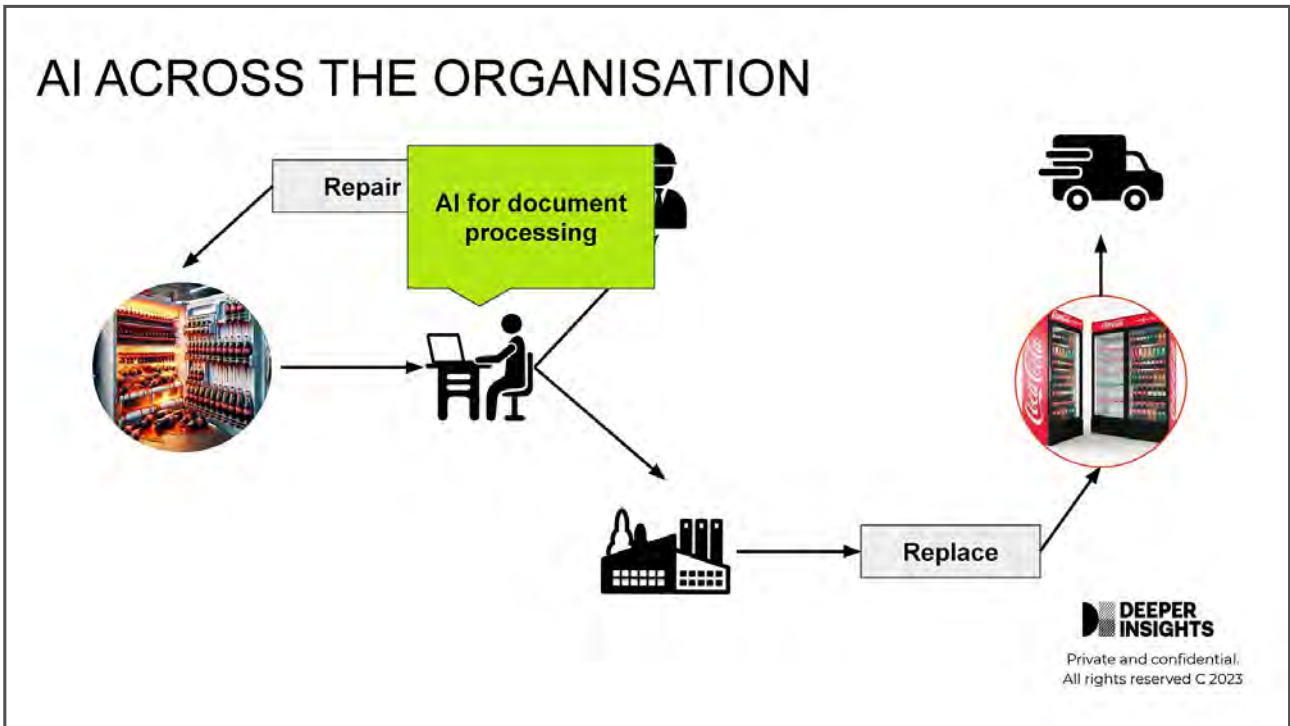
## AI ACROSS THE ORGANISATION



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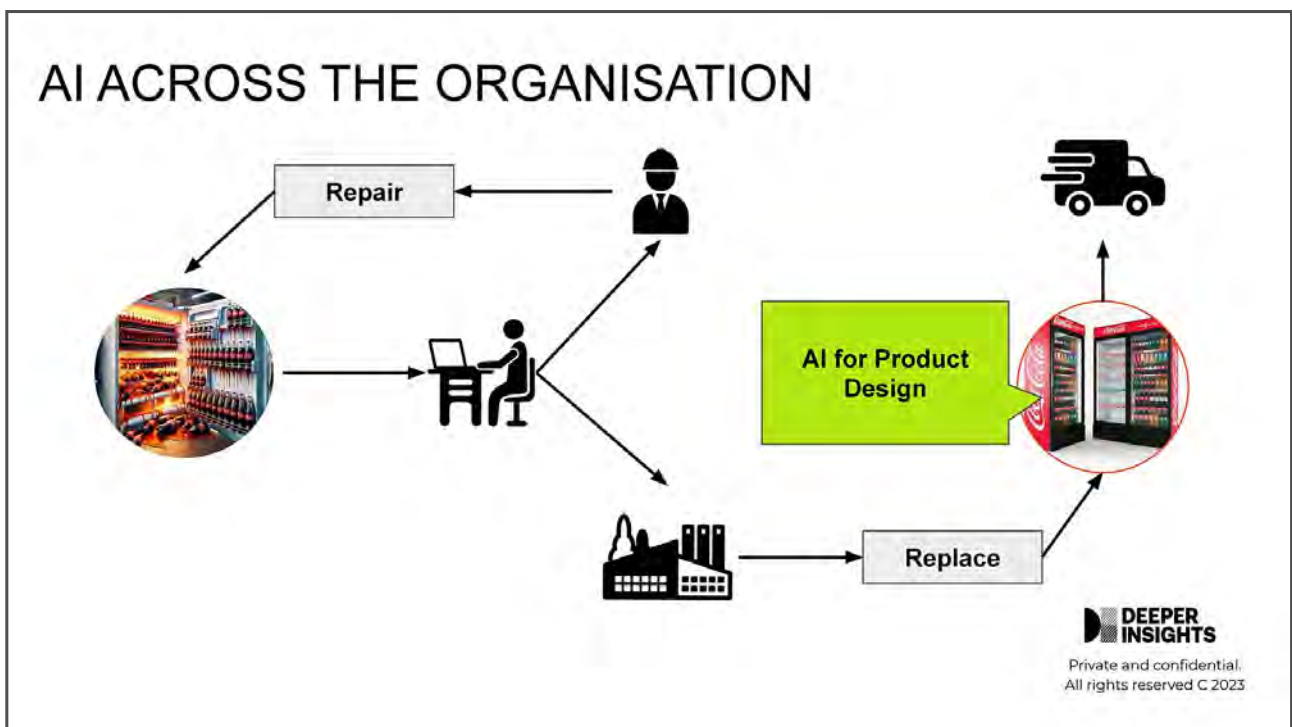
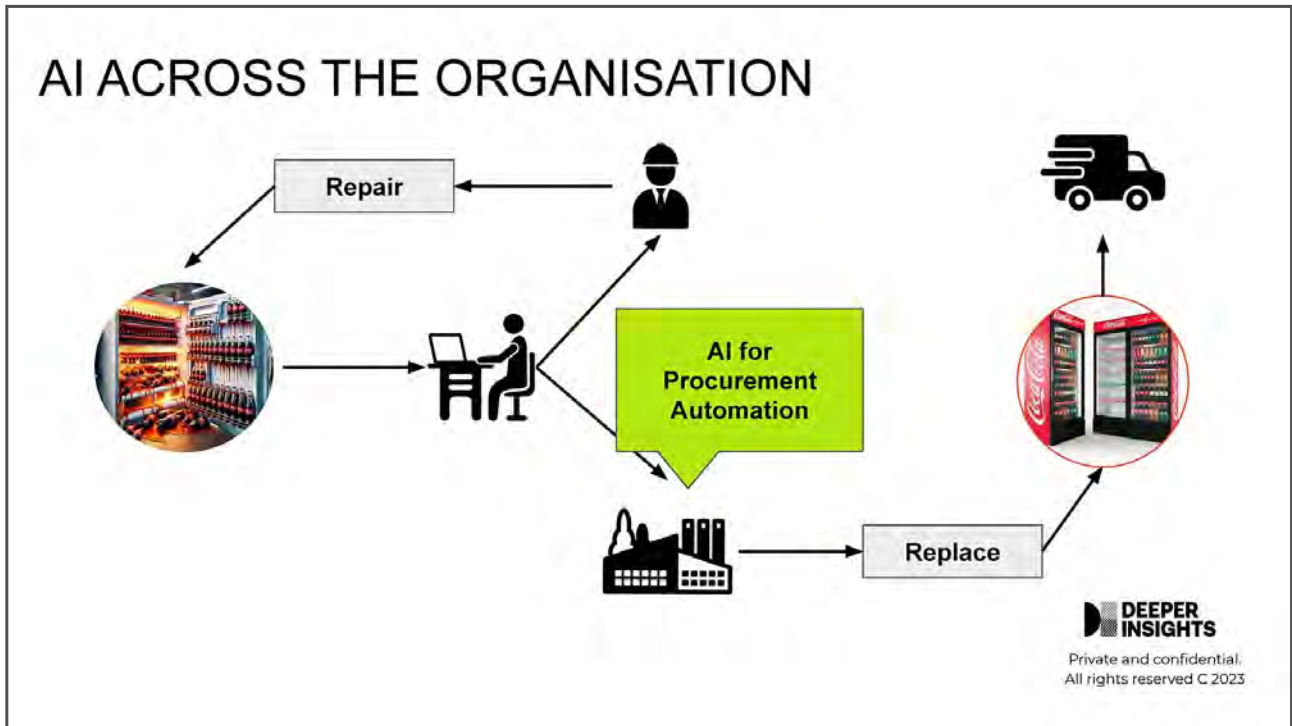
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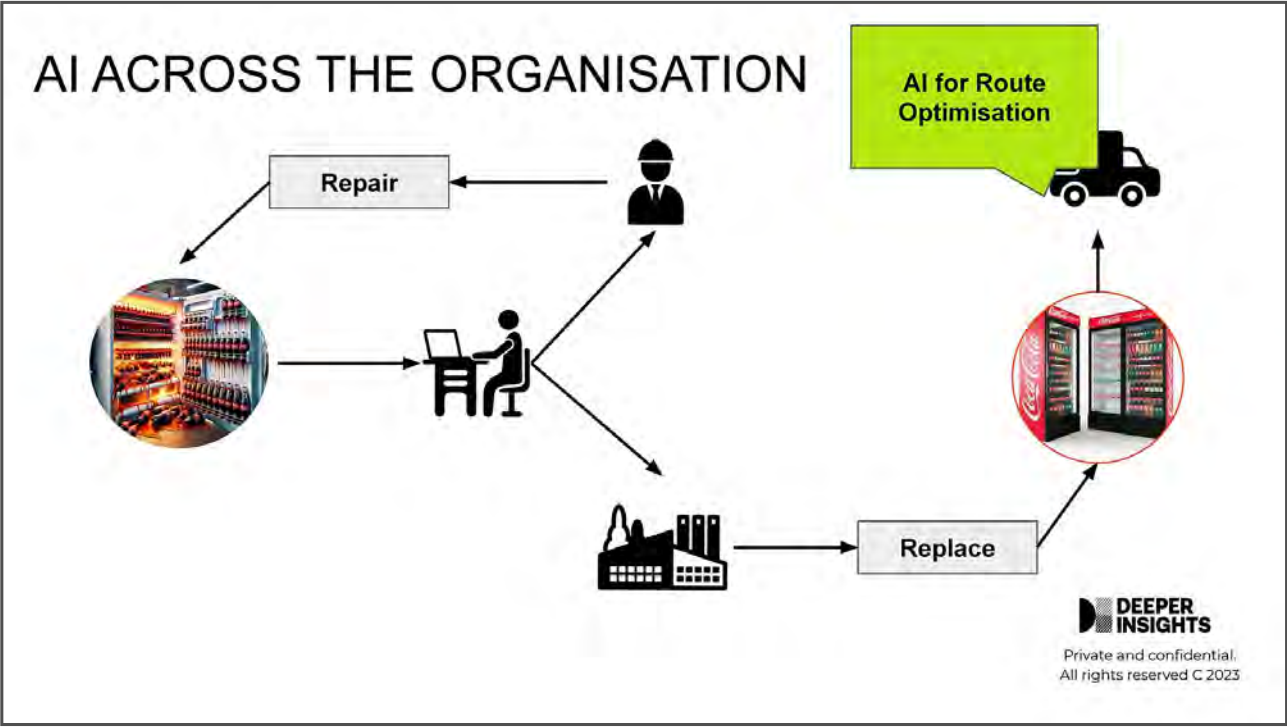
# Session I -3

## Aligning AI to Commercial Value



# Session I -3

Jack Hampson



It will take 10 years before we've realised the true value of AI



# Session I -3

Aligning AI to Commercial Value

Don't wait!

INSPIRED BY  
YOUR  
IMPOSSIBLE

THANK YOU

[jack.hampson@deeperinsights.com](mailto:jack.hampson@deeperinsights.com)  
CEO

DEEPER  
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# PRESENTATION

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## SESSION II

Humans, AI, and Robots: A New Paradigm for Collaboration and Coexistence

### Presentation I

15:40-16:05

Seung-Cheol Lee

Director, Indo-Korea Science and Technology Center,  
Korea Institute of Science and Technology (KIST)

### Presentation II

16:05-16:30

Praveen Pankajakshan  
Head, Cropin AI Lab, India

### Presentation III

16:30-16:55

Jongwoo Lim  
Professor, Mechanical Engineering, Seoul National University



Session II -1

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## **Machine Learning Techniques for Science and Engineering: Focused Study on Materials Science**

**Seung-Cheol Lee**

Director,

Indo-Korea Science and Technology Center,

Korea Institute of Science and Technology (KIST)



# Session II -1

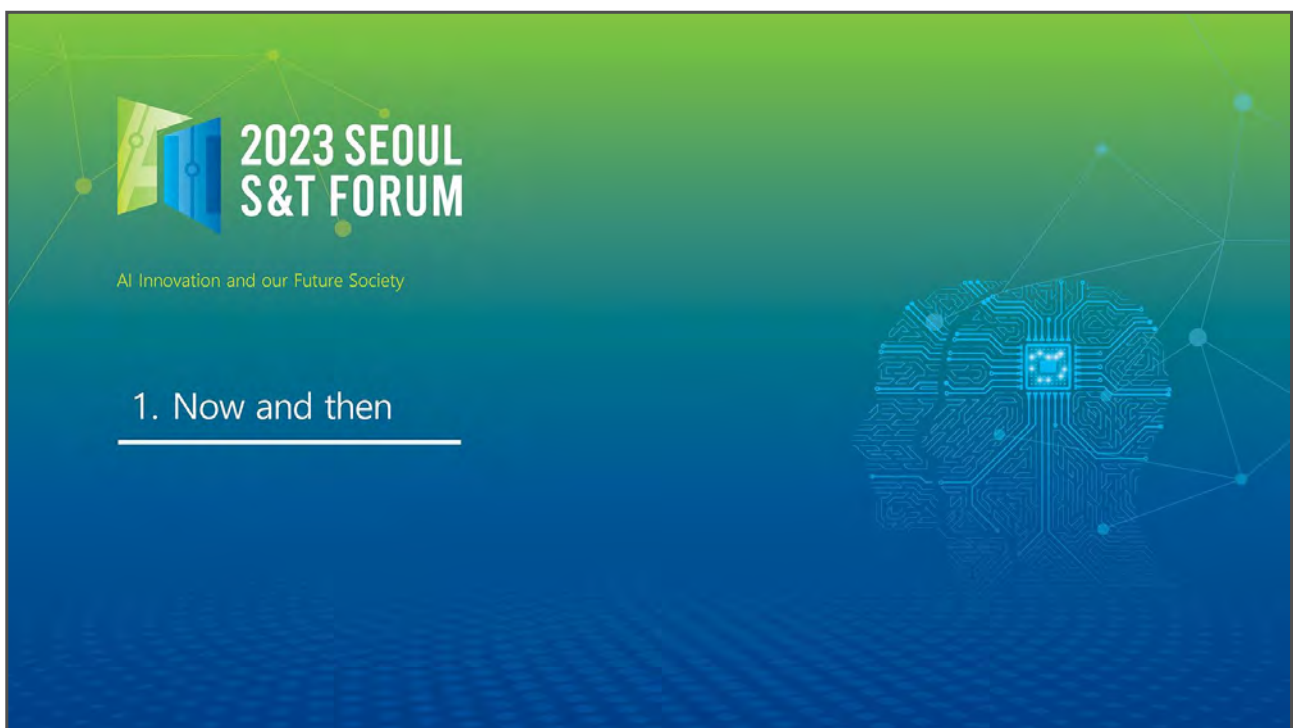
Machine Learning Techniques for Science and Engineering: Focused Study on Materials Science



2023 SEOUL S&T FORUM  
November 7, 2023 | The Plaza Hotel, Seoul, Korea

Presentation Title : Machine Learning Techniques for Science and Engineering: Focused Study on Materials Science  
Name : Dr. Seung-Cheol Lee  
Position : Director  
Organization : Indo-Korea Science and Technology Center, KIST

Hosted by  National Research Council of Science & Technology  
Organized by  Korea Institute of Science and Technology  SCIENCE AND TECHNOLOGY POLICY INSTITUTE  
Sponsored by  Ministry of Science and ICT



2023 SEOUL S&T FORUM  
AI Innovation and our Future Society

1. Now and then

# Session II -1

Seung-Cheol Lee

1. Now and then

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Experiment-driven

With 486 Windows or DOS PC, & FORTRAN

No network, Just DISC

Credit : Metrohm International

1. Now and then

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More research methodologies beyond experiments

Optical fiber network to Cluster Computer

FORTRAN, LINUX, VASP, VESTA, MATLAB, Quantum ESPRESSO, C++, and CINEMAS

# Session II -1

Machine Learning Techniques for Science and Engineering: Focused Study on Materials Science

1. Now and then

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**Indo-Korea Science and Technology Center**

- Established 2010
- Bengaluru, Karnataka, INDIA
- Organisation:

한국과학기술연구원  
**Director**

R&D Team	Computational Materials Science	Integrated Software Development - CINEMAR	Big Data & Machine Learning/Application Method	Admin. Team
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1. Now and then

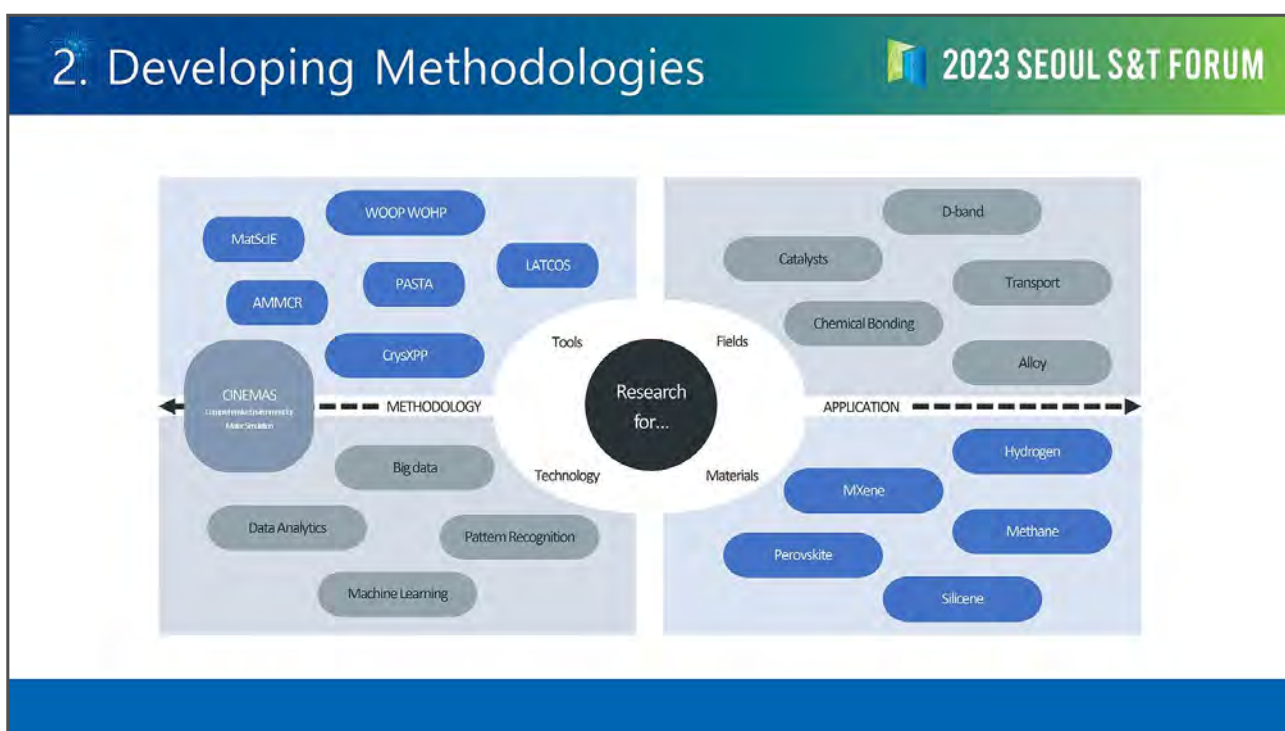
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①		Sanjay Singh	IIT BHU(Varanasi)
		Pawan Goyal	IIT Kharagpur
②		Niloy Ganguly	IIT Kharagpur
③		Debi Prosad Dogra	IIT Bhubaneswar
④		Bhaskaran Muralidharan	IIT Bombay
		Umesh V. Waghmare	JNCASR
⑤		Manish Jain	IISc



# Session II -1

Seung-Cheol Lee





# Session II -1

Machine Learning Techniques for Science and Engineering: Focused Study on Materials Science

## 2. Developing Methodologies

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The diagram compares two research methodologies. On the left, 'Ex-Methodology' shows a linear process: Hypothesis → Research design → Linear research → Property verification. On the right, 'NOW' shows a more complex, iterative process: Hypothesis → Research design → Derivation of candidate materials → Experiment validation → Development of Source code → Synthetic method theorem → Property verification. The 'NOW' process also includes 'Simulation' and 'Calculation' as parallel activities. A blue circle labeled 'Engineering' encompasses the 'Derivation of candidate materials', 'Experiment validation', and 'Development of Source code' steps.

## 2. Developing Methodologies

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A bar chart showing the number of publications per year from 1992 to 2020. The y-axis is logarithmic, ranging from 1 to 10,000. The x-axis shows years from 1992 to 2020. The chart shows a steady increase in publications, with a significant acceleration starting around 2012. Key milestones are marked with arrows: 2000 Human Genome, 2011 MGI, and 2012 AlexNet (ILSVRC2012). The chart is flanked by circular images of laboratory equipment and computer monitors.

Year	Publications per year (approx.)
1992	10
1996	15
2000	20
2004	30
2008	50
2012	100
2016	200
2020	1000

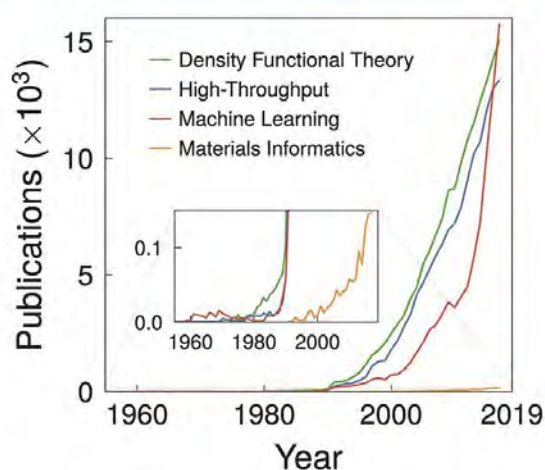
Morgan, Dane D. and Ryan Jacobs Open Access Government(2023)

# Session II -1

Seung-Cheol Lee

## 2. Developing Methodologies

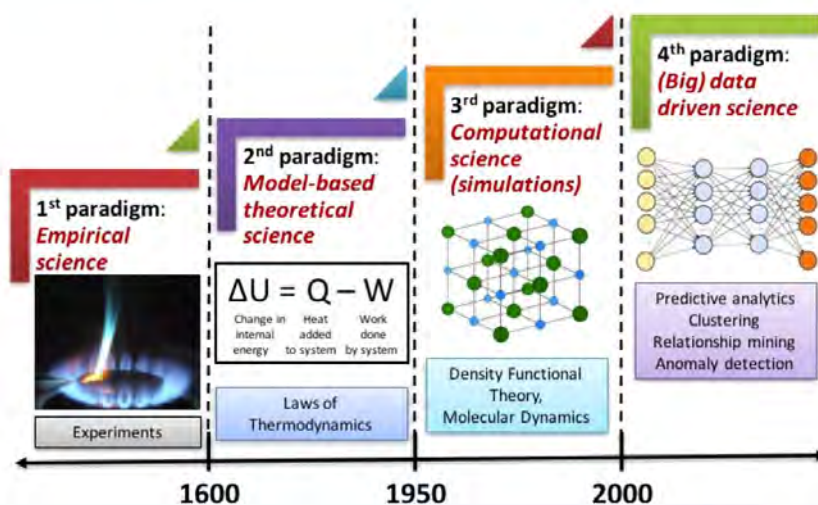
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Gabriel R Schleder et al. J. Phys.: Mater. 2 (2019)

## 2. Developing Methodologies

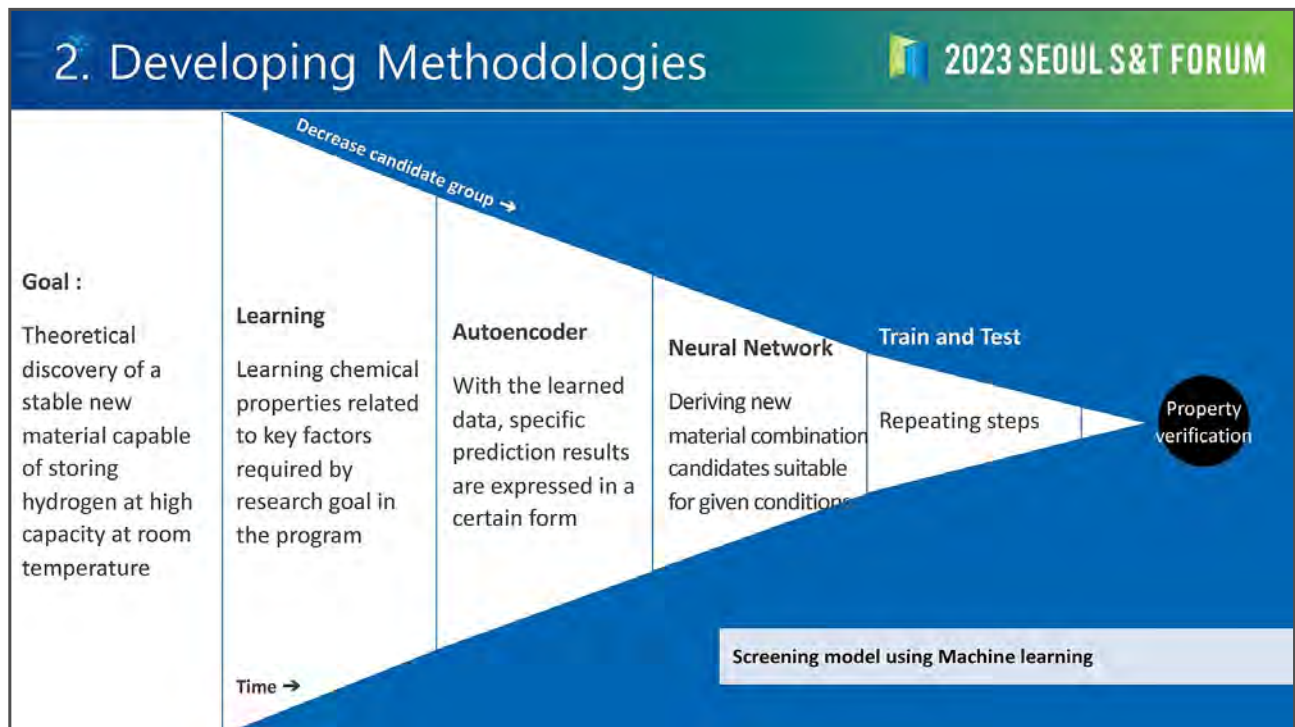
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A. Agrawal, A. Choudhary, APL Materials 4, 053208 (2016)

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AI Innovation and our Future Society

3. Challenges from IKST

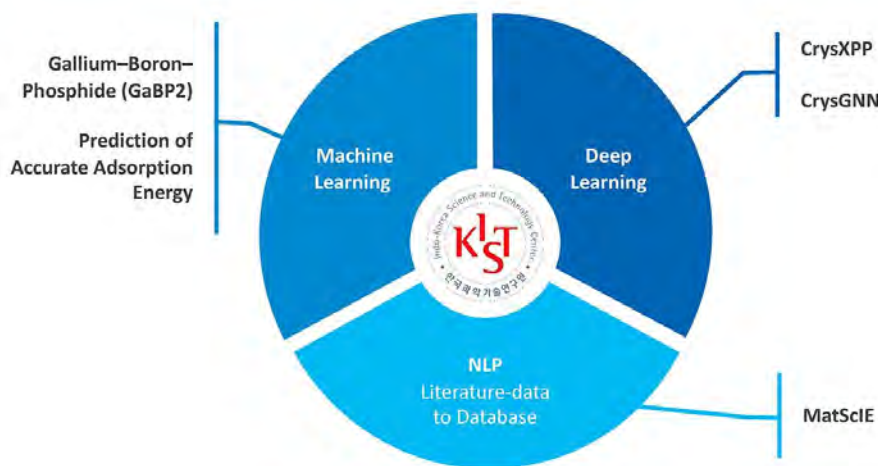


# Session II -1

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## 3. Challenges from IKST

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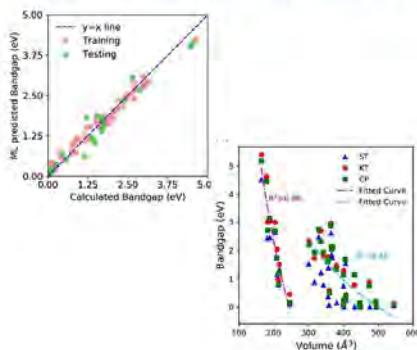
## 3. Challenges from IKST

2023 SEOUL S&T FORUM

### With Regression Model

#### Gallium-Boron-Phosphide (GaBP2): a new III-V semiconductor for photovoltaics

(Journal of Materials Science, 2020)



- Target to find a semiconductor: non-toxic, In free, and with bandgap 14.-1.5 eV
- Database with bandgap of ABX2 [A = {Al, Ga, Zn, Cd}, B = {Ga, In, Ge, Sn, Si} and X = {N, P, As, Sb}]-type stoichiometric semiconductors.
- Using our ML model we obtained a scaling law between Volume of unit cell and the bandgap.

$$E_g = \begin{cases} -16.54 + \frac{622.51}{V^{2/3}} & V \leq 246 \text{ \AA}^3 \quad \text{ABN}_2 \text{ family: } R^2 = 0.86 \text{ and RMSE} = 0.54 \text{ eV} \\ -6.10 + \frac{368.17}{V^{2/3}} & V \geq 290 \text{ \AA}^3 \quad \text{Others: } R^2 = 0.49 \text{ and RMSE} = 0.47 \text{ eV} \end{cases}$$



# Session II -1

Machine Learning Techniques for Science and Engineering: Focused Study on Materials Science

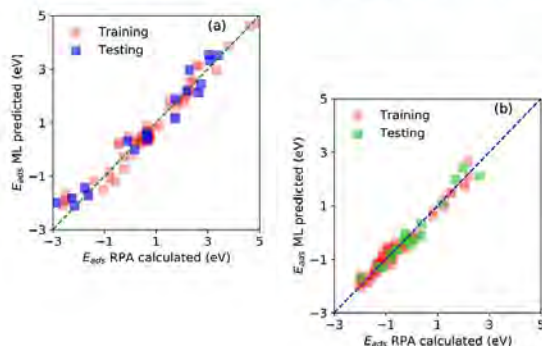
## 3. Challenges from IKST

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### With Regression Model

#### Machine Learning and Scaling Laws for Prediction of Accurate Adsorption Energy

(Journal of Physical Chemistry A, 2020)



- we predicted the adsorption energies of mono-atomic and di-atomic gases on the surfaces of many transition metals (TMs)
- With less than a set of 10 simple atomic features, our predictions of the adsorption energies within RMSE of 0.4 eV
- A set of mathematical equations constructed from the important features obtained from our ML model.

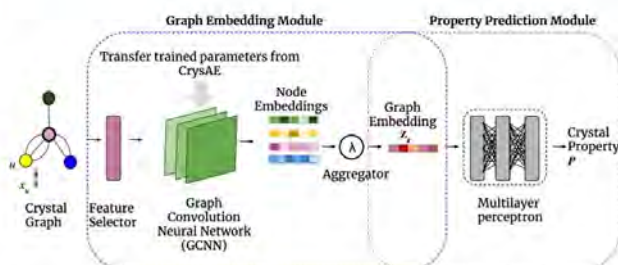
## 3. Challenges from IKST

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### Deep learning Framework

#### CrysXPP: An explainable property predictor for crystalline materials

(npj Computational Materials, 2022)



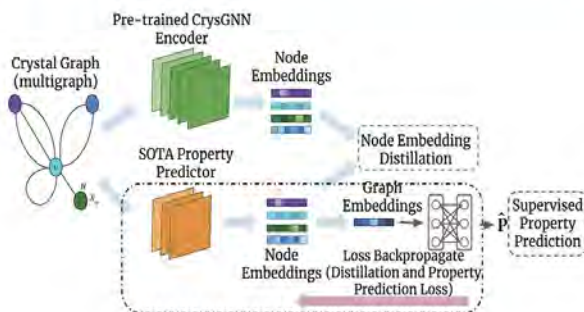
- A feature selector that helps to interpret the model's prediction
- Lowers the need for large property tagged datasets
- Rapid and accurate prediction of electronic, magnetic, and elastic properties of a wide range of materials.

## 3. Challenges from IKST

### Deep learning Framework

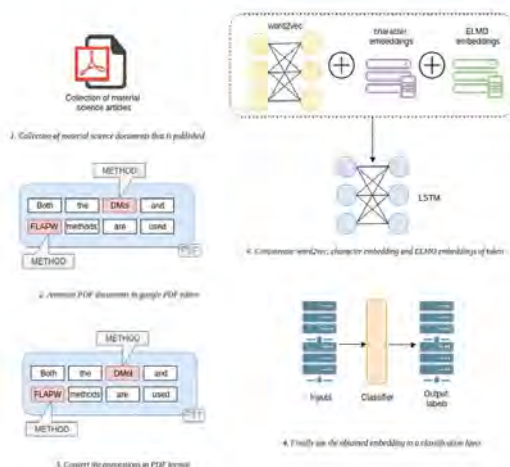
#### CrysGNN: Distilling Pre-trained Knowledge to Enhance Property Prediction for Crystalline Materials

(Proceedings of the AAAI Conference on Artificial Intelligence, 2023)



- GNN framework to capture both node and graph level structural information of crystal graphs using a huge amount of unlabelled material data.
- Pre-trained model using structural information from crystal data.
- Improved prediction accuracy of crystal structure, bandgap, bulk modulus, etc. using a pre-trained model with 800k crystal graphs.

## 3. Challenges from IKST



### An automated tool for extracting information from materials science articles into DBs

#### MatSci: An automated tool for the generation of databases of methods and parameters used in the computational materials science literature

(Computational Material Science, 2021)

- Extract necessary information by embedding pre-trained terms in the field of materials science.
- Extracts the material details, methods, code, parameters, and structure from the various research articles.
- A web application where users can upload published articles and view/download the information obtained from this tool and can create their own databases for their personal uses.

# Session II -1

Machine Learning Techniques for Science and Engineering: Focused Study on Materials Science



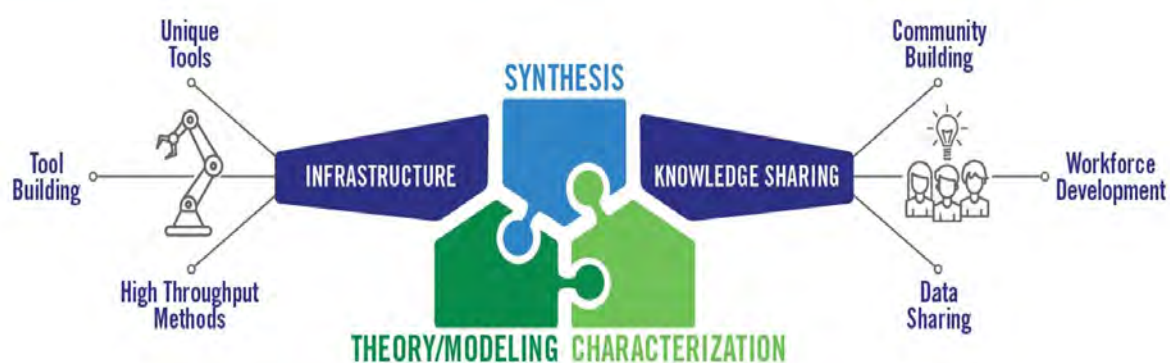


# Session II -1

Seung-Cheol Lee

## 4. Door for New era

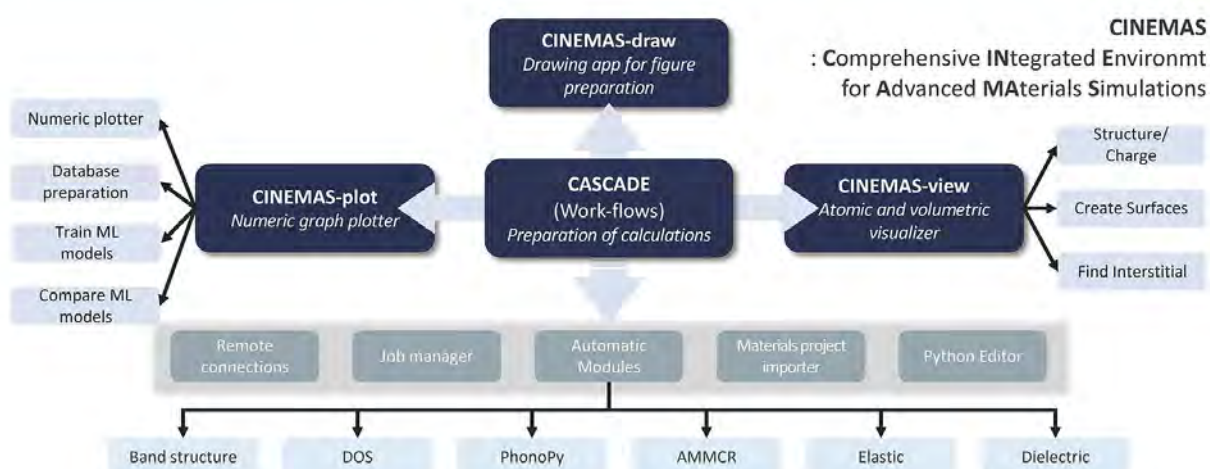
2023 SEOUL S&T FORUM



MATERIALS GENOME INITIATIVE STRATEGIC PLAN, 2021

## 4. Door for New era

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# Session II -1

Machine Learning Techniques for Science and Engineering: Focused Study on Materials Science

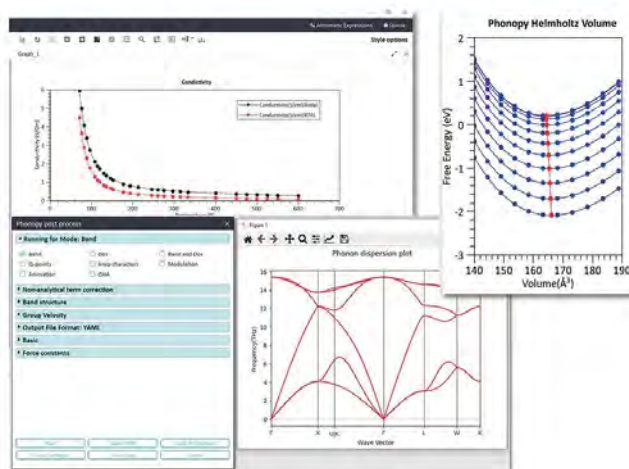
## 4. Door for New era

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## 4. Door for New era

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### Under implementing

- Cluster Expansion
- PASTA for energy barrier
- CrysXPP
- Data Science



# Session II -1

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Seung-Cheol Lee

 2023 SEOUL S&T FORUM

**Thank you for your attention**



Session II -2

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# Geospatial Foundational AI for Sustainable and Regenerative Agriculture

**Praveen Pankajakshan**


Head,

Cropin AI Lab, India



# Session II -2


Geospatial Foundational AI for Sustainable and Regenerative Agriculture



## Geospatial AI for Regenerative and Climate Smart Agriculture

Praveen Pankajakshan, PhD

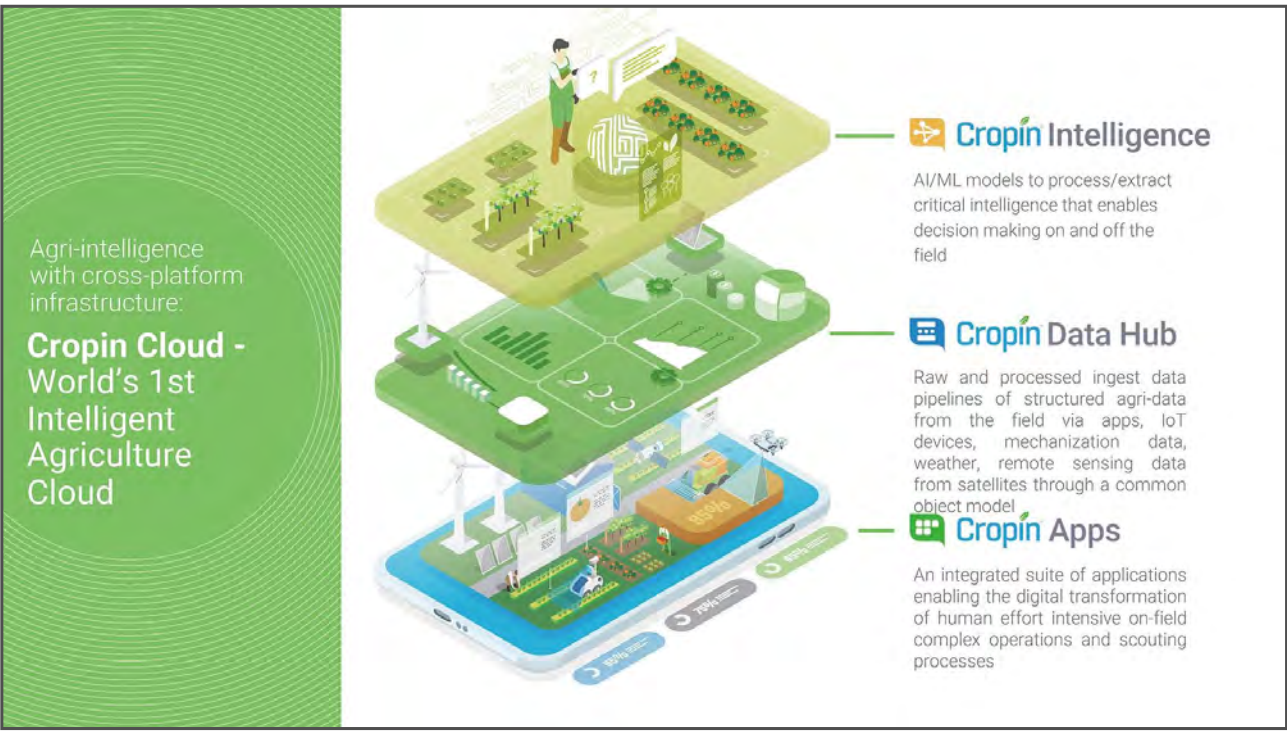
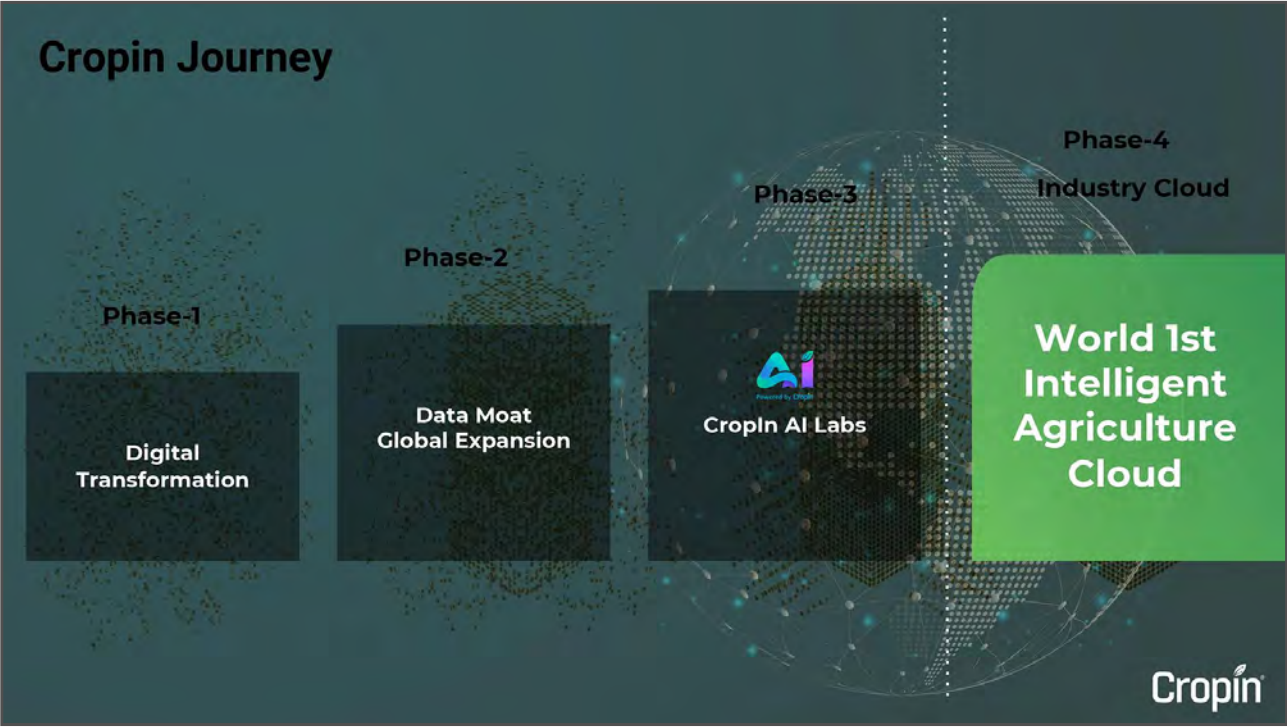
Cropin AI Lab  
praveenpankaj@ieee.org



# Cropin

# Session II -2

Praveen Pankajakshan



# Session II -2

## Geospatial Foundational AI for Sustainable and Regenerative Agriculture

**Cropin Apps**

- Cropin Grow**: Farming Digital Transformation. Shows a dashboard with maps and data charts.
- Cropin Connect**: Farmer Engagement Solution. Shows a mobile app interface with a 'My Jobs' section and a 'Push alert' notification.
- Cropin Trace**: Farm to Fork Traceability. Shows a 'Certified Seed Potato' product label with a QR code and a 'Seeding area' map.

**Cropin Data Hub**

Field Data, IOT, Mechanization data, Climate Data, Satellite data – All in one place, structured for your analysis


**Cropin Data Hub**

- Third Party Apps
- Socio-Economic Data
- Satellite data
- Sensors
- Drone Data
- Mechanization data
- Climate Data
- PoP
- Enhanced AI/ML models
- Sustainability Data




# Session II -2

Praveen Pankajakshan



## Comprehensive and actionable crop intelligence insights built upon certified Global field data Set

### Ag Intelligence Platform - Deployed in 13 Countries on 32 Commodities



<b>Crop Detection Models</b> Crop Area & production estimate at country, county & plot level	<b>Nitrogen Uptake Models</b> Nitrogen Uptake monitoring	<b>Irrigation &amp; Water Stress Model</b> Monitor water stress and irrigation need as per plantation stage
<b>Disease Model</b> For early disease warning	<b>Crop Progress</b> Monitor Stage Progress	<b>Yield Forecasts</b> On yield and maturity
<b>Deforestation Model</b>	<b>Carbon Model</b>	<b>Forest fire &amp; Stubble burning</b>

and more

## CROP INTELLIGENCE DELIVERED WORLDWIDE - PAN INDIA CAPABILITY


### Insights solution rolled out in 12 Countries for 34 Crops

**United States**  
 Crop: Corn  
 Intelligence: Yield Prediction  
 Accuracy: 88-90 %

**Brazil**  
 Crop: Sugarcane, Soyabean  
 Intelligence: Yield Prediction,  
 Accuracy: 88 %

**Chana:**  
 Crop: Cocoa  
 Intelligence: Yield Prediction, Black Pod Disease Prediction  
 Accuracy: 80-90%

**Nigeria**  
 Crop: Wheat, Corn & Sorghum  
 Intelligence: Crop Detection, Acreage Estimation, Yield Prediction,  
 Accuracy: 80-90%




**Japan**  
 Crop: Paddy  
 Intelligence: Acreage Estimation for sourcing/procurement

**India**  
 Crop: 27 Major Crops (Rice, Wheat, Soybean, Chickpea, Cotton, Mango, cashew, Potato etc)  
 Intelligence: Crop Detection, Acreage Estimation, Yield Prediction  
 Accuracy: 80-90%

**Bangladesh & Myanmar**  
 Crop: Paddy (Boro)  
 Intelligence: Boro Rice Crop Detection, Yield Prediction and Crop Health Analysis  
 Accuracy: 70-85%

**Mozambique & Zambia**  
 Crop: Soyabean  
 Intelligence: Crop Health Analysis, Yield Prediction  
 Accuracy: 70 %

**Australia**  
 Crop: Potato  
 Intelligence: Crop Health Analysis, Yield Prediction  
 Accuracy: 85-90 %



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# Session II -2

Geospatial Foundational AI for Sustainable and Regenerative Agriculture



## Climate Smart Agriculture



Building Resilience  
to adapt to climate  
change



Sustainability  
increases  
agriculture  
production and  
incomes



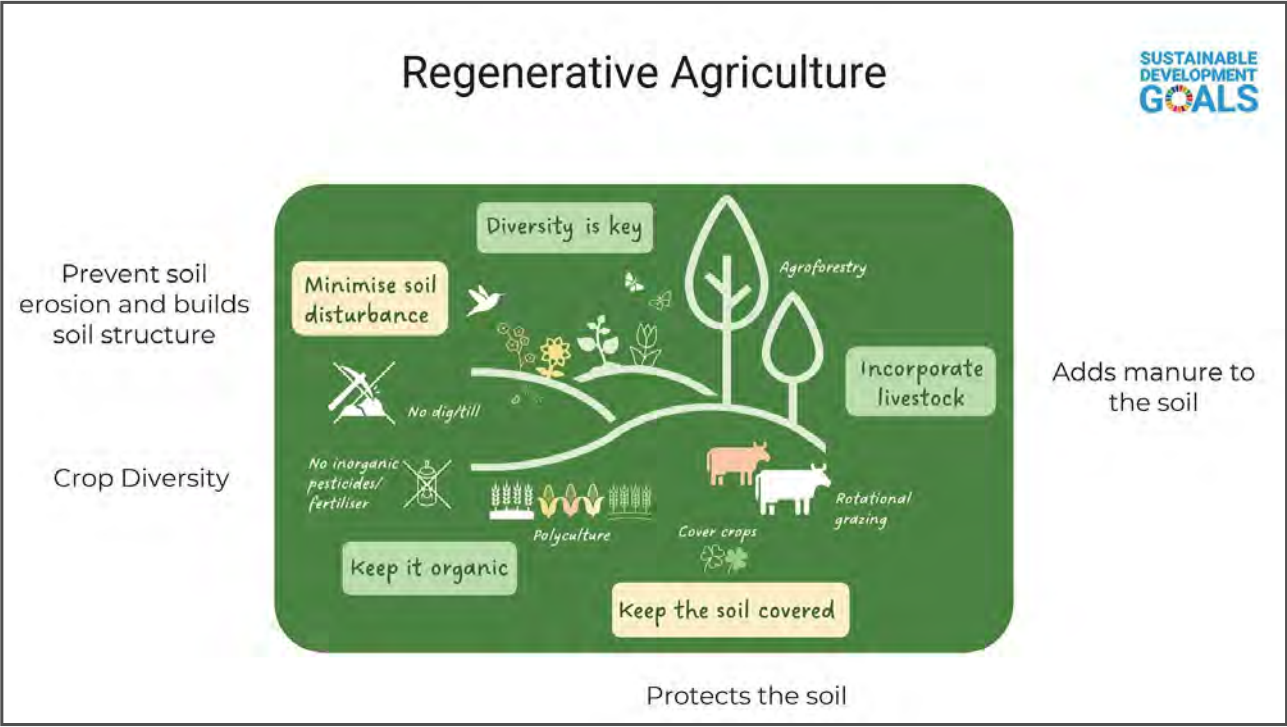
Reduce  
Greenhouse Gas  
Emissions

Source:



# Session II -2

Praveen Pankajakshan



## Regenerative Agriculture

*“Policies must prioritize regenerative agriculture and the restoration of degraded land. Subsidies must be redirected from traditional to sustainable and regenerative agriculture.”*

Source: [UNEP](#)

# Session II -2

Geospatial Foundational AI for Sustainable and Regenerative Agriculture

Overview of Models and Solutions-Regenerative				
Vegetation mapping	Forest mapping	Soil carbon mapping	Carbon flux monitoring	Wetland mapping
Type of crop Crop rotation LULC Cover crops Land Use Change Stubble burning Biomass	Deforestation Afforestation Forest fire Forest Above Ground Biomass	Tillage practices Cover crop Soil Organic Carbon Soil type Cropping pattern	Type of management practices Blanket Sprays and applications Irrigation scheduling Usage of implementers Climate resilience	Wetland and water body mapping

Land Use Land Classification-Deforestation and Forest Intrusion



# Session II -2

Praveen Pankajakshan

## Land Use and Land Cover (LULC)



Temperature increase of  $\sim 0.3^{\circ}\text{C}$  in 3 decades



Accelerated warming ( $\sim 0.9^{\circ}\text{C}$ ) 2001 to 2010



25-50% warming associated with LULC



Largest change linked to vegetation cover change

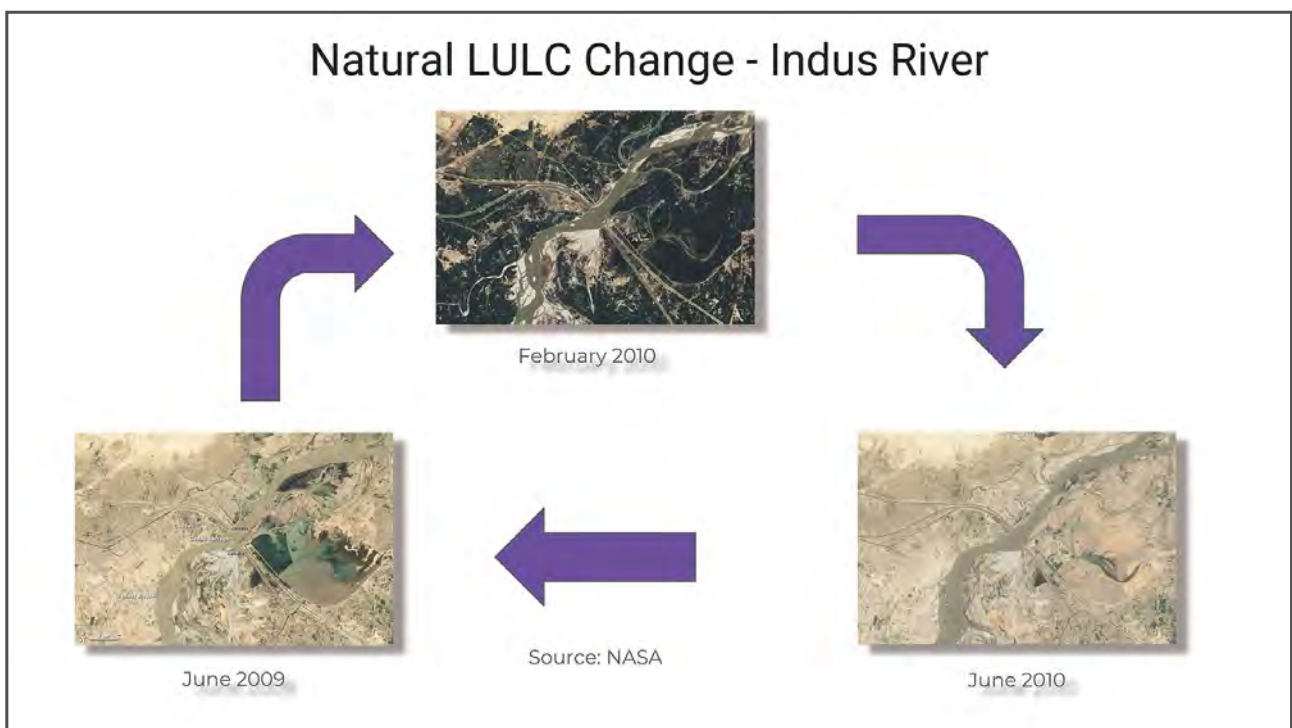
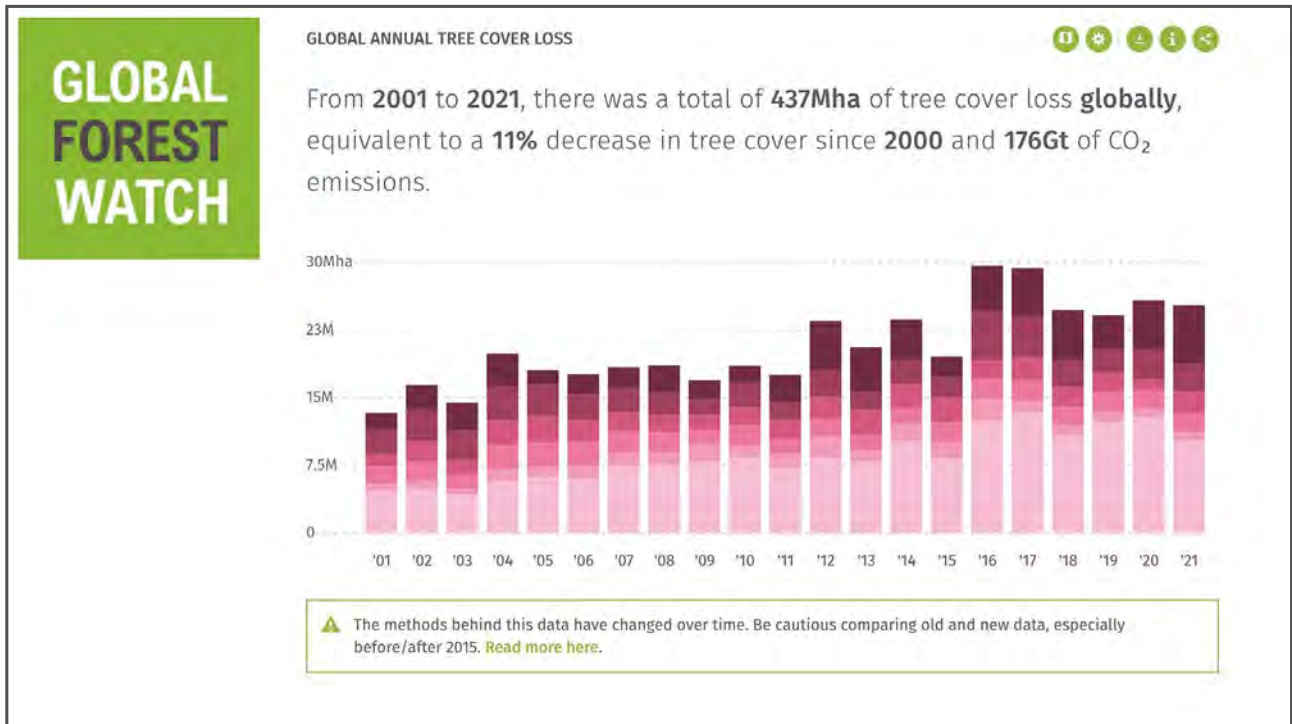
P.P., Vinoj, V., Swain, D. et al. Land use and land cover change effect on surface temperature over Eastern India. Sci Rep 9, 8859 (2019). <https://doi.org/10.1038/s41598-019-45213-z>

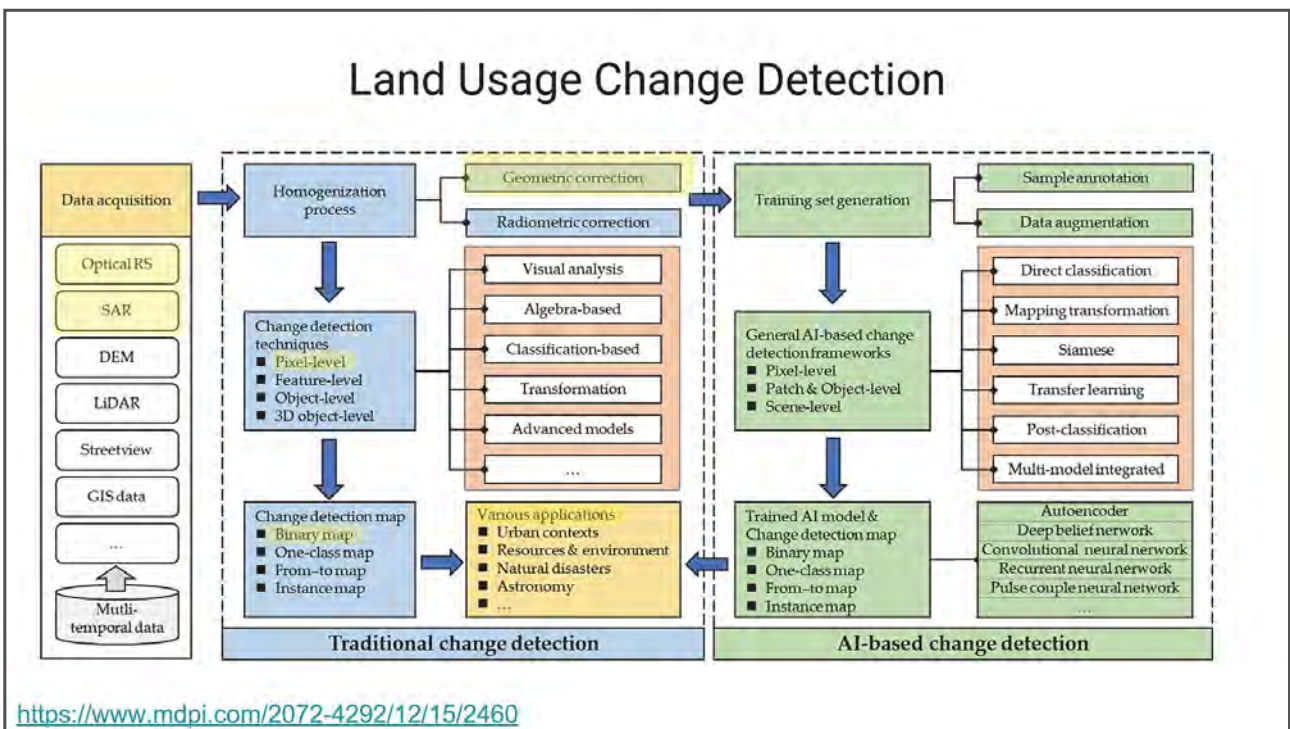
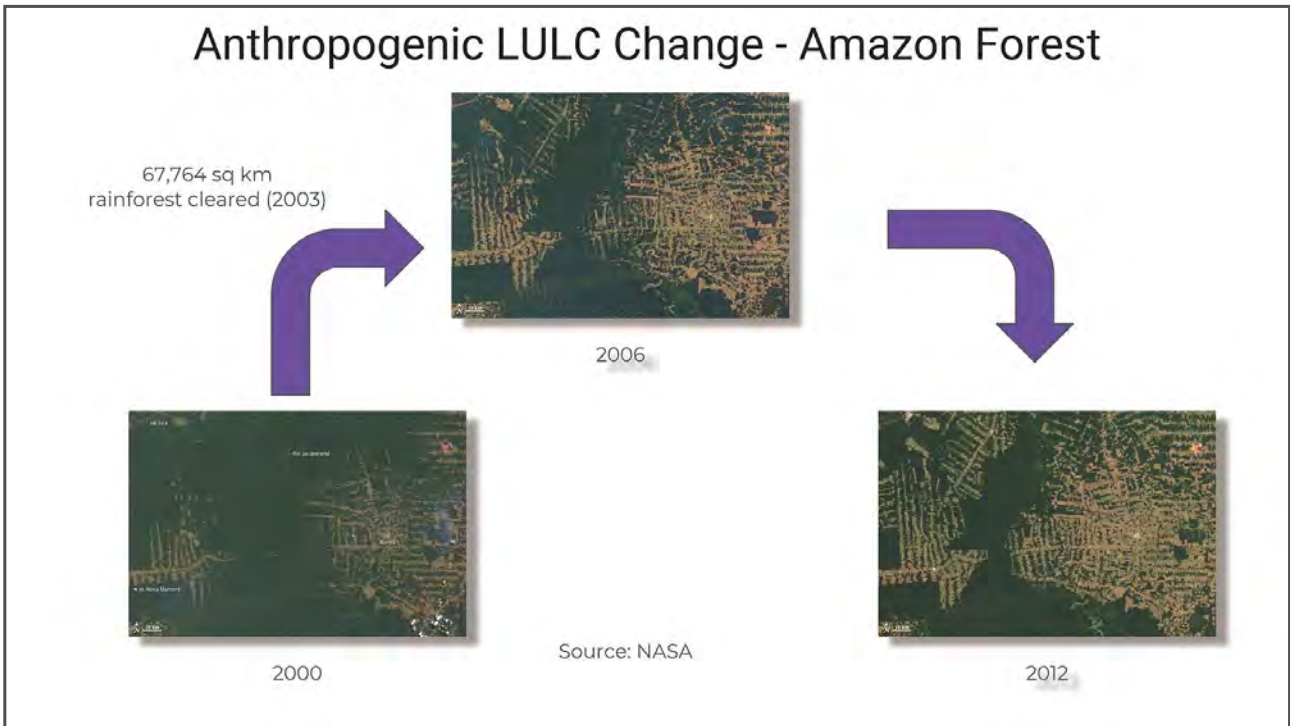




# Session II -2

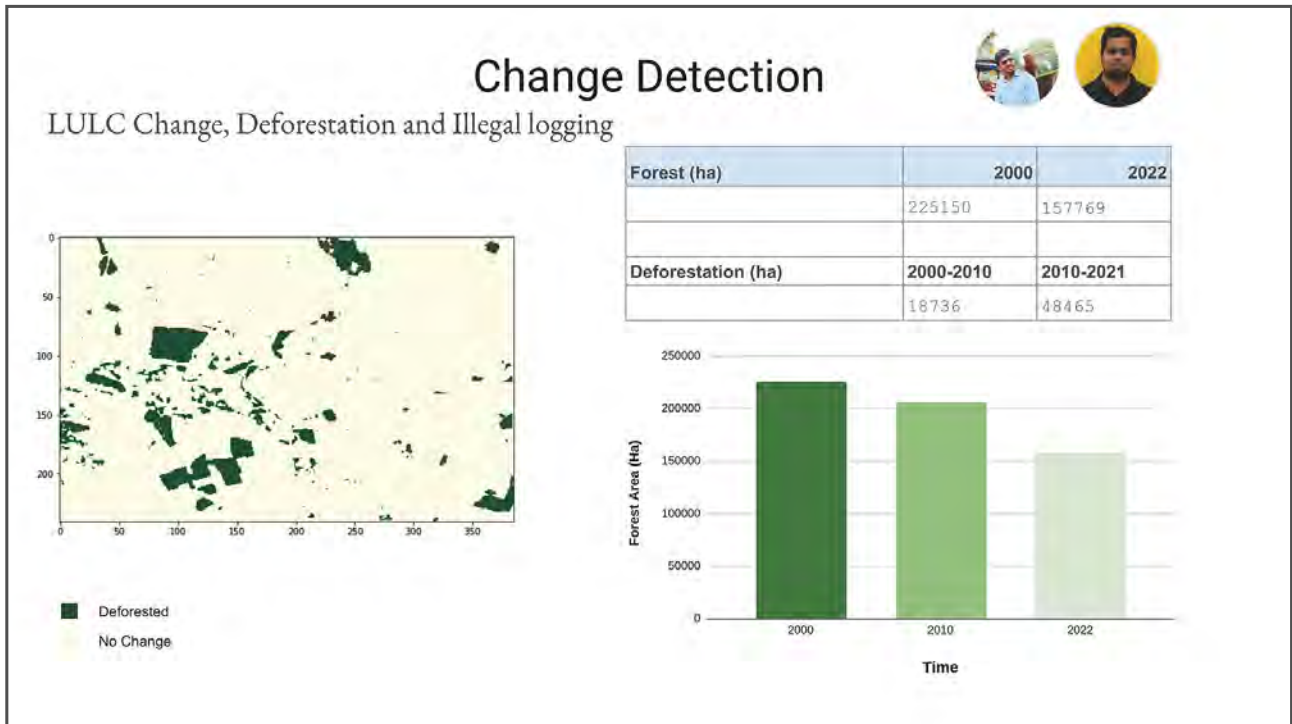
## Geospatial Foundational AI for Sustainable and Regenerative Agriculture





# Session II -2

## Geospatial Foundational AI for Sustainable and Regenerative Agriculture

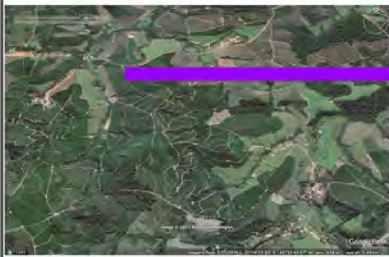




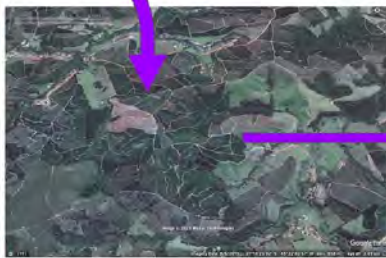
# Session II -2

Praveen Pankajakshan

## Case Study: Deforestation in Brazil



2010



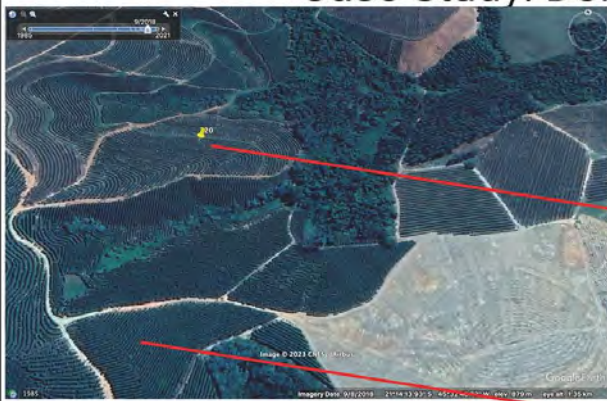
2015



2021

Image: Maxar/Google  
Analysis Source: Copin AI Lab

## Case Study: Deforestation in Brazil



2018



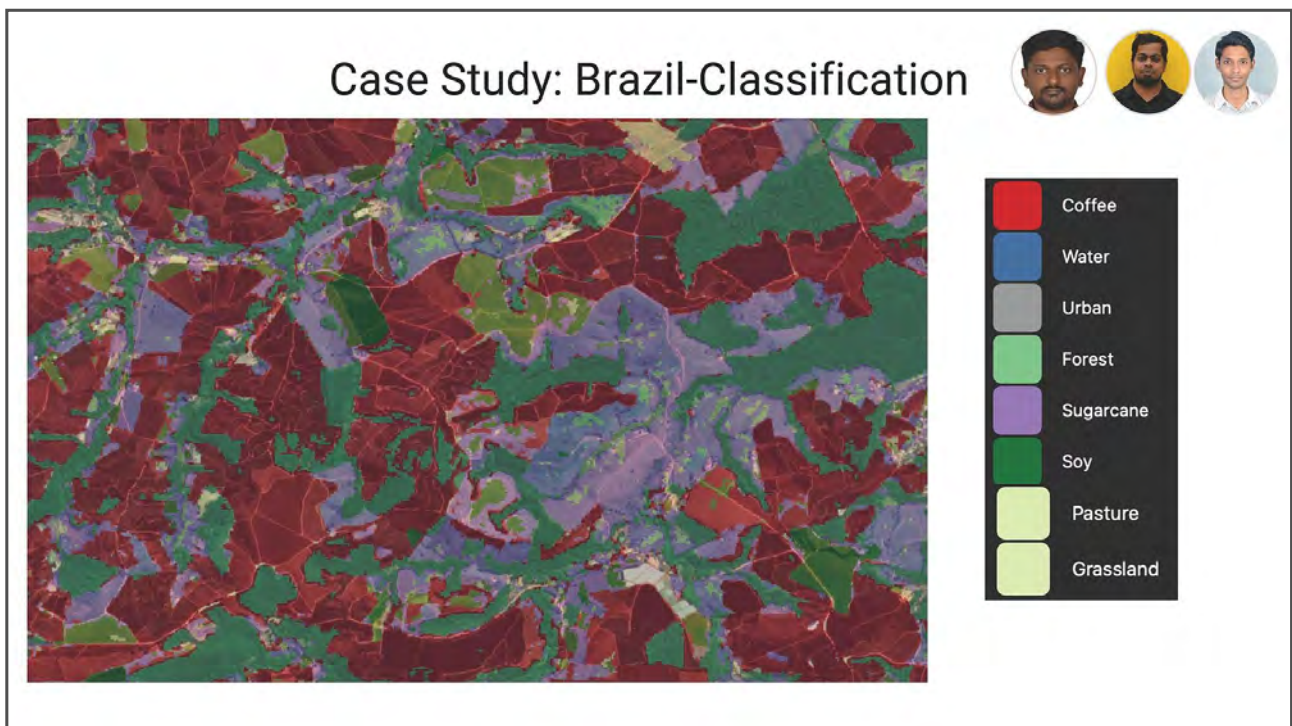
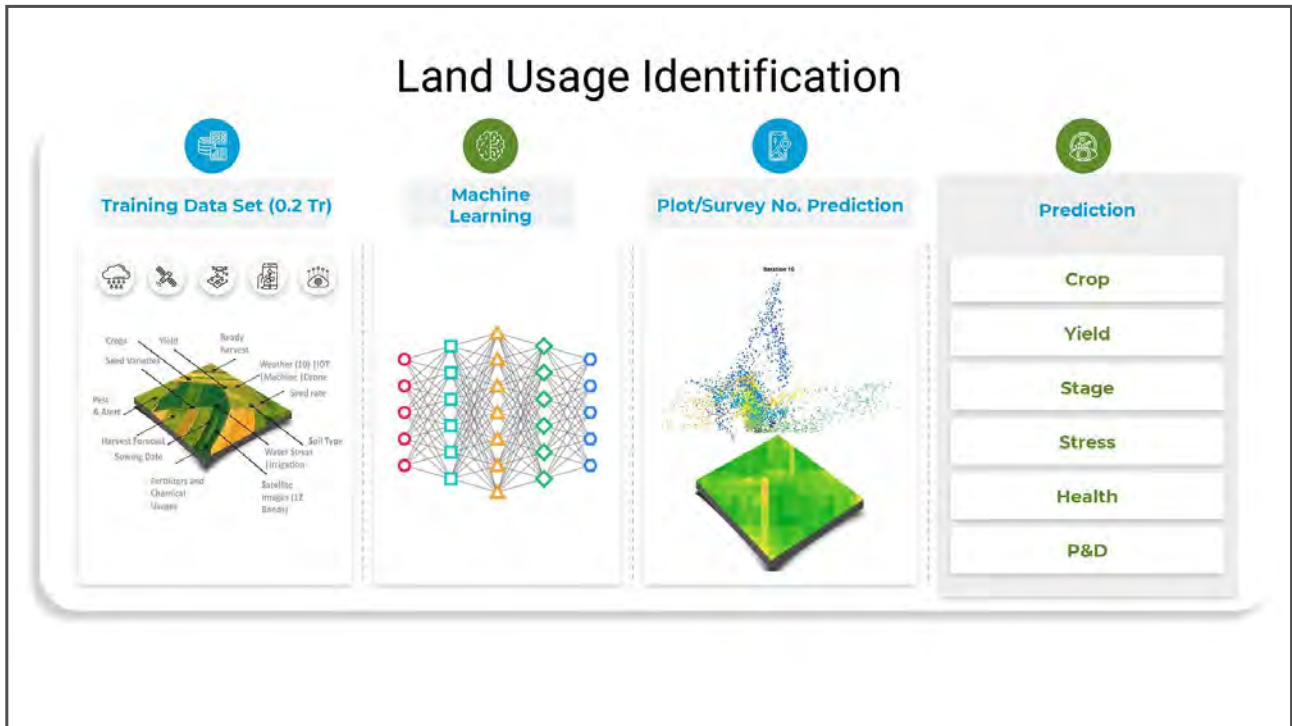
2021

Image: Maxar/Google  
Analysis Source: Copin AI Lab



# Session II -2

## Geospatial Foundational AI for Sustainable and Regenerative Agriculture



# Session II -2

Praveen Pankajakshan

## Stubble Burning

### Croplands Sequester Soil Organic Carbon Stock



Cropland soils could sequester 62 tonnes/ha over 50–75 years



Small-scale farmers account for 28% (26–30%) of SOC stock



Reduces global decadal mean temperature warming by 0.030 °C

Sub-Saharan Africa: maize, rice; Latin American & Caribbean: soybean, maize; South Asia: rice & wheat


[Bossio, D. A., Cook-Patton, S. C., Ellis, P. W., Fargione, J., Sanderman, J., Smith, P., ... & Griscom, B. W. \(2020\). The role of soil carbon in natural climate solutions. \*Nature Sustainability\*, 3\(5\), 391-398.](#)

[Fryer, James, and Ian D. Williams. "Regional carbon stock assessment and the potential effects of land cover change." \*Science of The Total Environment\* 775 \(2021\): 145815.](#)

[Toensmeier, E. \(2016\). \*The carbon farming solution: A global toolkit of perennial crops and regenerative agriculture practices for climate change mitigation and food security\*. Chelsea Green Publishing.](#)

# Session II -2

## Geospatial Foundational AI for Sustainable and Regenerative Agriculture

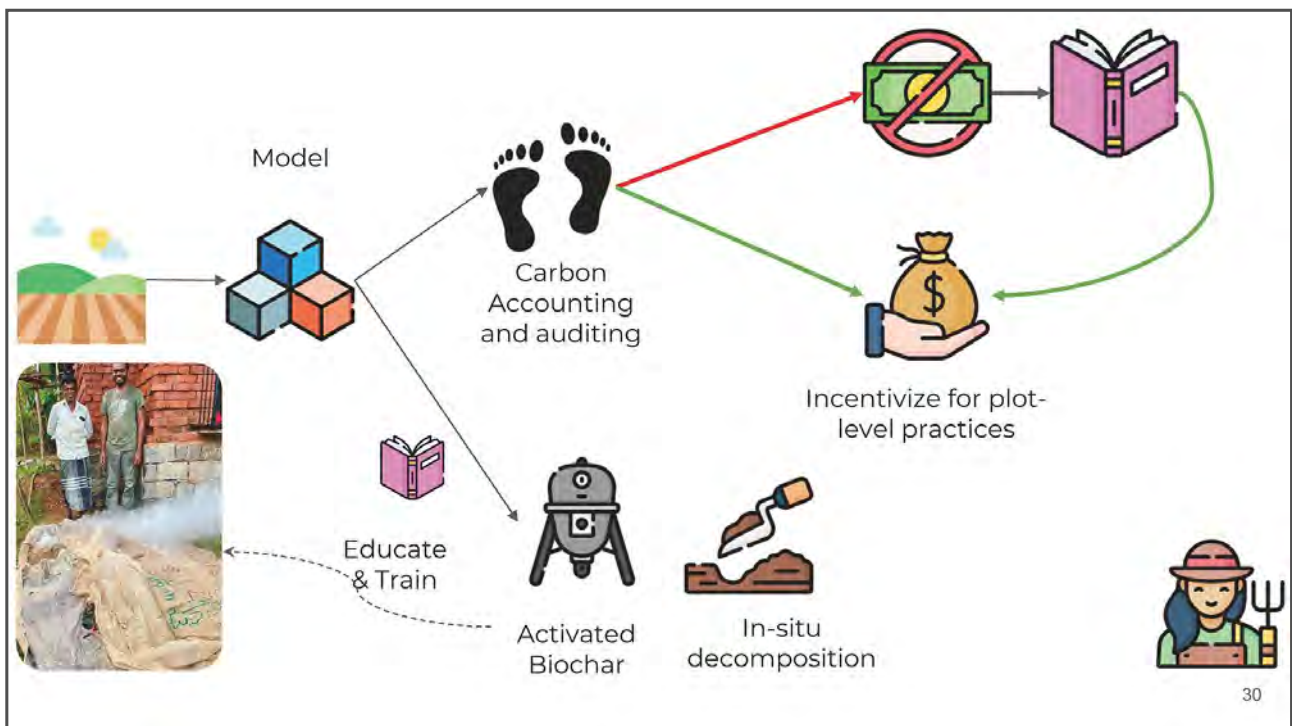


Biomass Residue After Harvest

>Four billion tonnes of biomass residues are burned globally per year

Accounting to \$120bn worth of crop and forest residues

29



# Session II -2

Praveen Pankajakshan

## Background of the Case Study

Indo-Gangetic Plain



[NASA Image by Jeff Schmaltz](#)

Recorded crop fire **Visible Infrared Imaging Radiometer Suite** (VIIRS) on the **Suomi NPP** satellite passed over India on October 25, 2017. Red outlines show the approximate locations of active burning.

- Crop residue burning in some parts of India after the paddy harvesting season.
- Farmers/Producers have to quickly prepare the fields for the next sowing season, especially when the current monsoon season gets delayed (due to climate change).
- Air quality in the region is affected resulting in respiratory issues to the population and adding to the woes of global warming.

31

## Dataset



[Sentinel-2](#) L2A

+

[Sentinel-1](#)

+

[MODIS/Aqua+Terra Thermal Anomalies/Fire locations](#)



Harvest period of the wet season 2022 (Mid September- End November)

+

November 2000-2021



Ground Validation through field visits



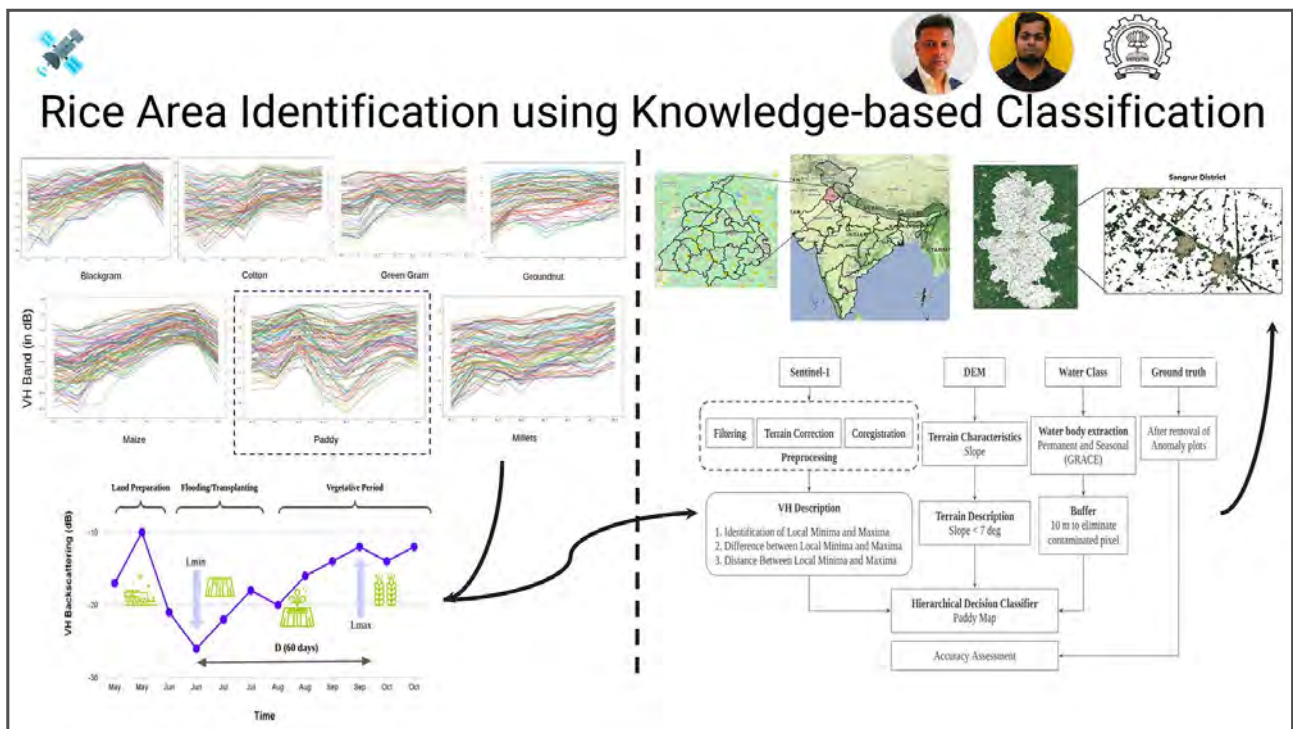
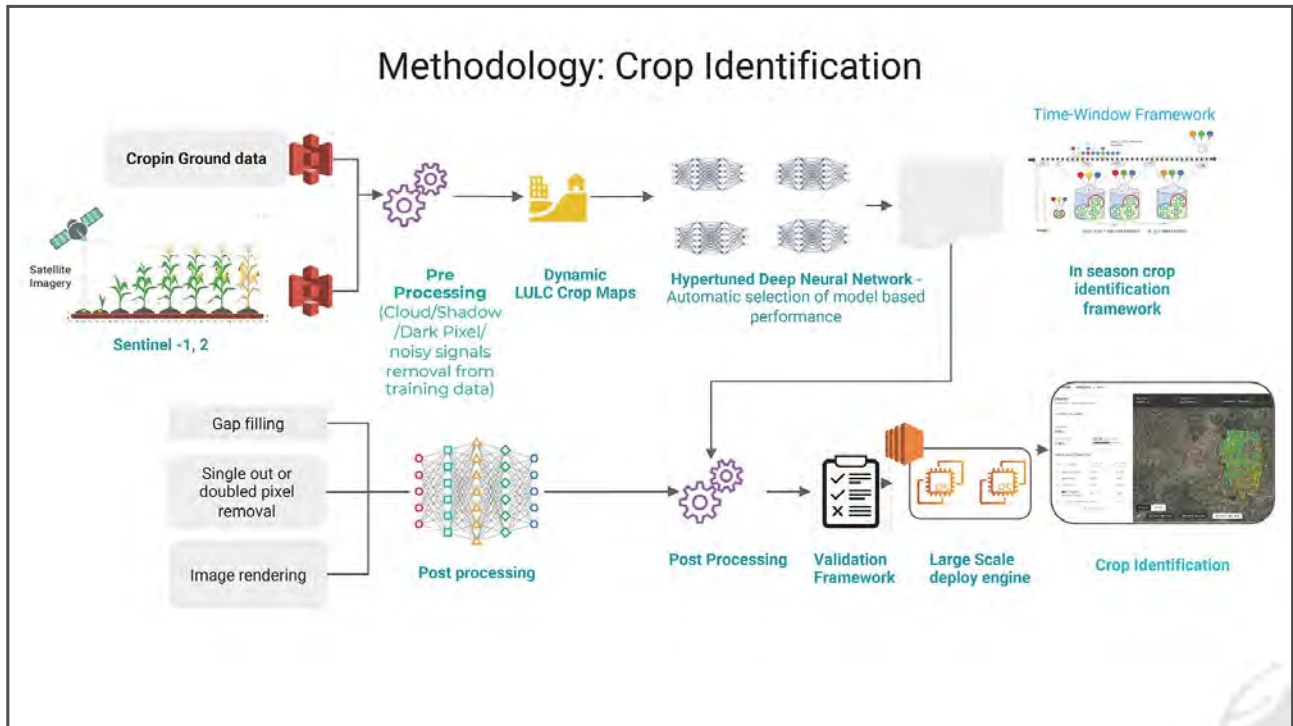
Study area: Punjab

32



# Session II -2

## Geospatial Foundational AI for Sustainable and Regenerative Agriculture



# Session II -2

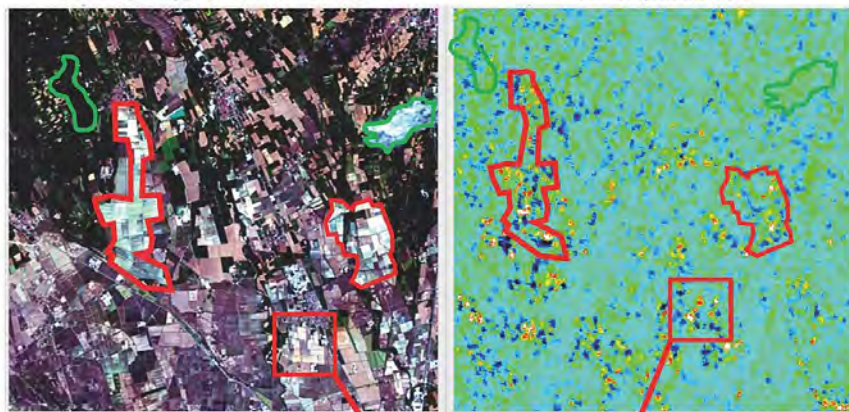
Praveen Pankajakshan

## Effect of available soil moisture on Paddy Cultivation



Cropin's proprietary AI algorithm that identifies rice plots using Satellite Imaging in the Glenn county of California. 63% drop in rice production due to the drastic decline in the available surface water compared to the same time last year

Rice paddies in Italy, 25 Apr. 2022



- Paddies, submerged
- Others (e.g. forest, cloud)

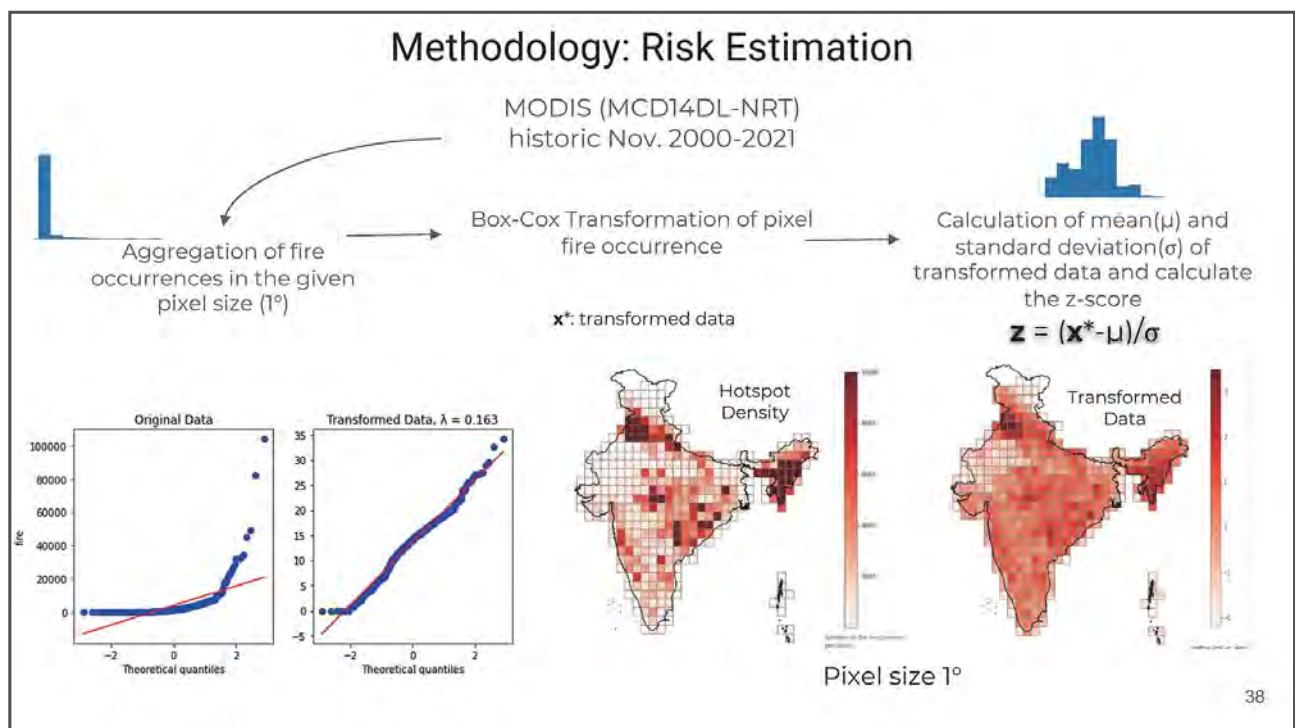
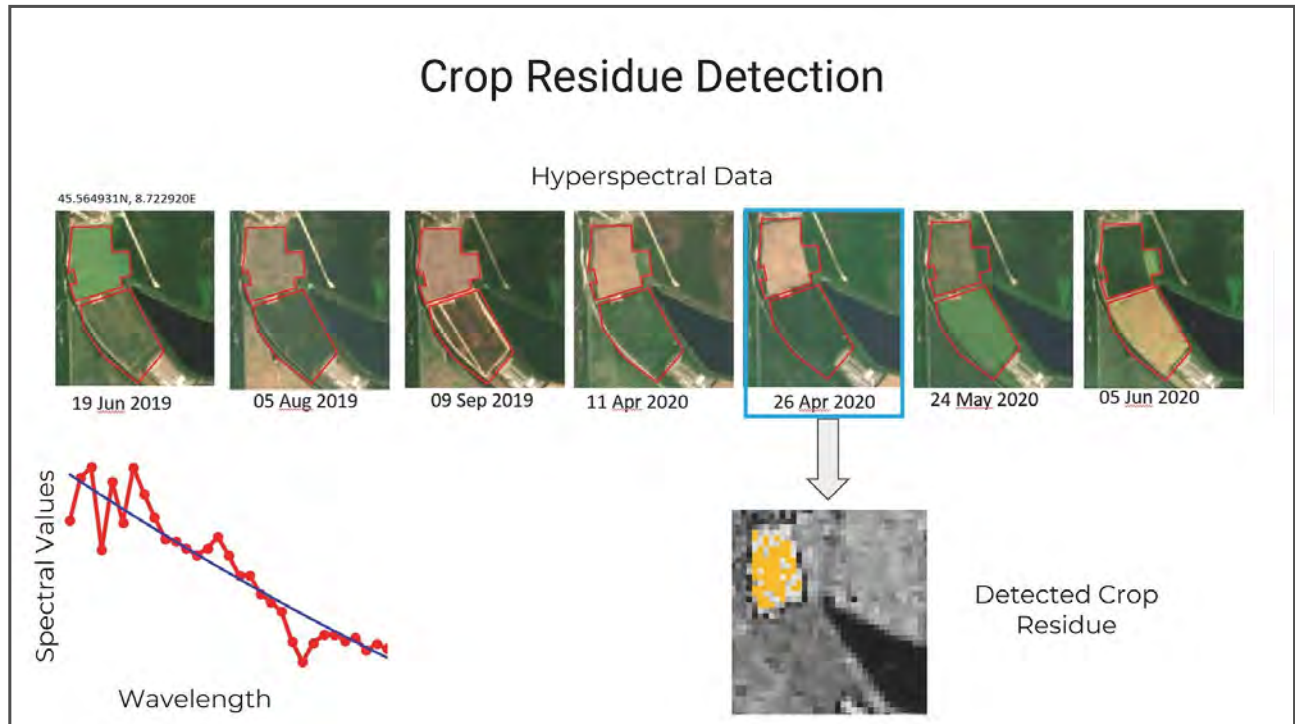
Rajkishore, S.K., Vignesh, N., Doraisamy, P., & Maheswari, M. (2015). METHANE EMISSION FROM RICE ECOSYSTEMS: 100 YEARS OF RESEARCH.

<https://doi.org/10.1016/j.jag.2020.102233>



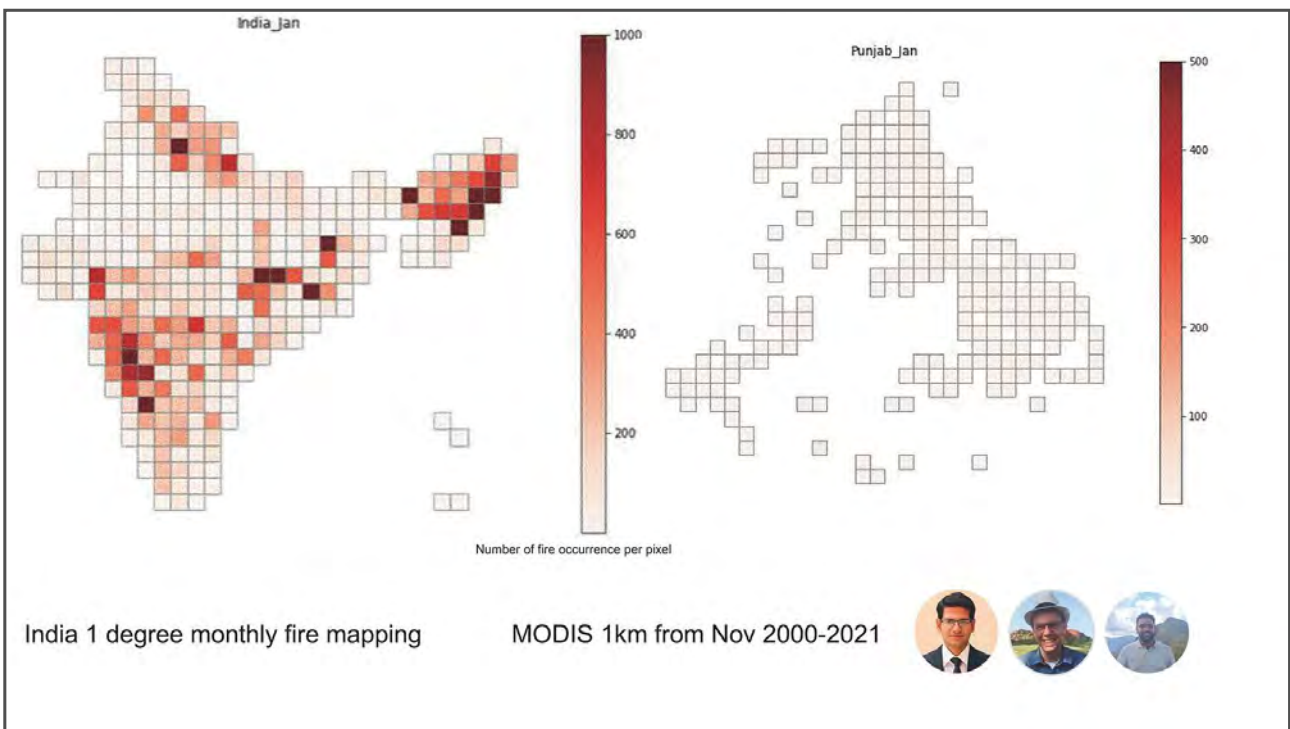
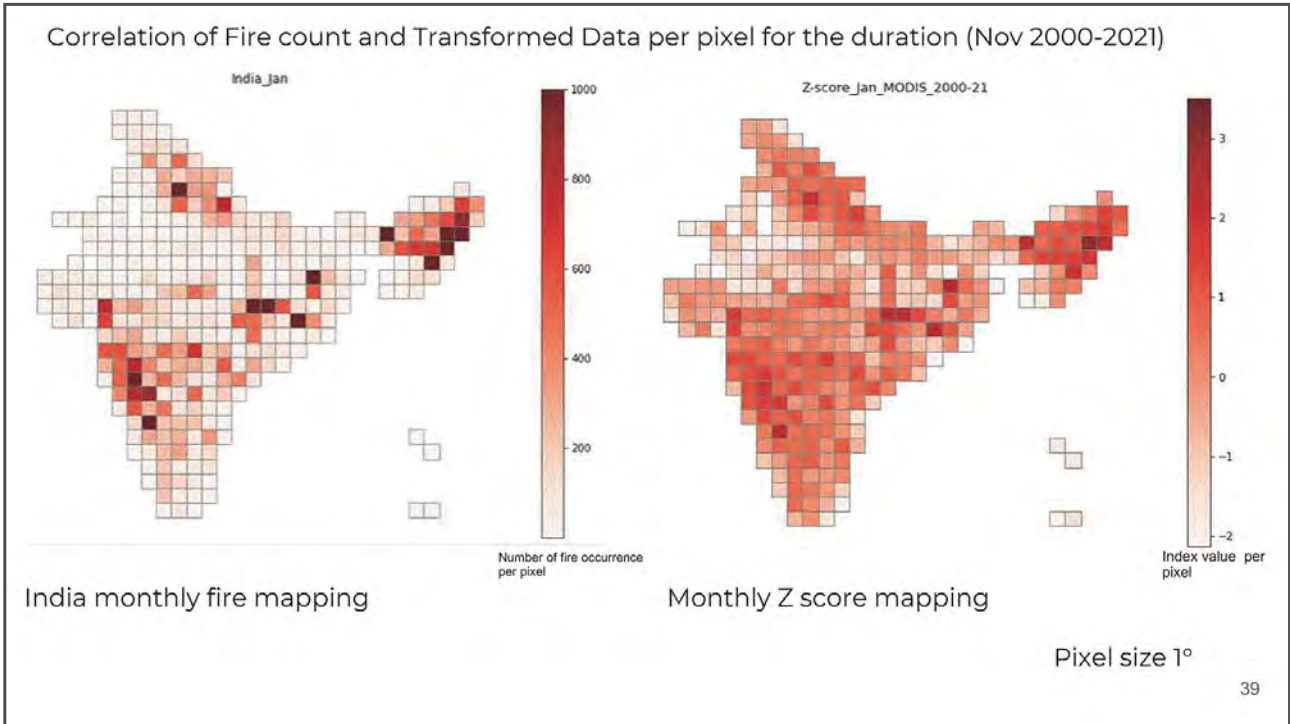
# Session II -2

## Geospatial Foundational AI for Sustainable and Regenerative Agriculture



# Session II -2

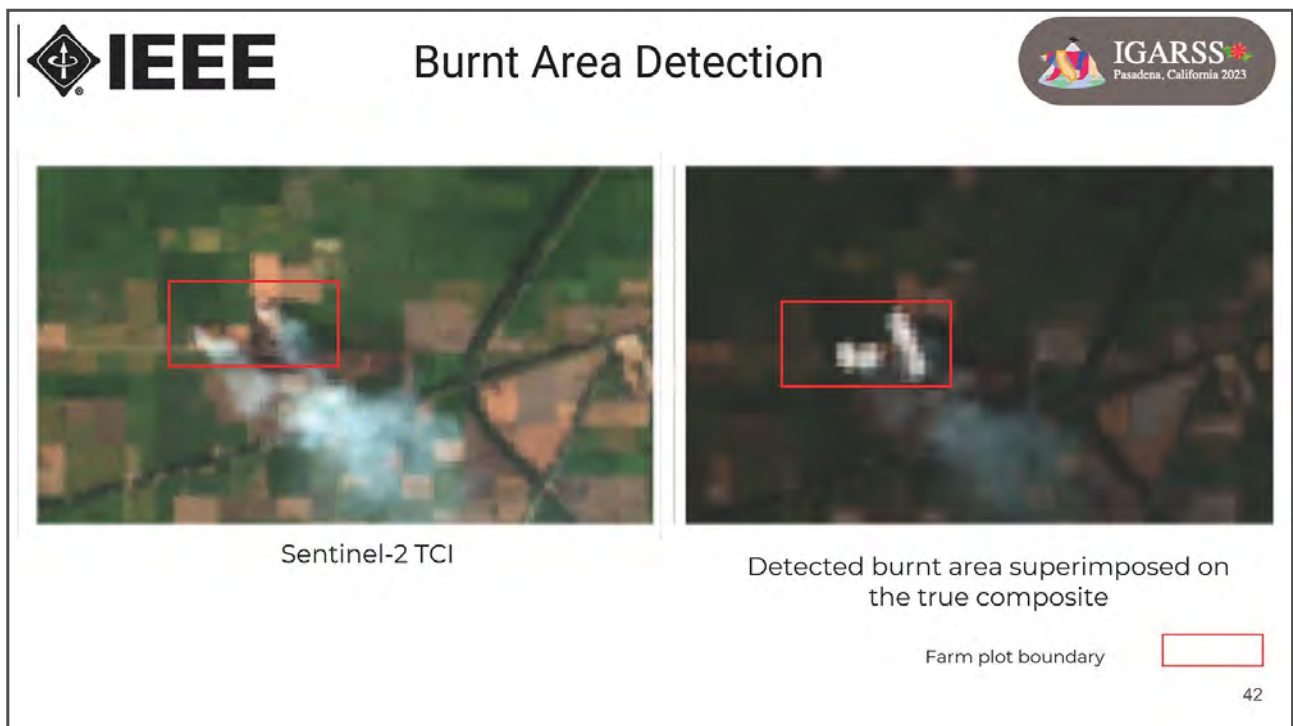
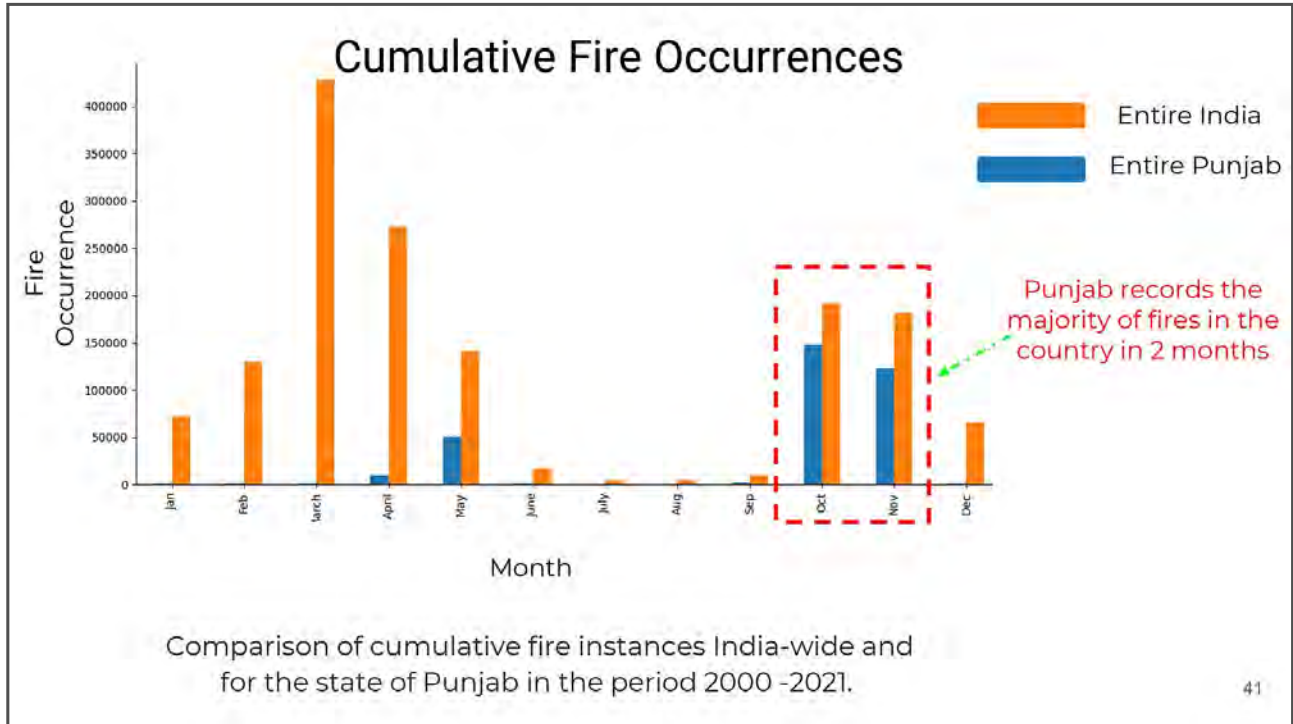
Praveen Pankajakshan





# Session II -2

## Geospatial Foundational AI for Sustainable and Regenerative Agriculture



# Session II -2

Praveen Pankajakshan

## Burnt Area Detection

True Composite, October 16, 2022  
Sentinel-2 TCI

Detected burnt area superimposed on  
the true composite

Farm plot boundary

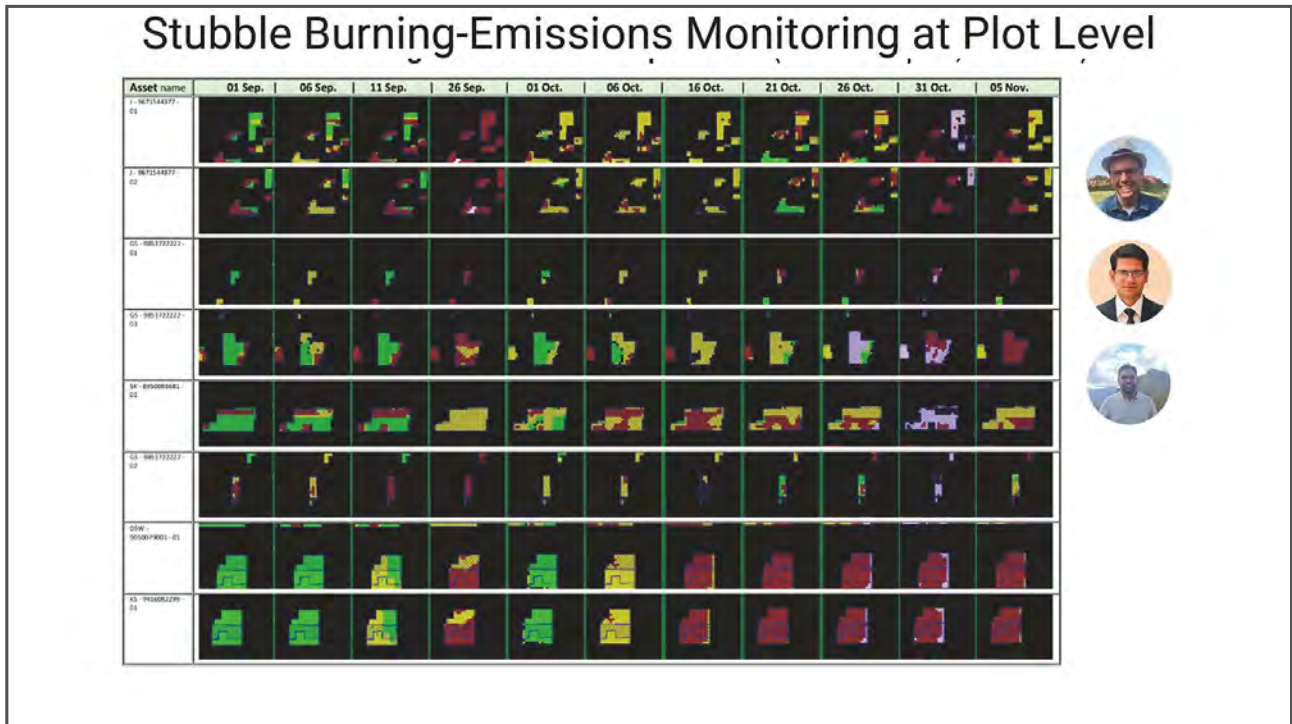
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# Session II -2

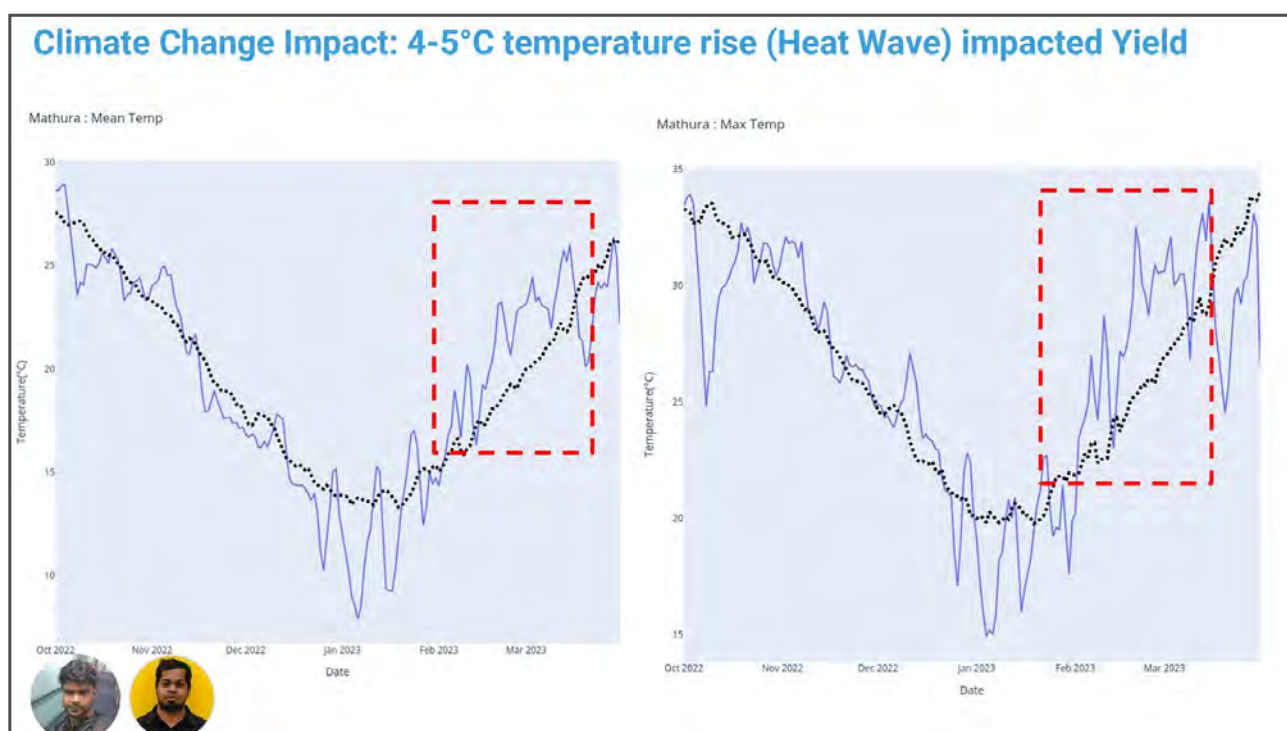
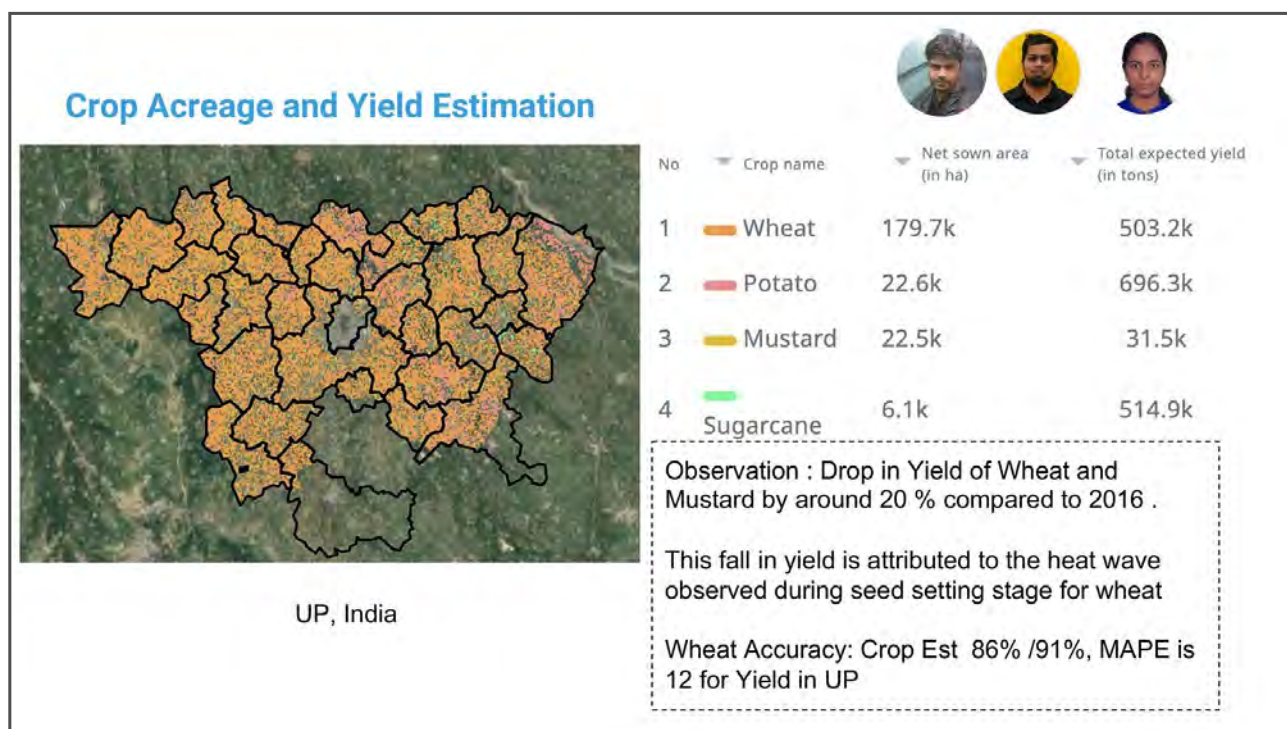
Geospatial Foundational AI for Sustainable and Regenerative Agriculture





# Session II -2

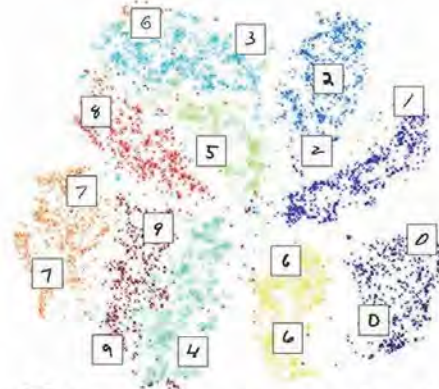
Praveen Pankajakshan





# Session II -2

Geospatial Foundational AI for Sustainable and Regenerative Agriculture



## Learning Representations

Extensions on Fundamental Foundational Ideas

## Learning Representations

*"... it's the idea of learning to represent the world before learning a task-and this is what babies do."*

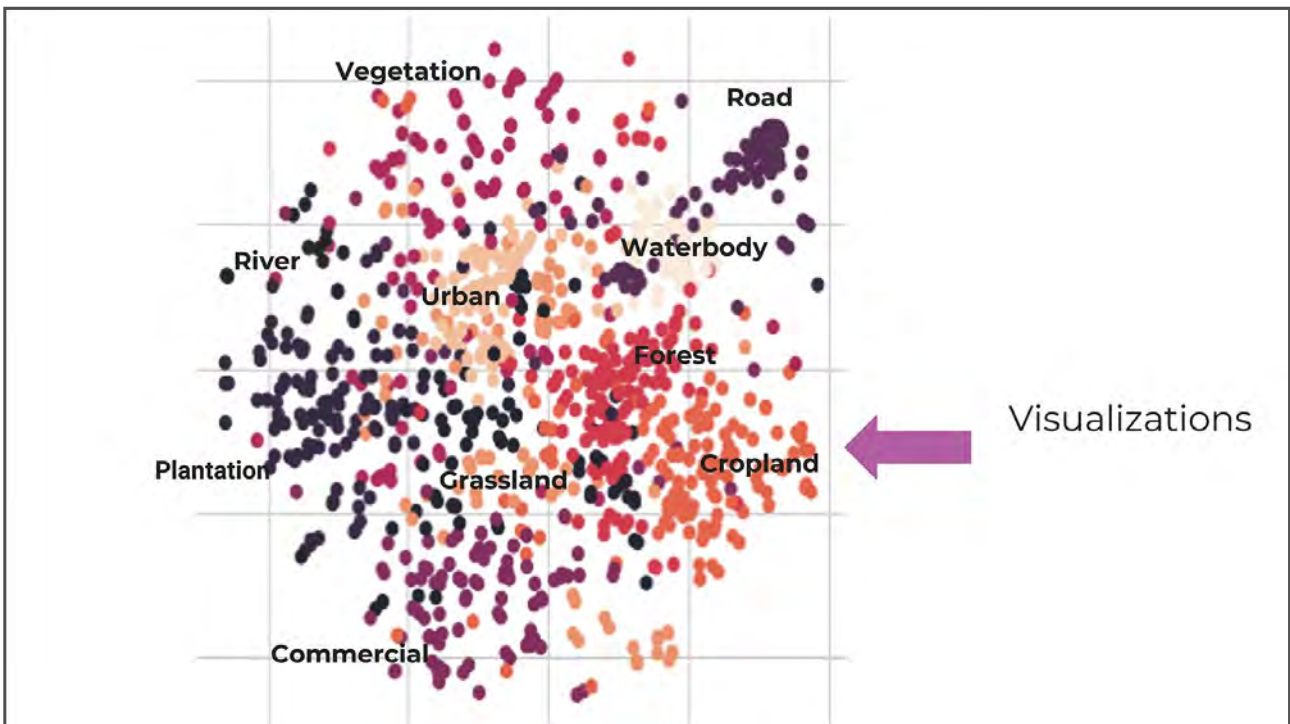
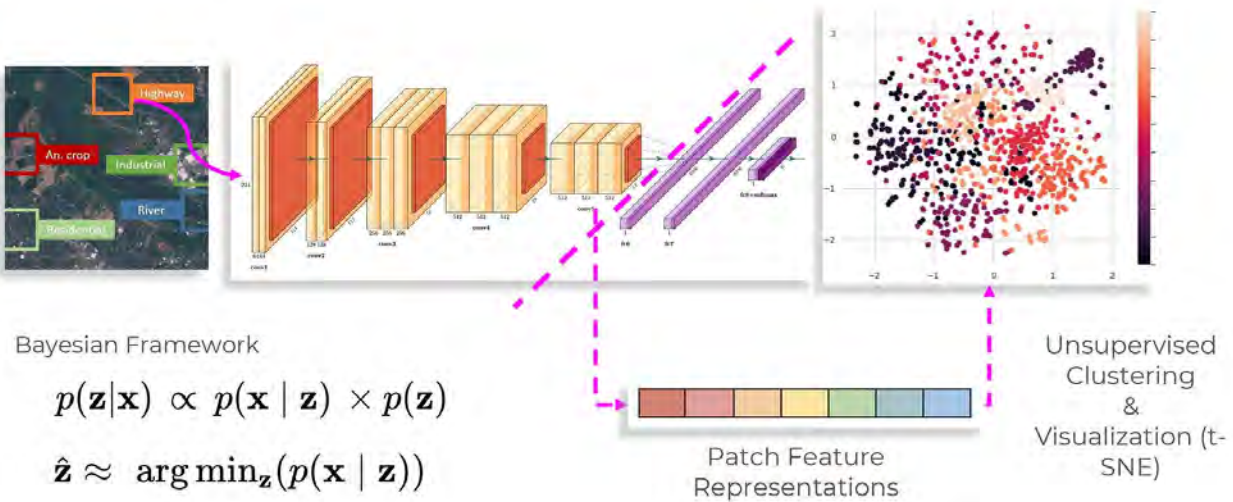
-Yann LeCun

\*AAAI 2020 Keynote:  
<https://www.youtube.com/watch?v=UX8OubxsY8w>

# Session II -2

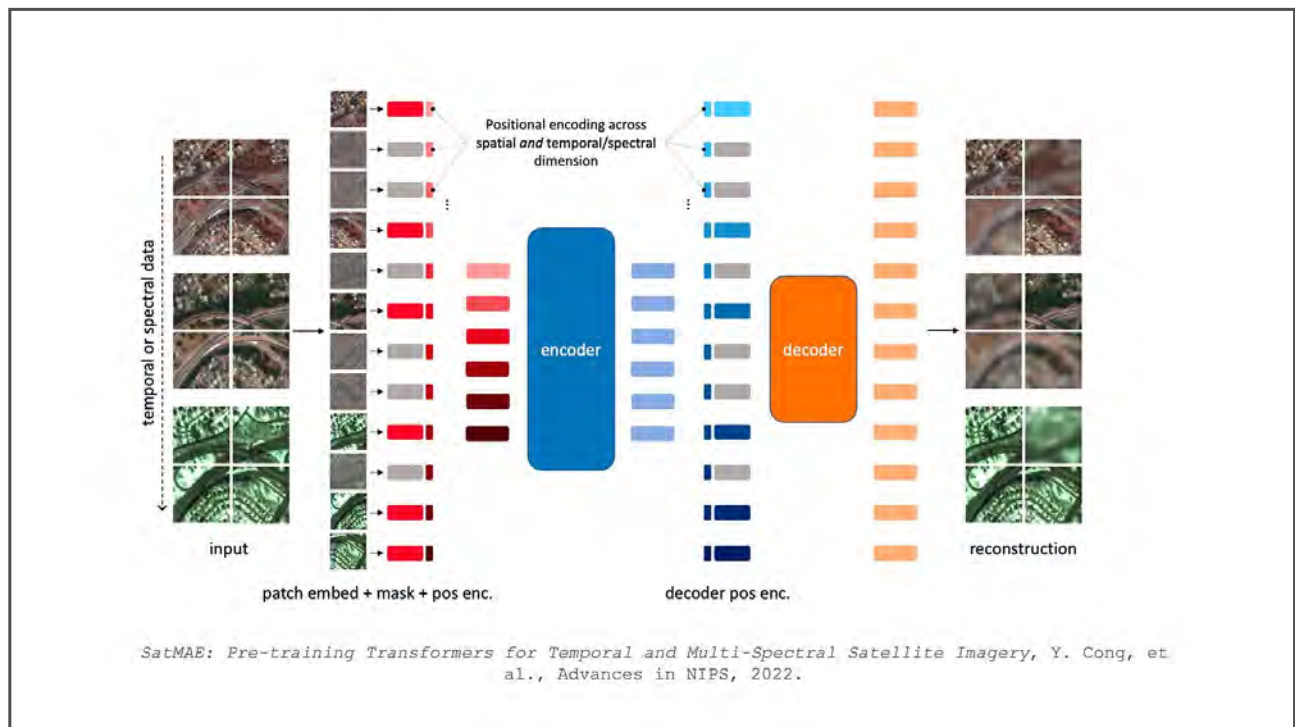
Praveen Pankajakshan

## Towards Learning Representations



# Session II -2

## Geospatial Foundational AI for Sustainable and Regenerative Agriculture



**Cropin**  
Harnessing Technology  
Revolutionizing Agriculture

**Thank you**



[praveenpankaj@ieee.org](mailto:praveenpankaj@ieee.org)



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# Efficient Large-scale 3D Modeling Using Omnidirectional Vision and Depth Sensing

**Jongwoo Lim**

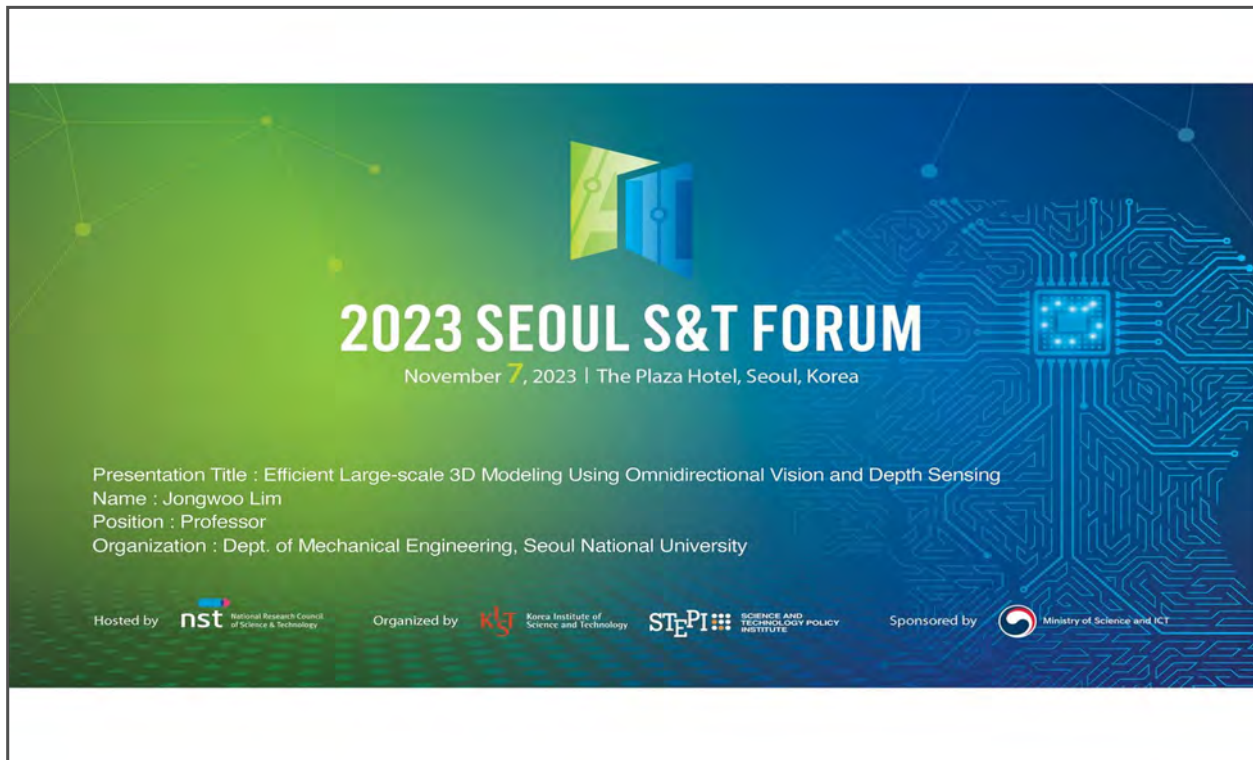
Professor,

Mechanical Engineering, Seoul National University




# Session II -3

## Efficient Large-scale 3D Modeling Using Omnidirectional Vision and Depth Sensing



The banner features a blue and green background with a circuit-like pattern. At the top center is a stylized logo consisting of three overlapping rectangular shapes in green, yellow, and blue. Below the logo, the text reads "2023 SEOUL S&T FORUM" in large white letters, followed by "November 7, 2023 | The Plaza Hotel, Seoul, Korea" in smaller white text. Below this, the presentation details are listed: "Presentation Title : Efficient Large-scale 3D Modeling Using Omnidirectional Vision and Depth Sensing", "Name : Jongwoo Lim", "Position : Professor", and "Organization : Dept. of Mechanical Engineering, Seoul National University". At the bottom, there are logos for the host (NST - National Research Council of Science & Technology), organizer (KIST - Korea Institute of Science and Technology), ST-PI (Science and Technology Policy Institute), and sponsor (Ministry of Science and ICT).



The slide has a blue header with the text "Modeling World (in 3D)" on the left and "2023 SEOUL S&T FORUM" on the right. Below the header, the text "Google Map / Earth / StreetView" is displayed. The main content is a screenshot of a Google Earth interface showing a 3D map of San Francisco and the surrounding Bay Area. The map includes labels for various locations such as San Francisco, Oakland, Berkeley, and San Jose. The interface also shows a search bar at the top and a navigation panel on the right side.

# Session II -3

Jongwoo Lim

## Google StreetView - Business View

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### Large-scale Computer Vision System

- Automatic panorama stitching
- Automatic pano pose estimation
- Pano moderation tools



◆ M. Colbert, J-Y. Bouquet, J. Beis, S. Childs, D. Filip, L. Vincent, J. Lim, S. Sathin, *Building indoor multi-panorama experiences at scale*, ACM SIGGRAPH 2012 Talks

## Microsoft - HoloLens Localization

2023 SEOUL S&T FORUM

### Cross-platform device localization



MINECRAFT EARTH

Microsoft HoloLens

android



# Session II -3

## Efficient Large-scale 3D Modeling Using Omnidirectional Vision and Depth Sensing

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### Omnidirectional Depth Estimation

Depth estimation by multi-view stereo matching

Left image      Right image      Shift = disparity

Monocular Field of View      Binocular Field of View

Ultra-wide FOV Fisheye Lens      360 Multi-view Stereo Setup

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### Omnidirectional Depth Estimation

#### 360 Omnidirectional depth estimation

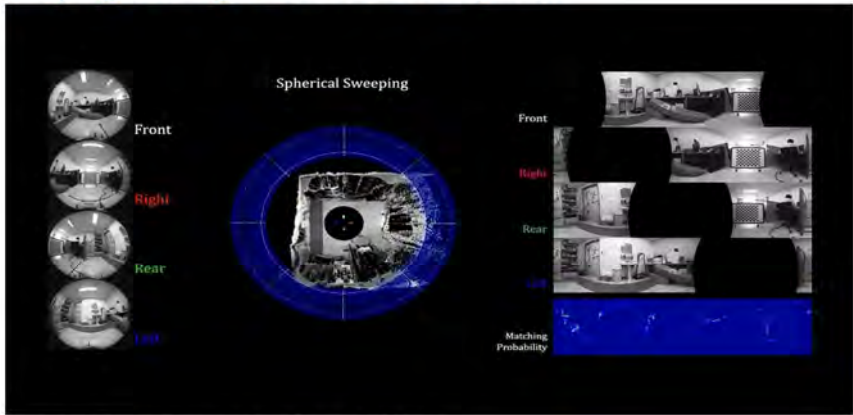
No "blind spots" unlike other 360 depth sensors like LiDARs

#### Challenges

- Large lens distortion, difficult calibration
- Stereo occlusions of near objects

SweepNet: initial 360 depth [ICRA19]
2023 SEOUL S&T FORUM

Spherical sweeping in the global coordinate system



• C. Won, J. Ryu, J. Lim, SweepNet: Wide-baseline Omnidirectional Depth Estimation, ICRA 2019

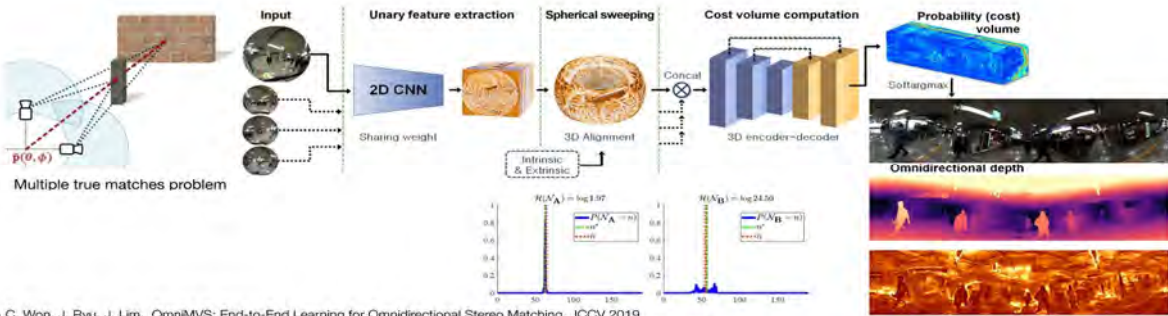
OmniMVS: 360 depth estimation
2023 SEOUL S&T FORUM

### Challenges

- Heavy computational overhead in multi-stage process
- Shallow and ad-hoc cost aggregation using SGM
- Multiple true matches due to global sweeping

### OmniMVS [ICCV19, TPAMI21]

- End-to-end learning framework,
- Warping 2D features to 3D spheres
- Uncertainty Estimation




• C. Won, J. Ryu, J. Lim, OmniMVS: End-to-End Learning for Omnidirectional Stereo Matching, ICCV 2019  
 • C. Won, J. Ryu, J. Lim, End-to-End Learning for Omnidirectional Stereo Matching with Uncertainty Prior, TPAMI 2021




# Session II -3

## Efficient Large-scale 3D Modeling Using Omnidirectional Vision and Depth Sensing


OmniMVS Result
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**Input Images**




**Stitched Panorama**



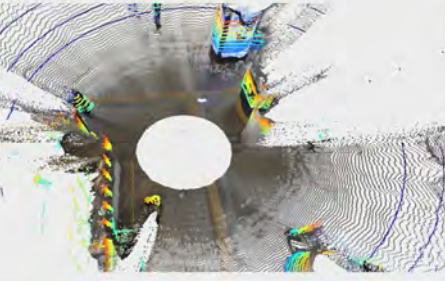
**360° Depthmap**



**LIDAR Points**



**Rendered Point Cloud (LIDAR points overlaid)**




Omnidirectional Visual Odometry
2023 SEOUL S&T FORUM

### Pose estimation and lens FOV

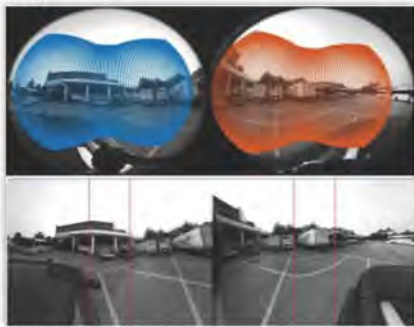
- Narrow FOV : rotation-translation ambiguity
- Wide FOV : hard feature matching & tracking due to lens distortion

### Benefits and challenges in our setup

- Stereo overlaps in all directions, full 360 observation
- Design an image projection model for robust feature matching



Landmarks (blue diamonds) and Camera (orange squares) positions are shown along a trajectory. Points  $P_{t+1}$  and  $P_t$  are marked on the trajectory, and  $X_p$  is a landmark position.



- H. Seok, J. Lim, ROVO: Robust Omnidirectional Visual Odometry for Wide-baseline Wide-FOV Camera Systems, ICRA 2019
- H. Seok, J. Lim, ROVINS: Robust Omnidirectional Visual Inertial Navigation System, RA-L w. IROS 2020

Omnidirectional VO Result
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**Input Videos**



**Estimated Camera Trajectory and Landmarks**

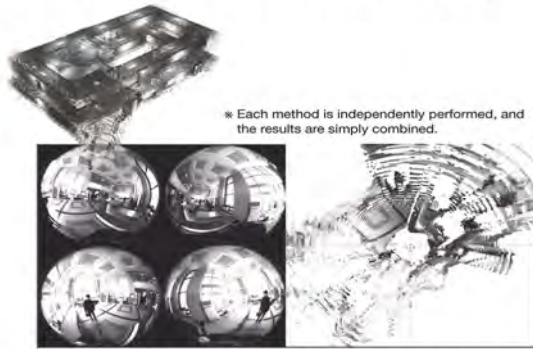


OmniSLAM : Dense Visual SLAM
2023 SEOUL S&T FORUM

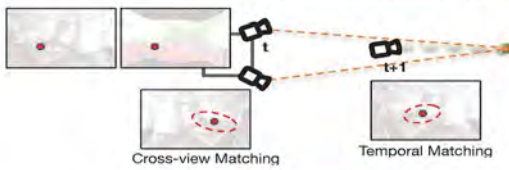
**Omnidirectional Visual SLAM + OmniMVS**

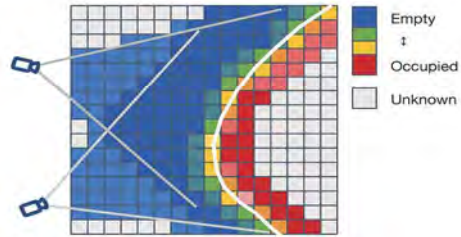
- Improved feature matching using view-wise depthmaps
- Volumetric reconstruction with TSDF occupancy voting

\* Each method is independently performed, and the results are simply combined.



\* ICRA 2020 Best Vision Paper Finalist





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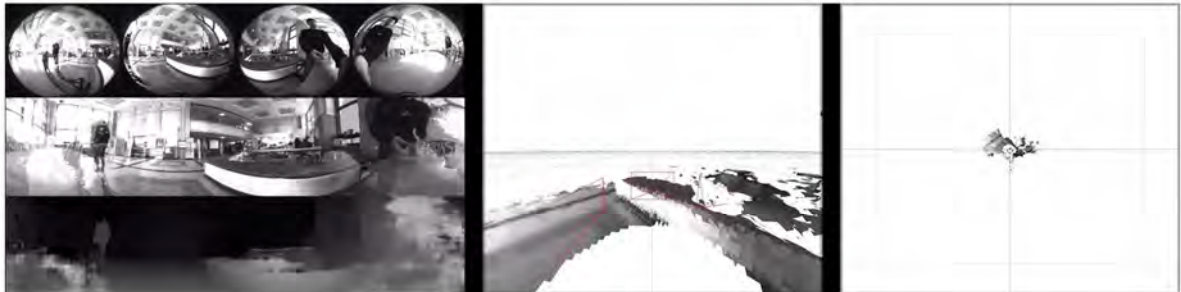
◆ C. Won, H. Seok, Z. Cui, M. Pollefeys, J. Lim, OmniSLAM: Omnidirectional Localization and Dense Mapping for Wide-Baseline Multi-Camera Systems, ICRA 2020

# Session II -3

## Efficient Large-scale 3D Modeling Using Omnidirectional Vision and Depth Sensing

### OmniSLAM : Dense Visual SLAM 2023 SEOUL S&T FORUM

**Result**  
Online dense modeling of the environment



• C. Won, H. Seok, Z. Cui, M. Pollefeys, J. Lim, OmniSLAM: Omnidirectional Localization and Dense Mapping for Wide-Baseline Multi-Camera Systems, ICRA 2020

### Large-scale Dense 3D Modeling 2023 SEOUL S&T FORUM



MultiplEYE  
Advanced 3D vision for future mobility

**Input Videos**



**Estimated 360° Depthmap**



**Estimated 3D Mesh Model**






## Application: Robot Navigation

2023 SEOUL S&T FORUM

### Vision-based dense mapping for autonomous robot navigation

Navigation map building




## Application: Robot Navigation

2023 SEOUL S&T FORUM

### Vision-based dense mapping for autonomous robot navigation

Autonomous robot navigation



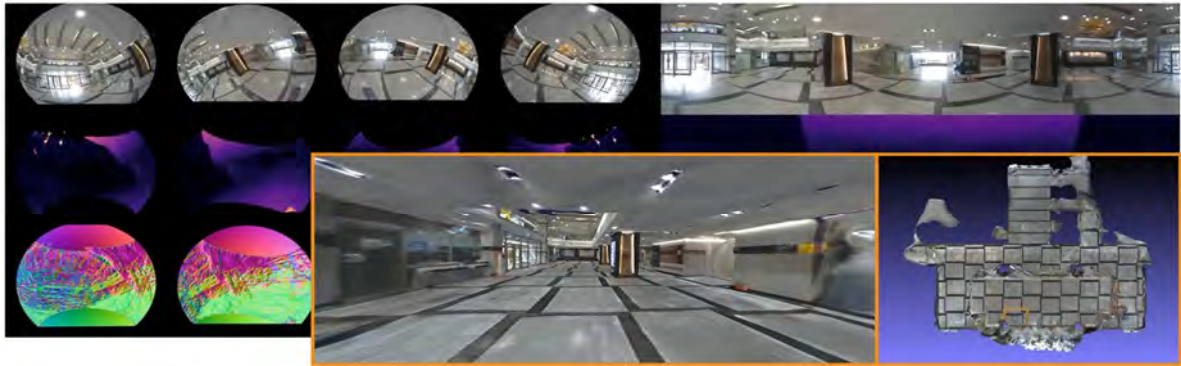


# Session II -3

## Efficient Large-scale 3D Modeling Using Omnidirectional Vision and Depth Sensing


**Application: Realistic 3D Modeling** 2023 SEOUL S&T FORUM

**Accurate and realistic environment modeling**  
Neural-geometrical hybrid 3D reconstruction



**Application: Large-scale Modeling** 2023 SEOUL S&T FORUM

**Efficient and continuous city-scale mapping**




**Application: Location Recognition** 2023 SEOUL S&T FORUM

Visual location recognition



**Large-scale Modeling in 3D** 2023 SEOUL S&T FORUM



**Thank you!**

# SEOUL S&T FORUM ARCHIVES

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The Seoul Science and Technology (Seoul S&T) Forum is a platform for discussing and reinforcing S&T's role in inclusive and sustainable development. The Forum offers compelling content as well as opportunities for interacting with key stakeholders in various fields. It brings together regional policymakers, international development professionals, and green technology R&DB specialists to exchange expert opinions, form concrete partnerships, and promote multilateral cooperation for sustainable development.

## A. Overview

1. Name: Seoul Science and Technology Forum (Seoul S&T Forum)
2. Official language: English/Korean
3. Duration: 1-day event, held in late October and/or early November
  - First held in 2010
  - Held annually from 2010 to 2014 and again in 2016, 2019, 2021, 2022 (9 times so far)
4. Target Participants: Regional policymakers, international developers, green technology R&DB specialists
5. Venue: Seoul, Korea
6. Website: <http://www.sstforum.com>

## B. Purpose

To provide a platform for addressing and assessing S&T's role in the inclusive and sustainable development of the global community, all while offering compelling, cutting-edge content and exceptional opportunities for interacting with key stakeholders from various fields.

# SEOUL S&T FORUM ARCHIVES

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## 1) 2022 Seoul S&T Forum

Title	A.I.'s Role in the Future Transformation of Science and Technology
Date	Oct. 31, 2022
Venue	The Plaza Hotel, Seoul, Korea
Host	National Research Council of Science and Technology (NST)
Organizers	Korea Institute of Science and Technology (KIST) Science and Technology Policy Institute (STEPI)
Sponsors	Ministry of Science and ICT
Participants	227 Participants from 34 different countries

## 2) 2021 Seoul S&T Forum

Title	Research Paradigm Shift for the World after COVID-19
Date	Nov. 2, 2021
Venue	The Plaza Hotel, Seoul, Korea
Host	National Research Council of Science and Technology (NST)
Organizers	Korea Institute of Science and Technology (KIST) Science and Technology Policy Institute (STEPI)
Sponsors	Ministry of Science and ICT
Participants	158 participants from 21 different countries



# SEOUL S&T FORUM ARCHIVES

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## 3) 2019 Seoul S&T Forum

Title	Critical Roles of Innovation Clusters: Addressing policy Issues and Challenges for Inclusive Growth
Date	Nov. 6~7, 2019
Venue	The Plaza Hotel, Seoul, Korea
Host	National Research Council of Science and Technology (NST)
Organizers	Science and Technology Policy Institute (STEPI) OSONG Medical Innovation Foundation Korea Innovation Foundation (INNOPOLIS) Korea Institute of Science and Technology (KIST)
Sponsors	Ministry of Science and ICT
Participants	289 participants from 27 different countries

## 4) 2016 Seoul S&T Forum

Title	Science, Technology & Innovation (STI) for Better Life
Date	Oct. 27~28, 2016
Venue	The Plaza Hotel, Seoul, Korea
Hosts/ Organizers	National Research Council of Science and Technology (NST) Korea Institute of Science and Technology (KIST) Science and Technology Policy Institute (STEPI) Green Technology Center (GTC) United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP)
Sponsors	Ministry of Science and ICT YTN Science
Participants	271 participants from 39 different countries

# SEOUL S&T FORUM ARCHIVES

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## 5) 2014 Seoul S&T Forum

Title	New Vision for Global R&DB
Date	Nov. 5~7, 2014
Venue	The Plaza Hotel, Seoul, Korea
Hosts/ Organizers	National Research Council of Science and Technology (NST) United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP)
Sponsors	Korea Institute of Science and Technology (KIST) Korea Institute of Industrial Technology (KITECH) Green Technology Center (GTC) YTN Science
Participants	Ministry of Science, ICT, &Future Planning Korea International Cooperation Agency (KOICA)

## 6) 2013 Seoul S&T Forum

Title	Creative R&DB for Inclusive &Sustainable Development for Global Community
Date	Oct. 30~Nov. 2, 2013
Venue	The Plaza Hotel, Seoul, Korea
Hosts	Korea Research Council of Fundamental Science and Technology (KRCF) Korea Research Council of Industrial Science and Technology (ISTK) United Nations Development Program (UNDP)
Organizers	Korea Institute of Science and Technology (KIST) Korea Institute of Industrial Technology (KITECH) Green Technology Center (GTC)
Sponsors	Ministry of Science, ICT, &Future Planning Korea International Cooperation Agency (KOICA)
Participants	316 participants from 43 different countries

# SEOUL S&T FORUM ARCHIVES

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## 7) 2012 Seoul S&T Forum

Title	A New Role of PRIs: Sharing Innovation Capacities
Date	Oct. 31~Nov. 3, 2012
Venue	Lotte Hotel, Seoul, Korea
Hosts/ Organizers	Korea Research Council of Fundamental Science and Technology (KRCF) Korea Institute of Science and Technology (KIST) Science and Technology Policy Institute (STEPI)
Sponsors	Ministry of Education, Science and Technology Korea International Cooperation Agency (KOICA)
Participants	209 participants from 30 different countries

## 8) 2011 Seoul S&T Forum

Title	Bridging Needs and Resources for Global Green Growth
Date	Oct. 5~8, 2011
Venue	Lotte Hotel, Seoul, Korea
Hosts/ Organizers	Korea Research Council of Fundamental Science and Technology (KRCF) Korea Institute of Science and Technology (KIST) Science and Technology Policy Institute (STEPI)
Sponsors	Ministry of Education, Science and Technology Korea International Cooperation Agency (KOICA) Maeil Business News Korea
Participants	188 participants from 20 different countries

# SEOUL S&T FORUM ARCHIVES

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## 9) 2010 Seoul S&T Forum

Title	International Cooperation of Public Research Institutes for Green Growth
Date	Nov. 18~20, 2010
Venue	Shilla Hotel, Seoul, Korea
Hosts	Korea Research Council of Fundamental Science and Technology (KRCF)
Organizers	Korea Institute of Science and Technology (KIST) Science and Technology Policy Institute (STEPI)
Sponsors	Ministry of Education, Science and Technology Presidential Committee on Green Growth The Korea Economic Daily
Participants	384 participants from 35 different countries



# GENERAL INFORMATION ON KOREA

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## LANGUAGE

The Korean language - like Hungarian, Turkish, Mongolian and Finnish - is classified among the Ural-Altaic language group. Hangeul (the Korean alphabet) is composed of 10 simple vowels and 14 consonants. A group of scholars under the patronage of King Sejong the Great developed this ingenious language system nearly five hundred years ago. In 2009, the town of Bau-Bau in Sulawesi, Indonesia adopted Hangeul as their official written language.

## CURRENCY

Currency: ₩ (KRW) You can exchange up to \$10,000 in foreign currency and/or travelers' checks at a time. Bank operation hours in Seoul are 9:00 am - 4:00 pm, Monday through Friday, with bank operations at Incheon International Airport lasting from 6:00 am - 9:00 pm daily.

## VISA

Visitors from countries not under Visa Exemption Agreements must apply for visa extensions if planning to stay more than 30 days. To see if you are visa exempted, please visit: <https://www.visa.go.kr/>

## TOURISM

Tourist information for Seoul, Korea - as well as other information - can be found at the websites for the Korea Tourism Guide(<http://english.visitkorea.or.kr/enu/index.kto>) and the Seoul Convention Bureau(<http://www.miceseoul.com/>).

## BUSINESS HOURS

Office hours for government workers are usually 9:00 am to 6:00 pm on weekdays. Banks are open from 9:00 am to 4:00 pm on weekdays and closed on weekends. Major stores are open every day from 10:30 am to 8:00 pm, and there are many 24-hour businesses throughout all major cities.

## CREDIT CARDS

Diners Club, Visa, American Express, and Master Card are widely accepted at major hotels, shops, and restaurants in most cities. Check with your credit card company for details on merchant acceptability and other services which may be available.

## TAX REFUNDS

To receive a tax refund, present receipts for your purchased goods to the customs desk at Incheon International Airport upon your departure. These receipts can be cashed-in at the Cash Refund Office in front of the Airport Duty Free Shop.

## TELEPHONE / MOBILE PHONE

To make international calls, please dial the international dialing code (001,002, 00700) + country code + area code + phone number. Most convenience stores, hotels and airports sell domestic and international calling cards. Mobile phones can be rented at the airport or at major hotels. You will need identification (passport) and a credit card to utilize mobile phone rental services.

## TIMES ZONE

Korea is 9 hours ahead of Greenwich Mean Time (GMT+9) and does not recognize daylight saving time.

## ELECTRICITY

The standard electrical supply is 220 volts AC/60 cycles. Most hotels can provide outlet converters for 110 and 220 volts. Always double-check the power supply before plugging-in your equipment.