Remote Sensing of Environment

Using Big Data and AI

LEE MOUNG JIN

CONTENTS

LEE MOUNG JIN, PhD

AFFILIATION

Senior Research Fellow, Korea Environment Institute

RELATED EXPERIENCE

Education and Research

Adjunct Professor, Dept. of Geoinformatics, The University of Seoul, *2019- 2020*

Adjunct Professor, Dept. of Environmental Engineering, The Catholic University, *2013 – 2016*

Academic Activities & Memberships

Consultant, Build on AI data set, *2018- present*

Editor, Korean Society of Environmental Impact Assessment *2022- present*

Editor, Korean Journal of Remote Sensing *2017- present*

Editor, GEO DATA *2019- present*

Academic Award

Minister prize, Build on AI data set, *2023*

Minister prize, Build on public big data, *2018*

Minister prize, Support to climate change policy making, *2009*

The grand prize, Journal of the Korean Association of Geographic Information Studies, *2014*

Excellent prize, Korean Journal of Remote Sensing, *2018*

Related Paper

SCI 48 (25), ***KCI*** 73 (30), ***Patent*** 7 (5), A foreign book 4 (2)

I . A Bout KEI

KEI in Numbers (2024)

Founded in 1993

Under the Prime Minister's Office

Budget 46.8B KRW

(35M USD),
(as of Dec. 2023)
48.3% government contributions
51.7% external funding

Total 321 Staff

256 Researchers,
65 administrative support, etc.

176 Projects

70 KEI Internal projects,
106 commissioned projects from external funding
(as of April 2024)

2022

Inauguration of Dr. Chang Hoon Lee as KEI's President
(13th President of KEI)

I . A Bout KEI

VISION

Global Environmental Think Tank **KEI 2030**

MISSION

Contribute to Sustainable Development of
the Republic of Korea and the Global Community

CORE VALUES

GOALS

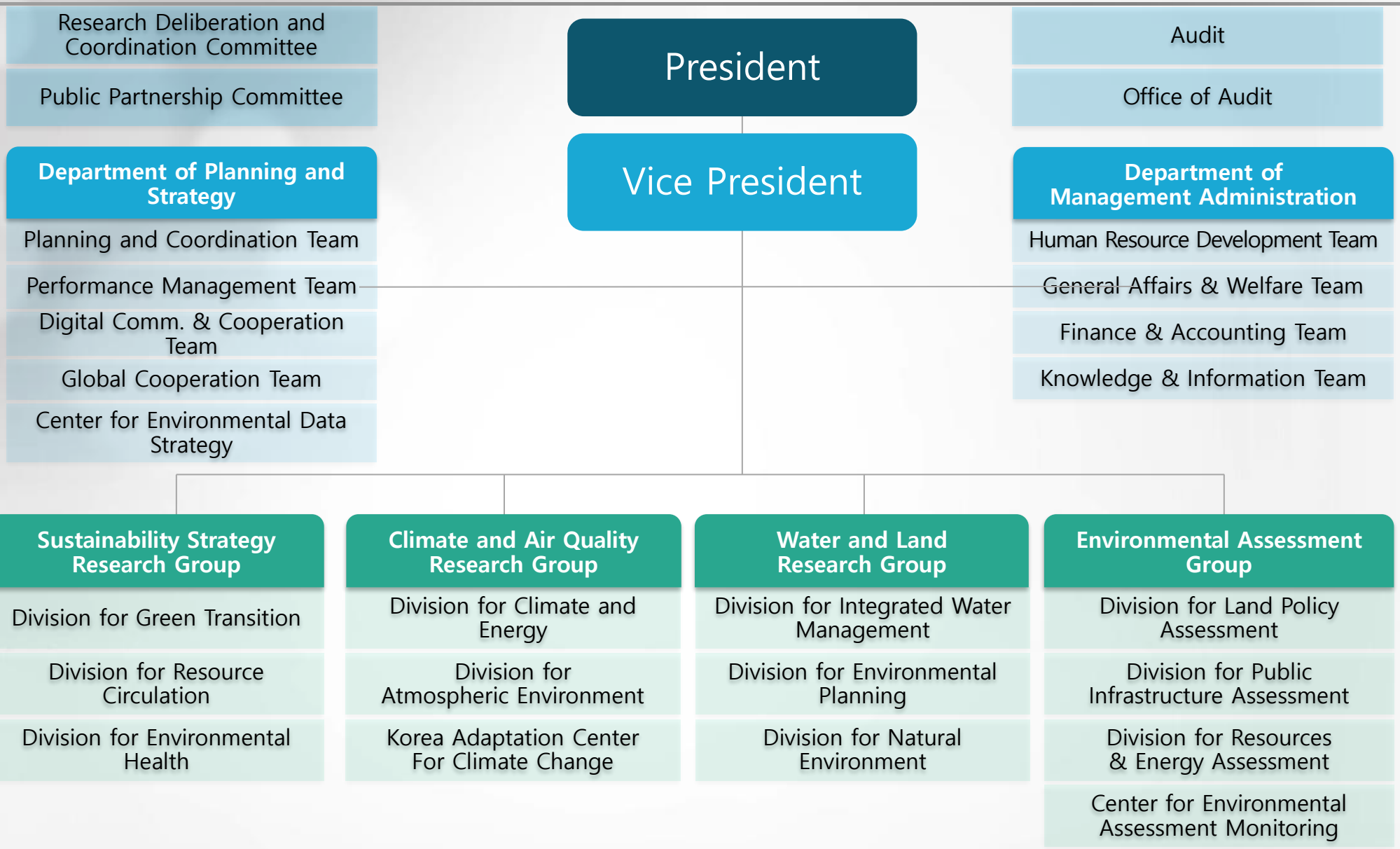
I. Enhance problem-solving research to advance towards a sustainable society

II. Strengthen leadership in environmental assessment and secure broad acceptance

III. Maximize research outcomes and lay the groundwork for becoming a global leader

IV. Promote innovation in management

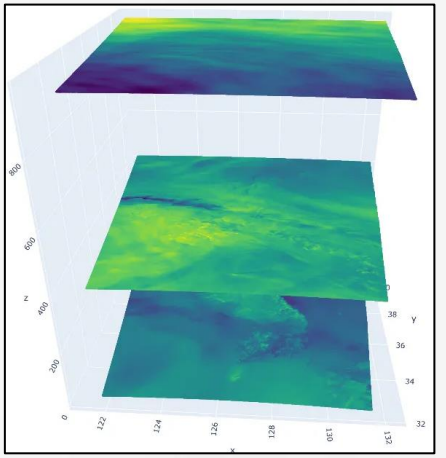
Ⅰ. A Bout KEI


Research Deliberation and Coordination Committee
Public Partnership Committee
President
Vice President
Audit
Office of Audit
Department of Planning and Strategy
Planning and Coordination Team
Performance Management Team
Digital Comm. & Cooperation Team
Global Cooperation Team
Center for Environmental Data Strategy
Department of Management Administration
Human Resource Development Team
General Affairs & Welfare Team
Finance & Accounting Team
Knowledge & Information Team
Sustainability Strategy Research Group
Division for Green Transition
Division for Resource Circulation
Division for Environmental Health
Climate and Air Quality Research Group
Division for Climate and Energy
Division for Atmospheric Environment
Korea Adaptation Center For Climate Change
Water and Land Research Group
Division for Integrated Water Management
Division for Environmental Planning
Division for Natural Environment
Environmental Assessment Group
Division for Land Policy Assessment
Division for Public Infrastructure Assessment
Division for Resources & Energy Assessment
Center for Environmental Assessment Monitoring

Ⅱ. Changing Environmental Issues & Data

1 Multi dimensional and time environmental Issues

- ✓ Environmental issues do not arise from individual causes or a single process, but rather manifest through complex and multi causes and effects.
- ✓ A multi dimensional spatial approach and interpretation of environmental problems on a global (Global) and local (Local) scale is necessary.
  - Global: Net Zero, Fine Dust
  - Local: Gumi Hydrofluoric Acid (2015), Flooding 2020s (2022)

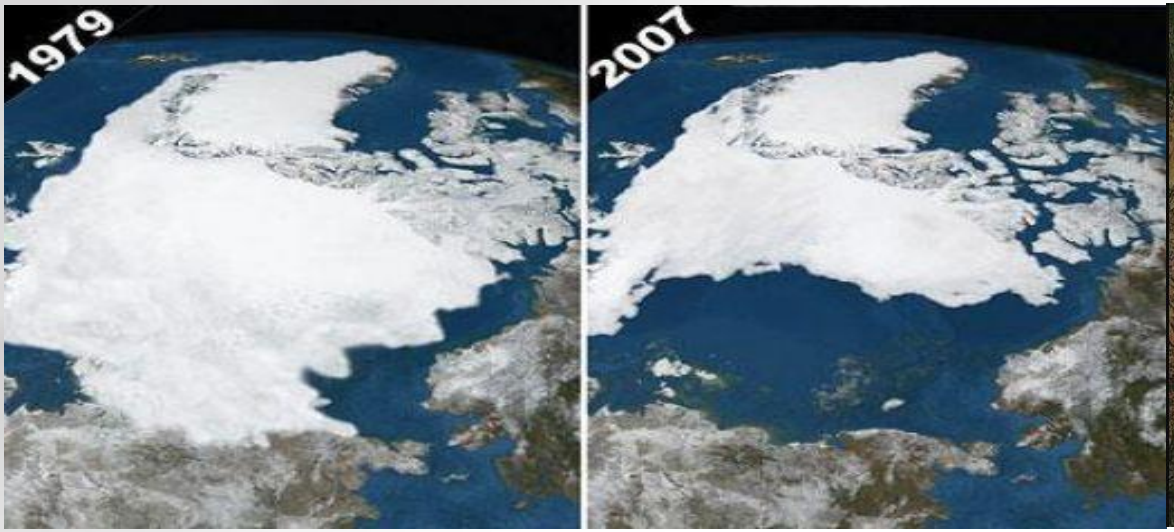


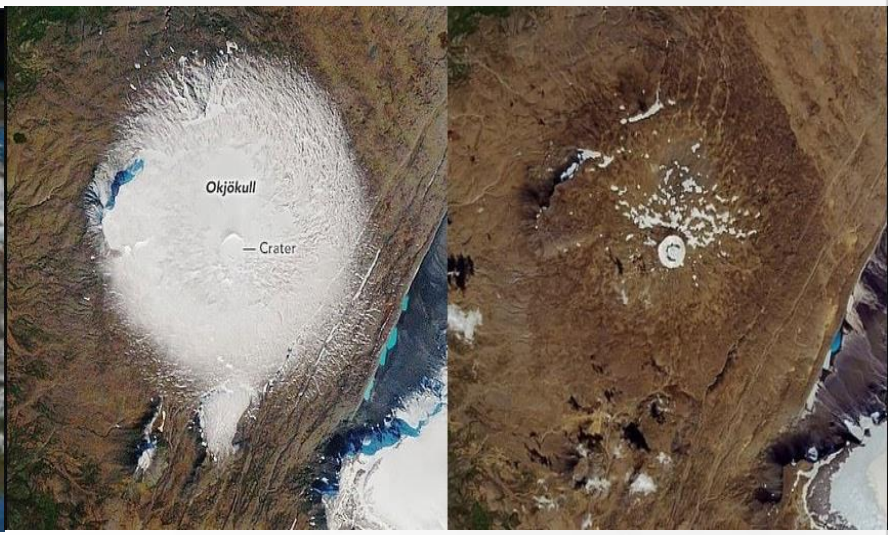
Written by DHL
(thlee33.medium.com/)

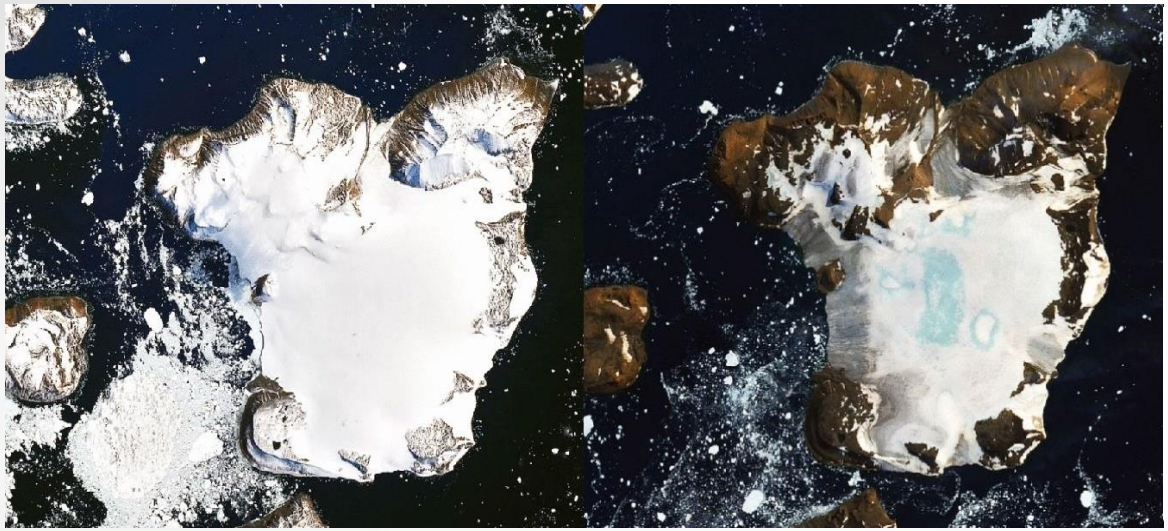
- ✓ Expansion of the diversity of remote sensing applicable to domestic environmental issues
  - Aerial Imagery, Earth observation satellites (Arirang series), environmental satellites, water resources satellites and GEDI, etc.
- ✓ Expansion of the diversity of satellite image analysis and potential for utilizing ICT (AI, Big Data, etc.)
  - AI (Vision, Generative AI, etc.) and spatial Big Data, etc.

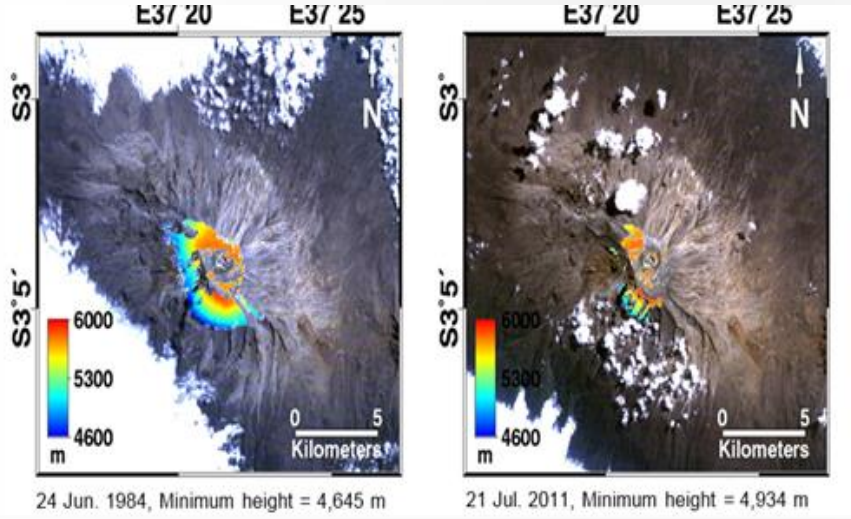
Ⅱ. Changing Environmental Issues & Data

2 Climate Crisis and Remote Sensing









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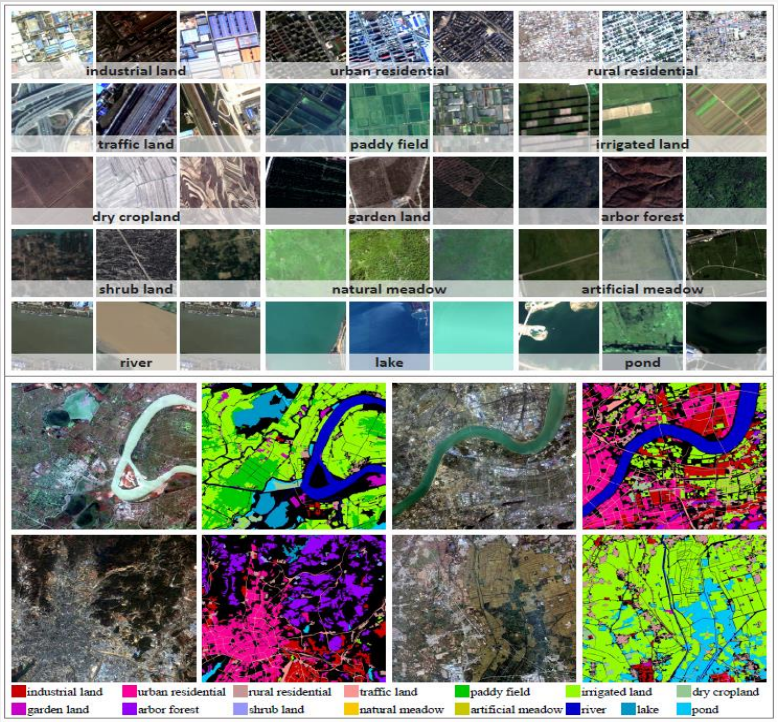
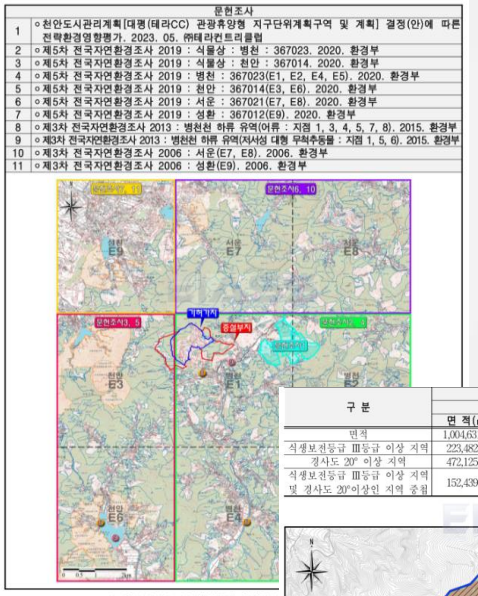
Ⅱ. Changing Environmental Issues & Data

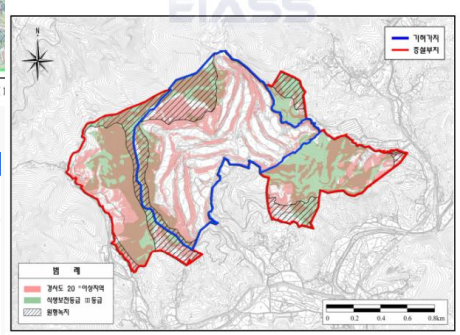
3 Vision(Images), Text, Numerical Data

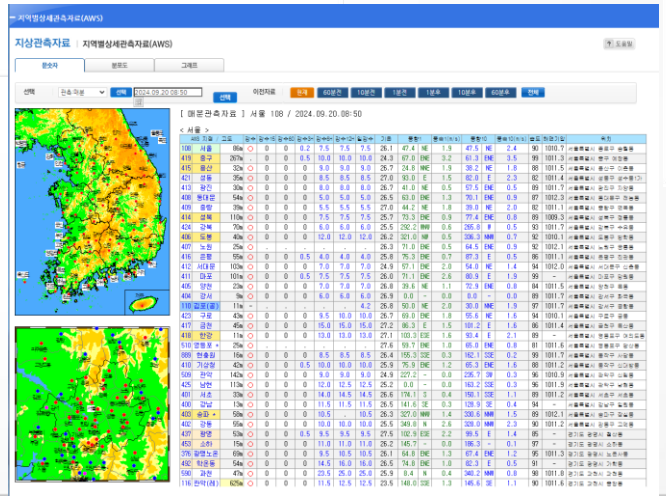




(그림 8.1.1.1-2) 문헌조사 위치도(

구 분	계획지구			
	기허가지		증설부지	
	면 적(㎡)	분포비(%)	면 적(㎡)	분포비(%)
면적	1,004,631.30	100.00	957,431.00	100.00
식생보전등급 Ⅲ등급 이상 지역	223,482.03	22.24	660,569.35	68.99
경사도 20° 이상 지역	472,125.60	46.99	568,260.50	59.35
식생보전등급 Ⅲ등급 이상 지역 및 경사도 20°이상인 지역 중첩	152,439.55	15.17	274,160.39	28.64





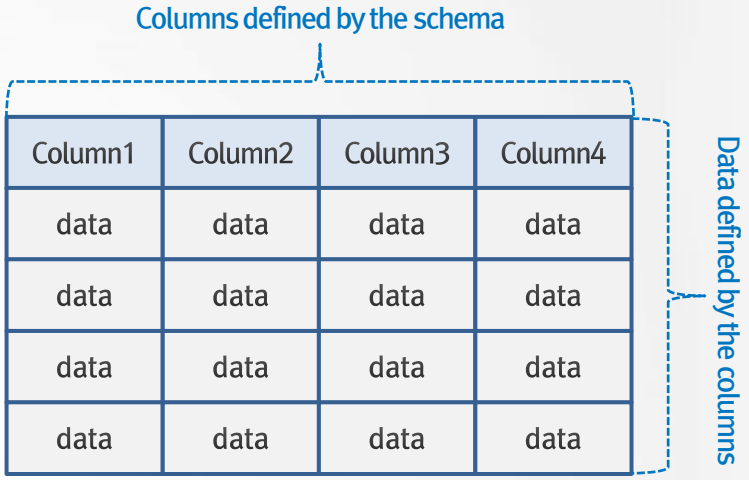
https://www.etnews.com/20211104000256

Ⅲ. Concept of Big Data & AI

1 Big Data Composition

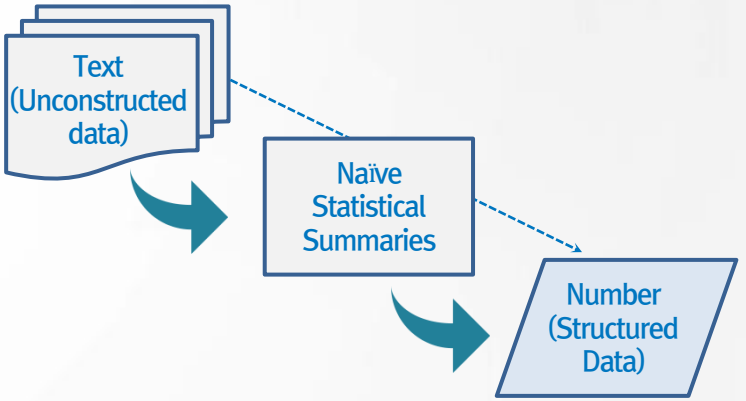
Structured Data

- ✓ The data and files stored in fixed columns, such as tables, and the attributes of the data are distinguished by specified rows and columns
- ✓ Example: Vector, Raster, Climatic Change Scenario etc.



Unstructured Data

- ✓ Unstructured-Data : No specific data type, and one data other than the data set is objected to the collection data
- ✓ Example: Text in paper & news, Image, Video and multimedia etc.

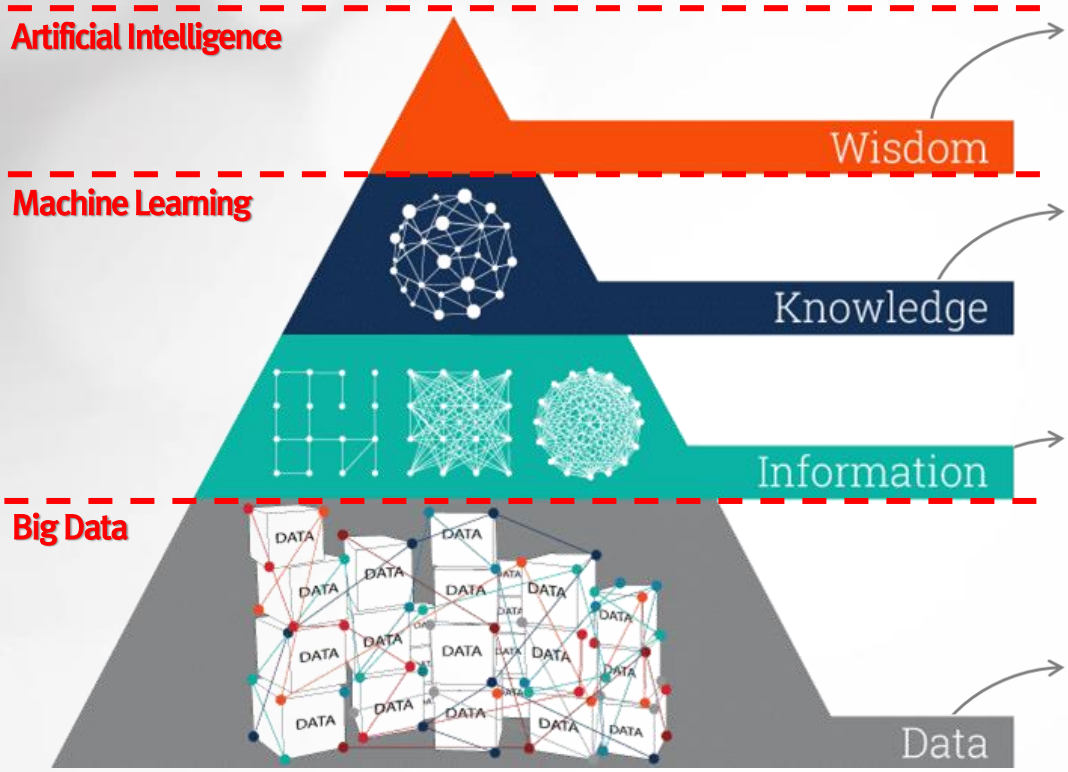


Objectives **Efficient analysis of Big data becomes AI**

Ⅲ. Concept of Big Data & AI

2 Change in Data Utilization

✓ Data, information, knowledge and Wisdom are presented sequentially in various trouble shooting processes using data analysis.

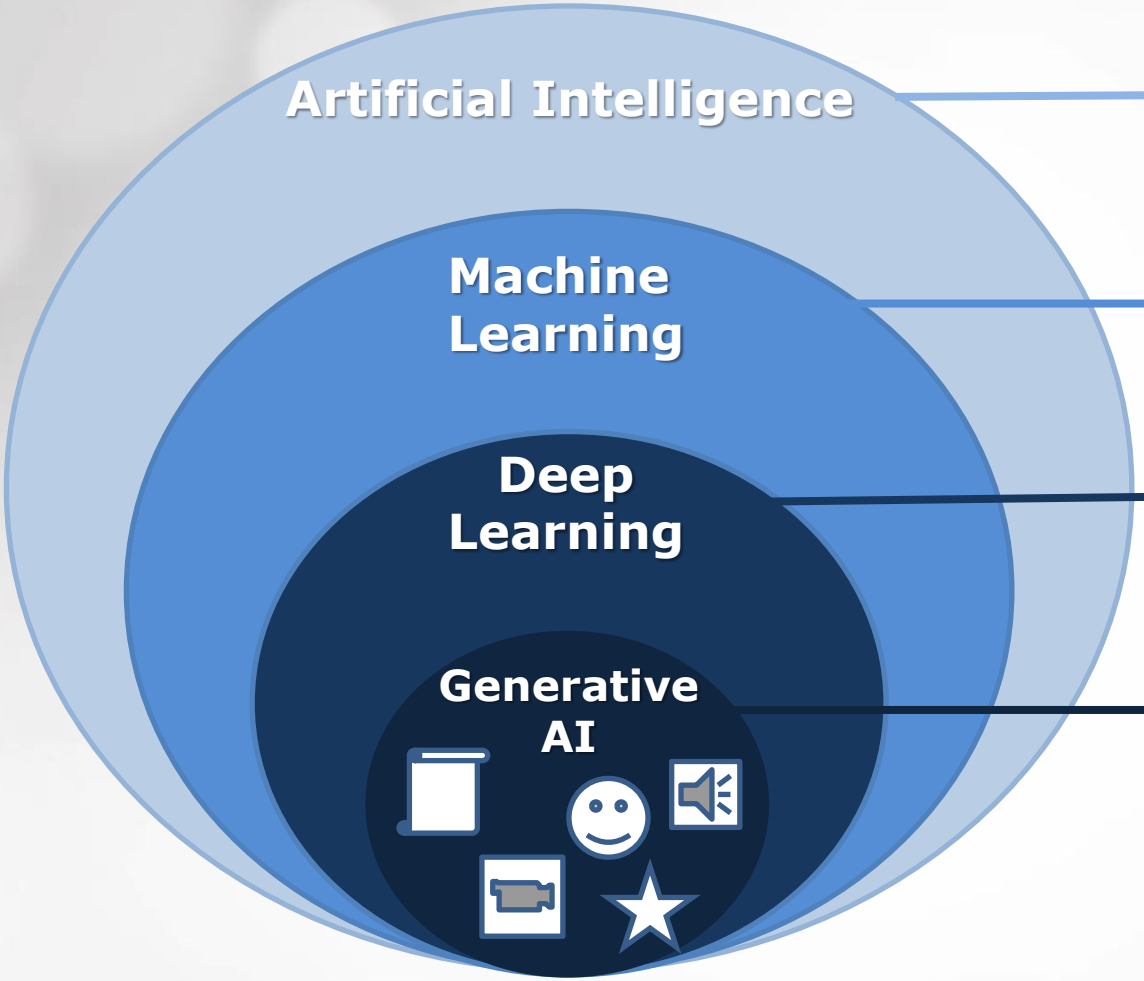


- Wisdom
  - Applied Knowledge
  - Knowledge applied in action
- Knowledge
  - Organized Information
  - Over viewing information as a description of collected facts, but also understanding how to apply it to achieve our goals
- Information
  - Linked elements
  - data that has been “cleaned” of errors and further processed in a way that makes it easier to measure, visualize and analyze for a specific purpose
- Data
  - Discrete elements
  - a collection of facts in a raw or unorganized form such as numbers or characters

Objectives **Increase in physical data (Big Data), Evolution of Analysis Phase**

Ⅲ. Concept of Big Data & AI

3 Define and Establishing Relationships



Development of smart systems and machines with the ability to carry out tasks that would otherwise require human intelligence

Creates algorithms that can learn from data and make decisions based on patterns observed

Uses an artificial neural network to process data through various layers of algorithms and reach an accurate decision without human intervention.

Artificial intelligence that generates results based on user characteristics.
Inputs and outputs to these models can include text, images, sounds, animation, 3D models, or other types of data.

- LLM: Large Language Model
- GAN: Generative Adversarial Networks
- VAE: Variational Auto Encoder

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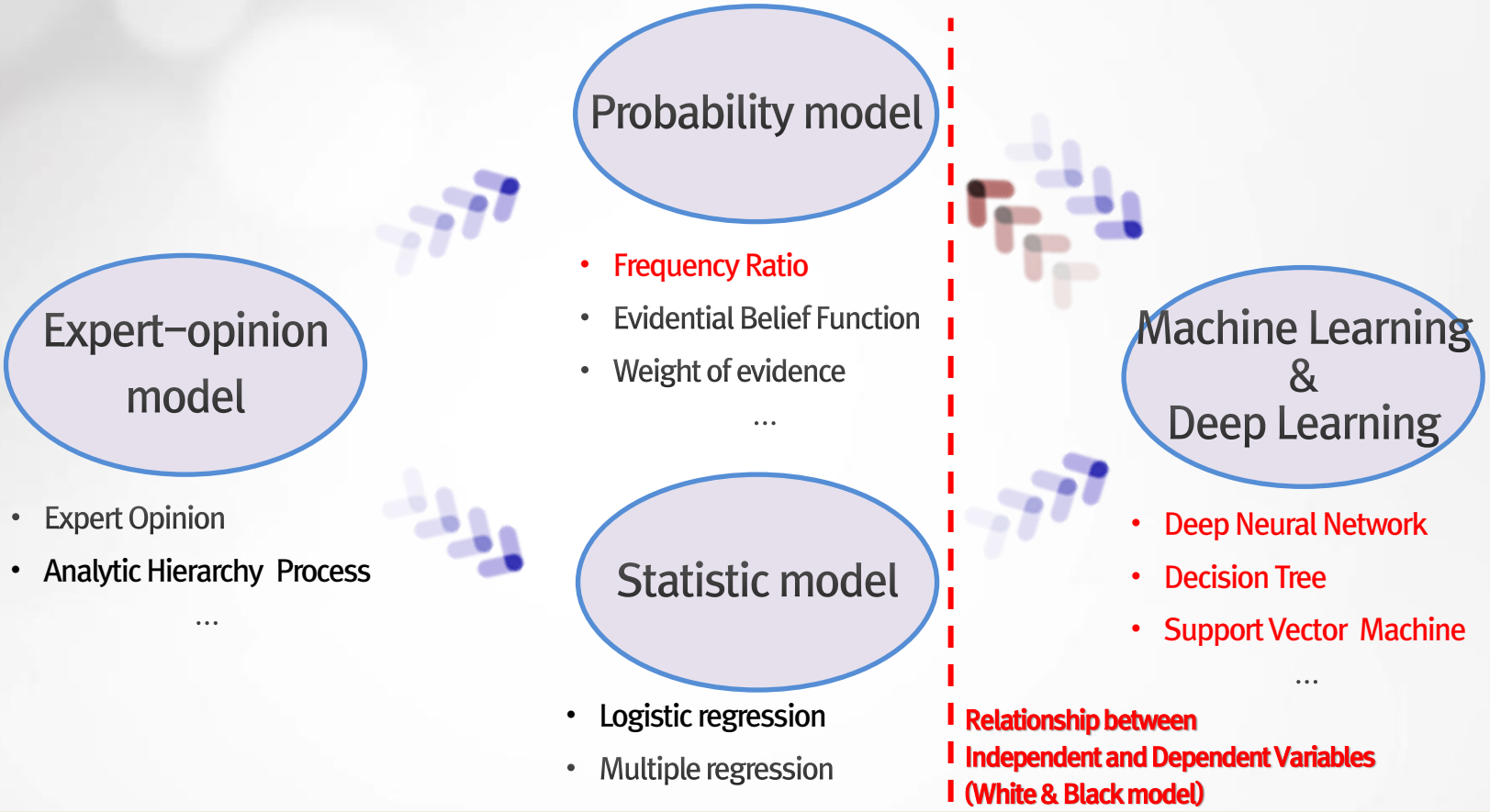
Ⅲ. Concept of Big Data & AI

4 Change in Data Processing Models

✓ Advances in **hardware**, including the **data source** are starting to accumulate exponentially more data (Big Data) and are driven by technologies that can handle large amounts of data (AI).



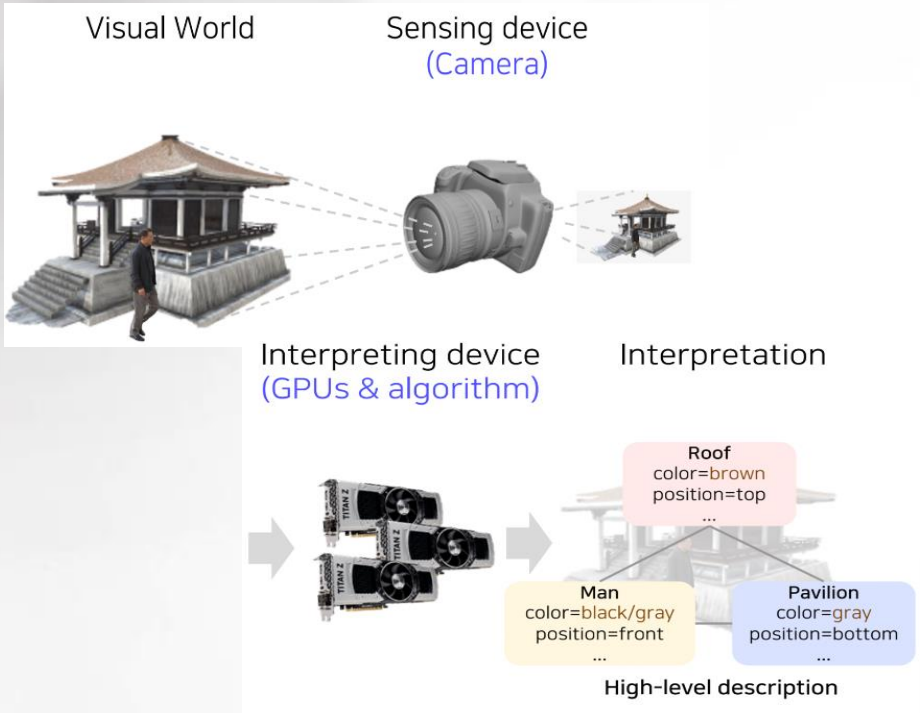
References

Lee M J*.* Lee S R, Jeon S W, Kim G H, 2013, Landslide Vulnerability Mapping considering GCI(Geospatial Correlative Integration) and Rainfall Probability in Inje, Environmental policy research, 12; 3:21–47

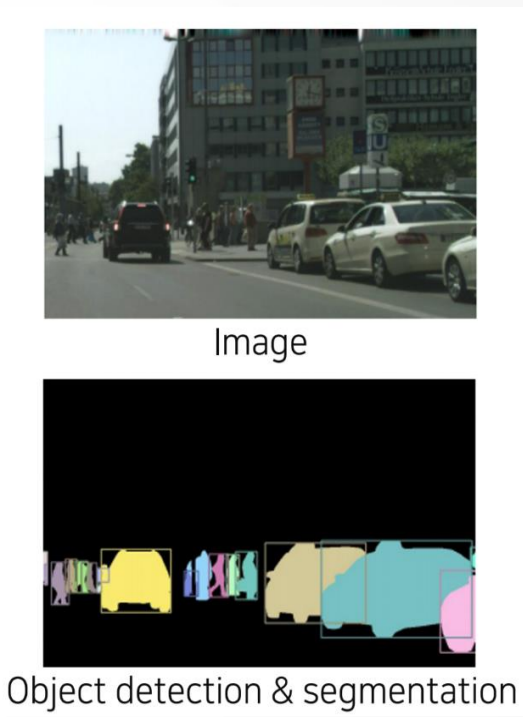
Ⅳ. Vision, Text & Numerical Data

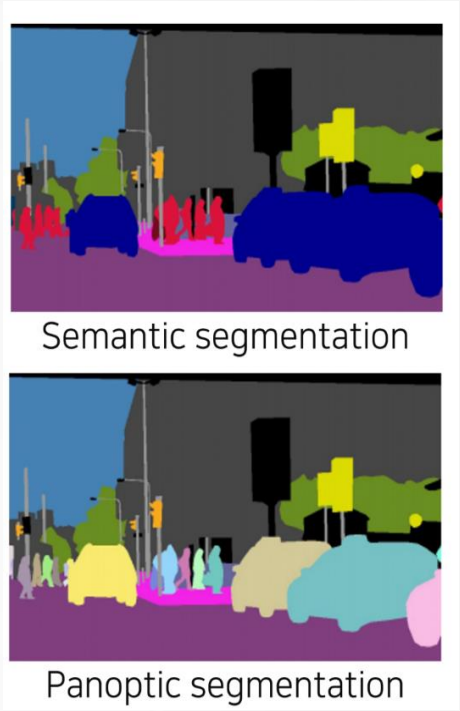
1 Computer Vision & Remote Sensing

- ✓ Computer Vision : Technology that allows computers to analyze and interpret images and video data by putting an eye on a machine.
- ✓ Applying the same method of image classification for computer vision and remote sensing



▲ Traditional Computer Vision Configure Image Classification
(https://m.boostcourse.org/ai340/lecture/1462952)



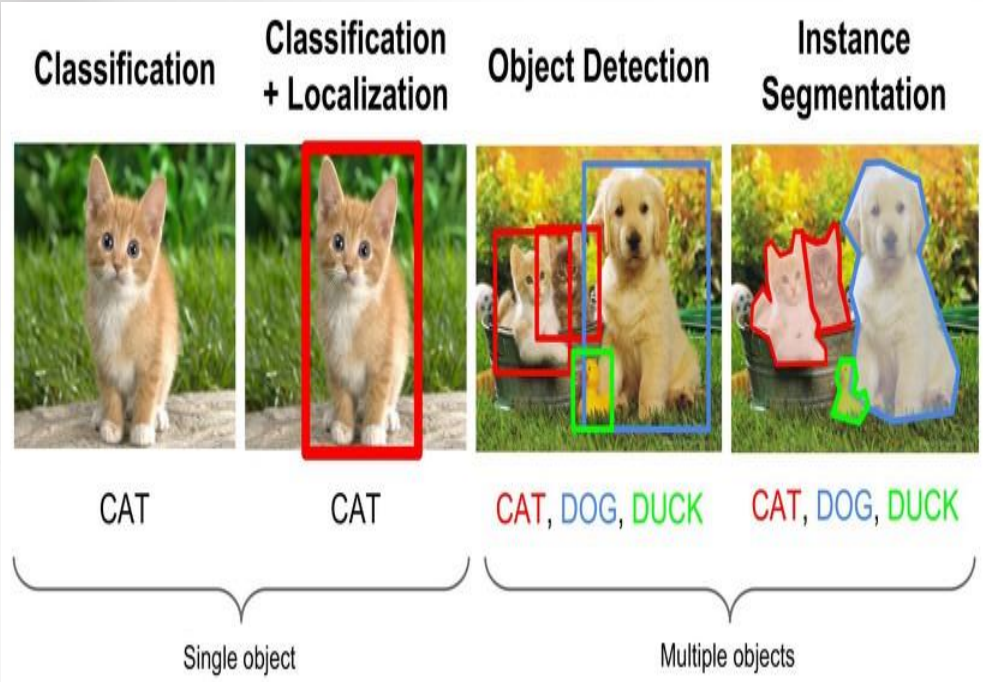


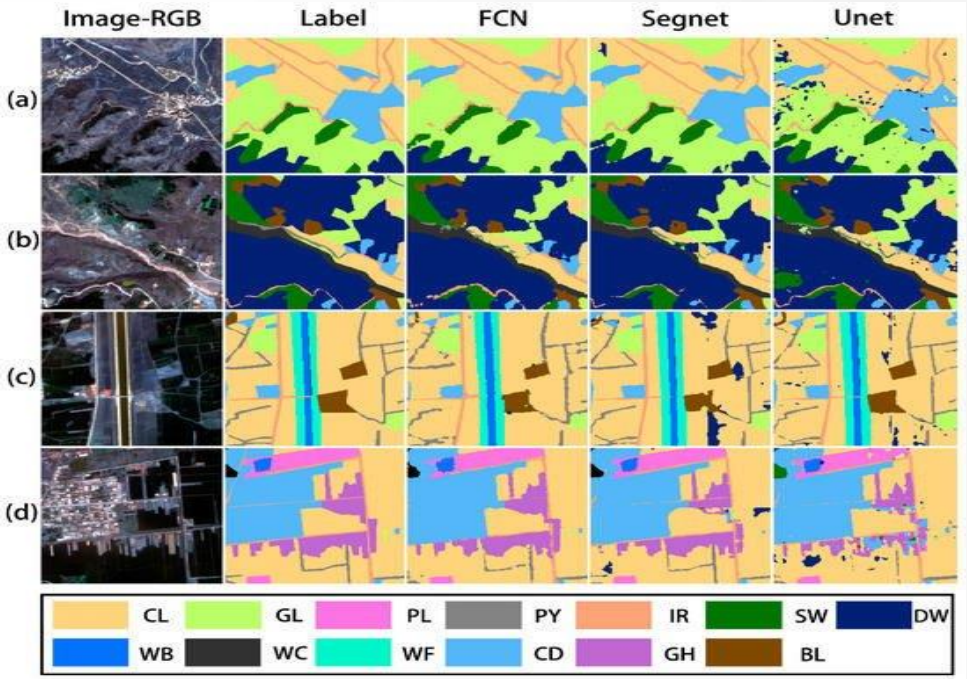
▲ Traditional computer vision
(https://m.boostcourse.org/ai340/lecture/1462952)

Ⅳ. Vision, Text & Numerical Data

1 Computer Vision & Remote Sensing

- ✓ Application of Remote Sensing : Development of computing power, the use of Data mining and Machine learning since the 2010s
- ✓ Recently, existing AI also has problems such as loss of spatial information in the feature extraction process, and algorithms that solve classification and localization simultaneously are emerging



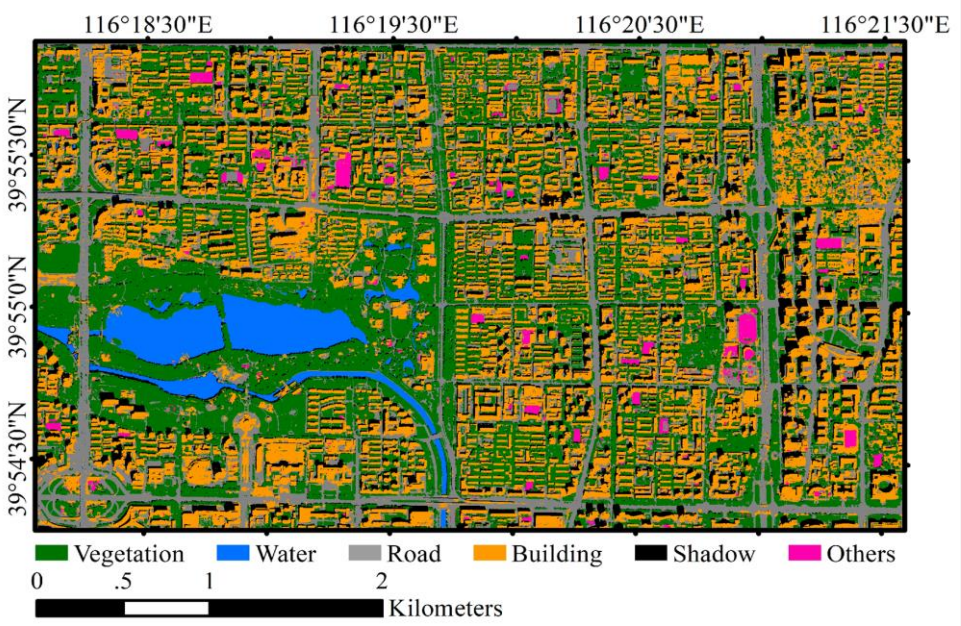


Ⅳ. Vision, Text & Numerical Data

2 Remote Sensing AI

- ✓ Remote sensing, variety of ways to monitor changes in landcover, and the resolution of satellite imagery has steadily improved (Rogan and Chen, 2004; Herold et al., 2003).
- ✓ In particular, AI algorithms based on convolutional neural networks (CNNs) have demonstrated higher performance than machine learning algorithms (Kussul et al., 2017).

YOLO-Fine: One-Stage Detector of Small Objects Under Various Backgrounds in Remote Sensing Images (Pham et al., 2020)

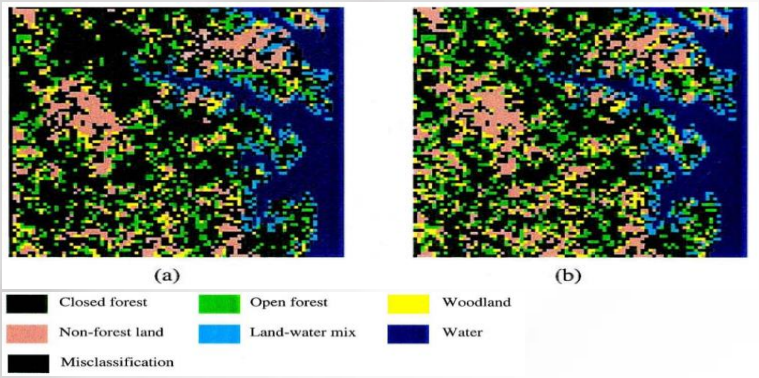


Classicification result WorldVeiw-2 and 3 imagery using ResASPP-Unet (Zhang et al., 2018)

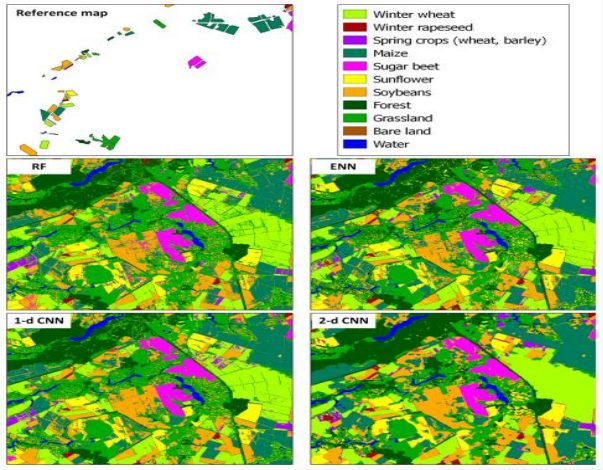
Ⅳ. Vision, Text & Numerical Data

2 Remote Sensing AI

Example of Land cover classification

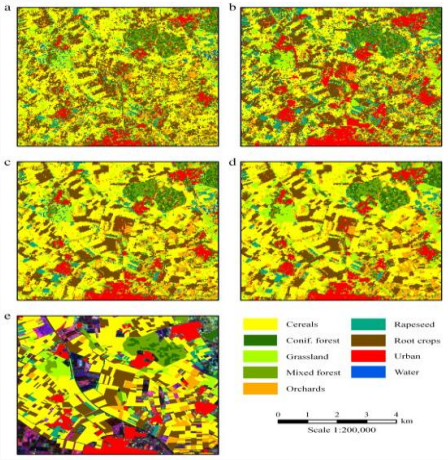


An assessment of support vector machines for land cover classification (Huang et al., 2002)

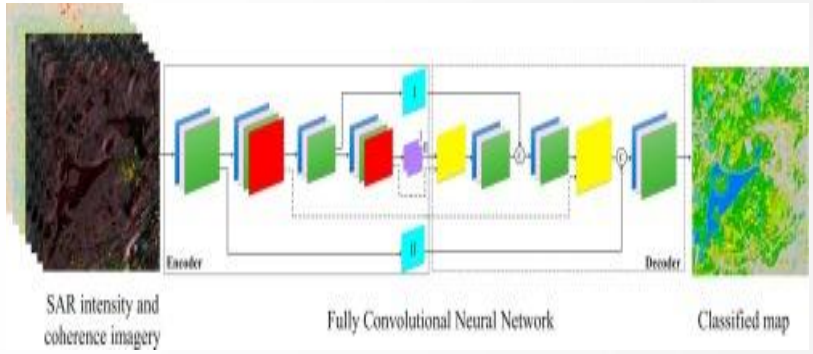


Deep learning classification of land cover and crop types using remote sensing data(Kussul et al., 2017)

2010



Classifier ensembles for land cover mapping using multitemporal SAR imagery (Waske and Braun, 2009)



A new fully convolutional neural network for semantic segmentation of polarimetric SAR imagery in complex land cover ecosystem(Mohammadimanesh et al., 2019)

Research using machine learning algorithms was mainly conducted.

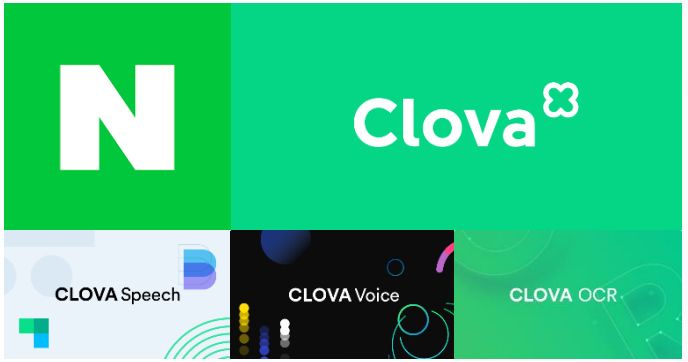
Various CNN-based deep learning algorithms such as FCN (Fully Convolutional Networks) are being applied.

Ⅳ. Vision, Text & Numerical Data

3 LLM(Large Language Model) Generative AI

- ✓ AI is driven by advanced learning algorithms such as Transformers* and Reinforcement Learning (RLHF)** to drive dramatic performance improvements in AI itself.
- ✓ Mega AI started with language generation models, but is expanding into various areas that can be mapped to language, such as images, speech, and video.

Generative AI that can convert natural language prompts into images.

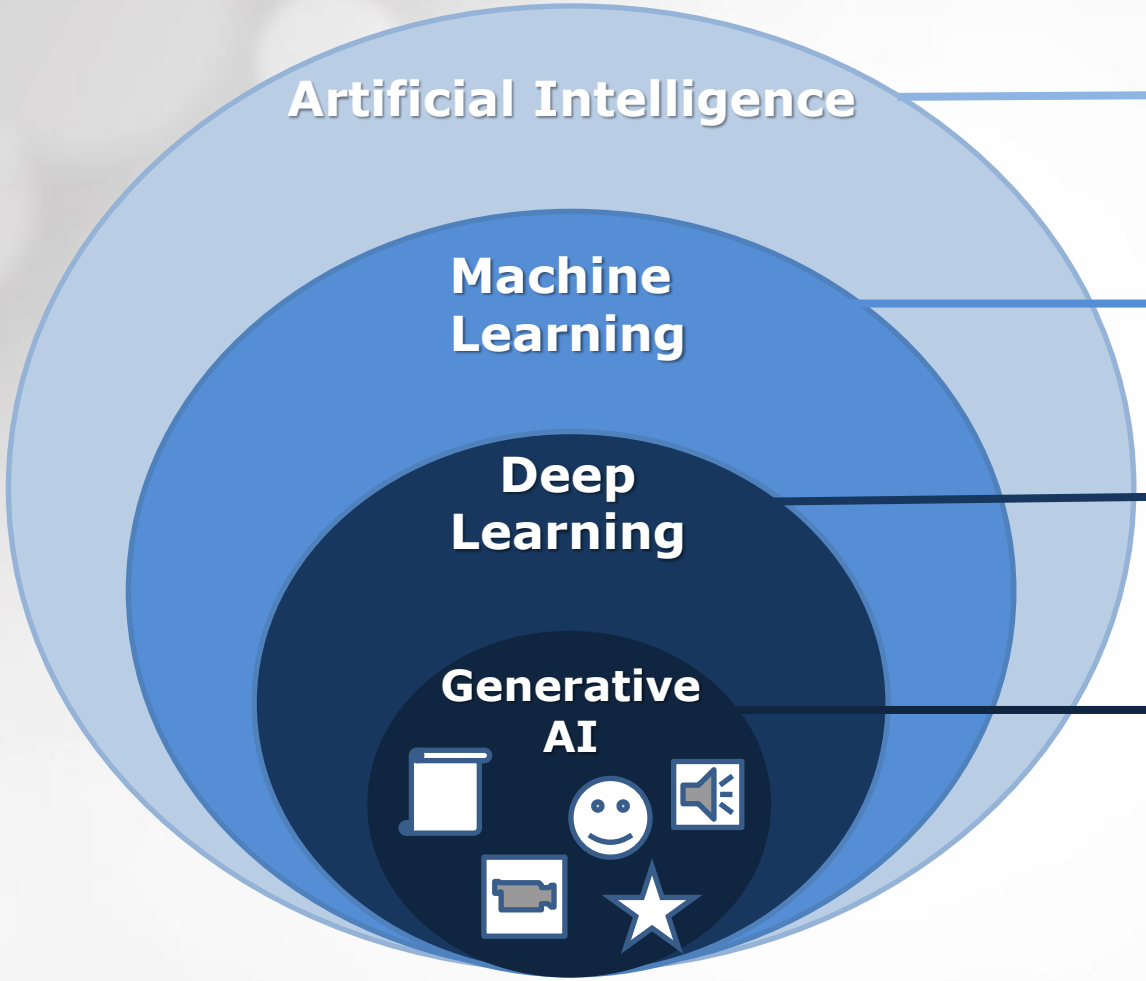


Ultra-Large AI
→ the most outstanding accuracy for understanding the Korean language.

Large Language Model
Meta AI

V. Composition of Deep Learning & Machine Learning

1 Define and Establishing Relationships



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- VAE: Variational Auto Encoder

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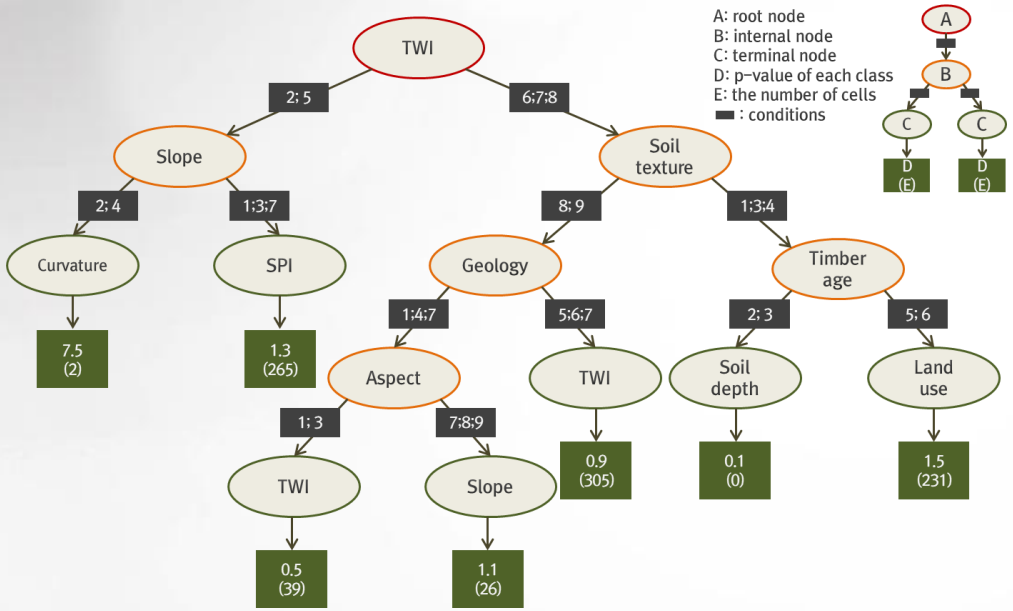
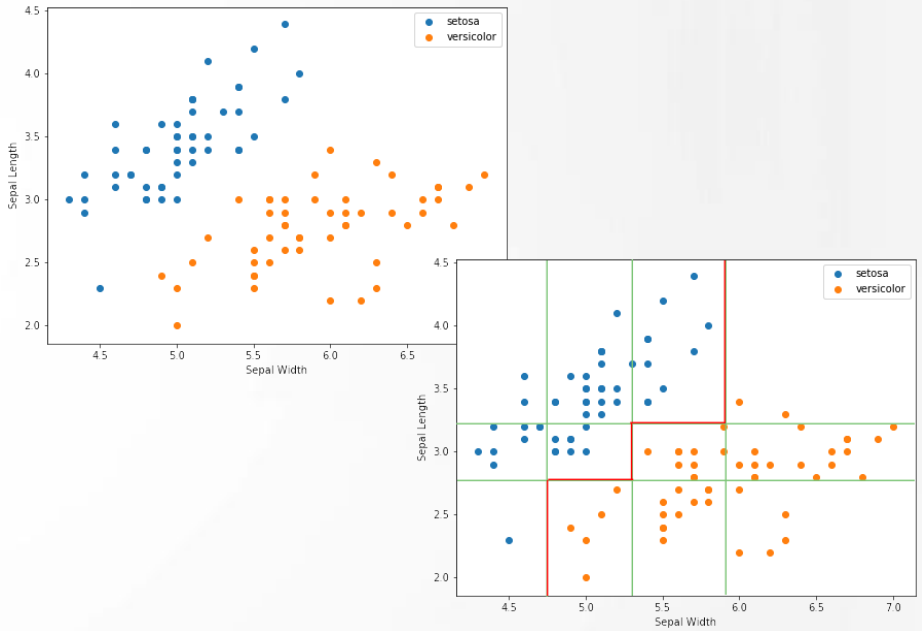
V. Composition of Deep Learning & Machine Learning

2 Decision Tree

- ✓ In order to understand the DT of ML, the aforementioned Supervised Learning, Unsupervised Learning and Reinforcement Learning must be identified.
- ✓ How does this make up the Tree structure? 's become a very important factor.
- ✓ Under what conditions should one be separated? Expert knowledge is reflected.
- ✓ The advantage of DT is to make a structure of a large tree, and input data is to use all data together.





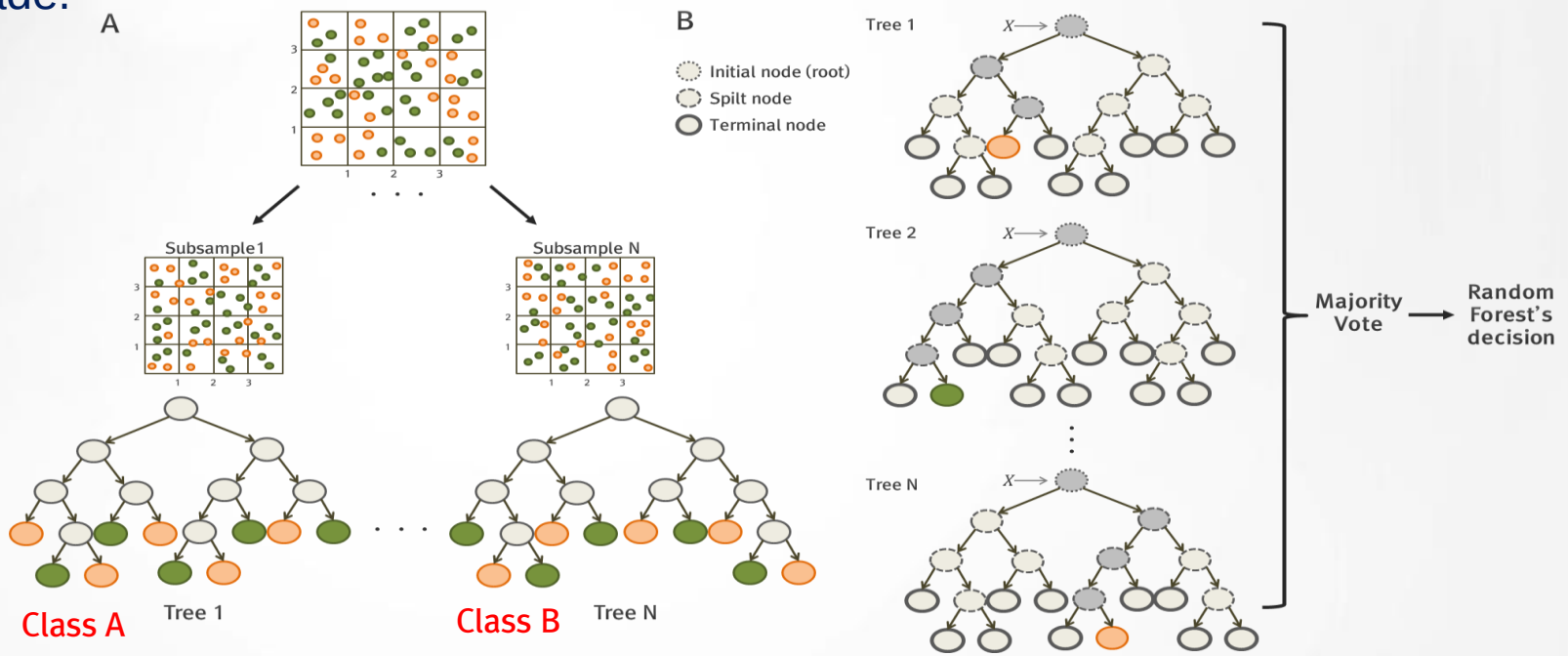
References

Park S J, Lee C W, Lee S, ***Lee M J*.,*** 2018, Landslide Susceptibility Mapping and Comparison Using Decision Tree Models: A Case Study of Jumunjin Area, Korea, Remote Sensing, doi:10.3390/rs10101545

Ⅴ. Composition of Deep Learning & Machine Learning

3 Random Forests

- ✓ Random Forests consists of many small trees. Utilize many decisions and various forms of classification
- ✓ RF is basically an ensemble model, The meaning of "Random“ is randomly generates a tree for accurate classification based on minimal expertise.
- ✓ Based on randomly selected results, Voting is carried out for optimum results and decision making is made.

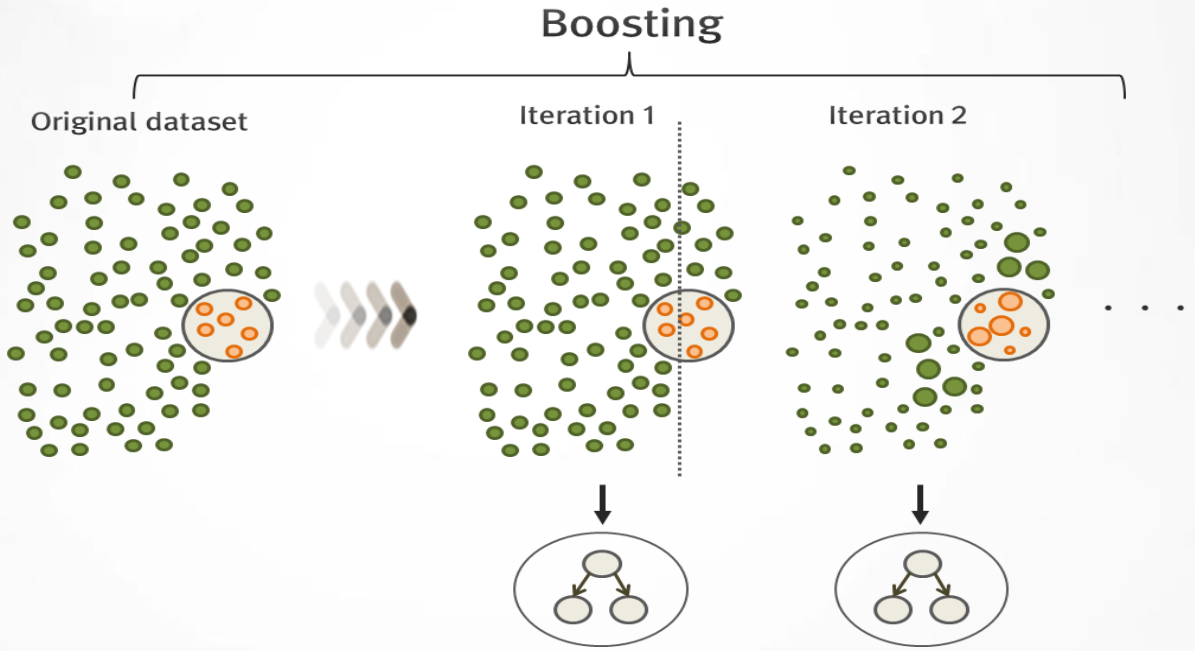


References
Lee S M, Kim J C, Jung H S, ***Lee M J****, Lee S., 2017, Spatial prediction of flood susceptibility using random-forest and boosted-tree models in Seoul metropolitan city, Korea, Geomatics, Natural Hazards and Risk, doi:10.1080/19475705.2017.1308971

Ⅴ. Composition of Deep Learning & Machine Learning

4 Boosted Tree

- ✓ Boosting Tree increases the accuracy of classification by using simple additional models of data that cannot be distinguished by existing models.
- ✓ Data is classified by providing weight, it becomes Adaboost, In addition, applying a differential to unclassified data becomes a gradient boost.
- ✓ Finally, learn several learners by making up for weaknesses by making errors between prediction and actual values a target variable.



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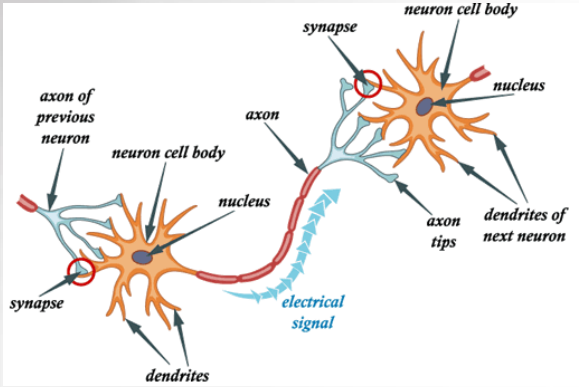
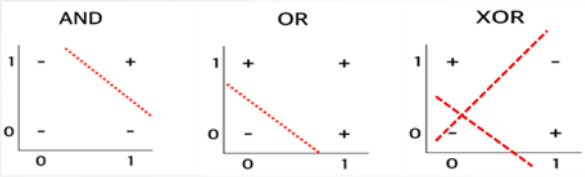
Lee S M, Kim J C, Jung H S, ***Lee M J****, Lee S., 2017, Spatial prediction of flood susceptibility using random-forest and boosted-tree models in Seoul metropolitan city, Korea, Geomatics, Natural Hazards and Risk, doi:10.1080/19475705.2017.1308971

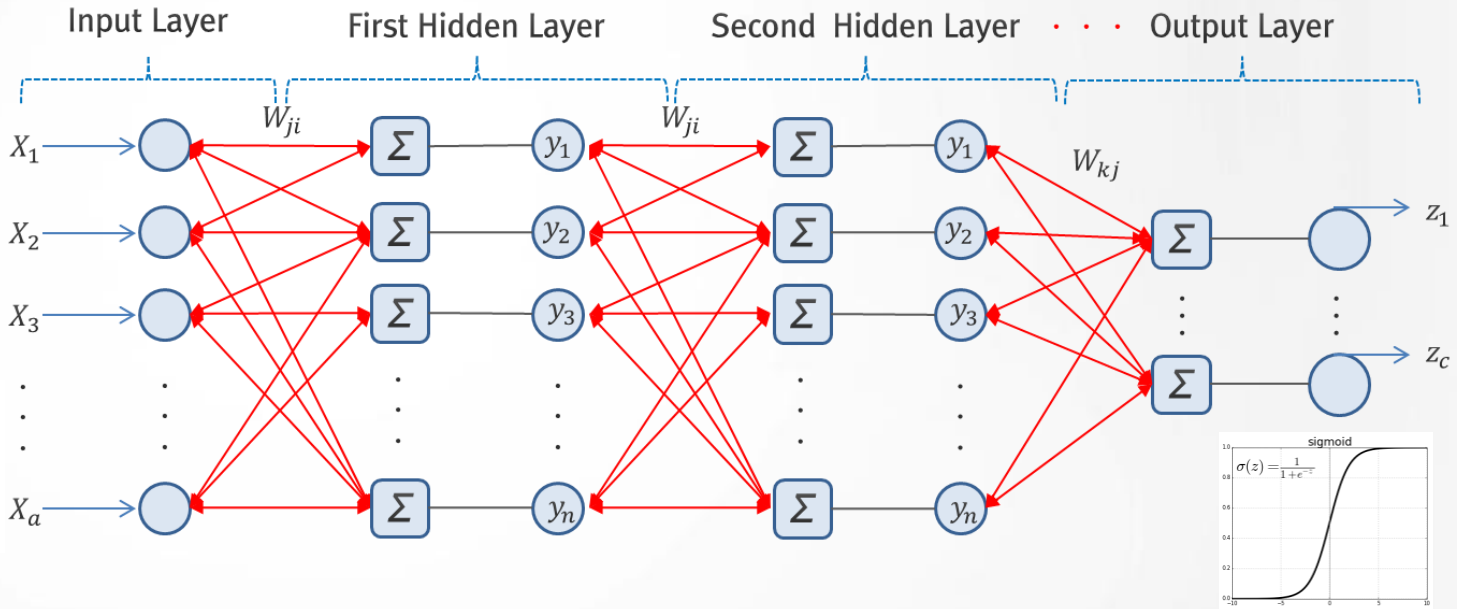
V. Composition of Deep Learning & Machine Learning

5 Artificial Neural Network (MLP, Back Propagation)

- ✓ 1945 year with the development of computer technology, Process computer's data in series.
- ✓ The most important thing is to calculate the weight through training.
- ✓ It utilizes a nonlinear activation function (mainly hyperbolic tangent or logistic function) that lets it classify data that is not linearly separable.
- ✓ ANN is important to determine the proper weight by adjusting the number of Hidden layers, number of "repetitions" were found by experience.







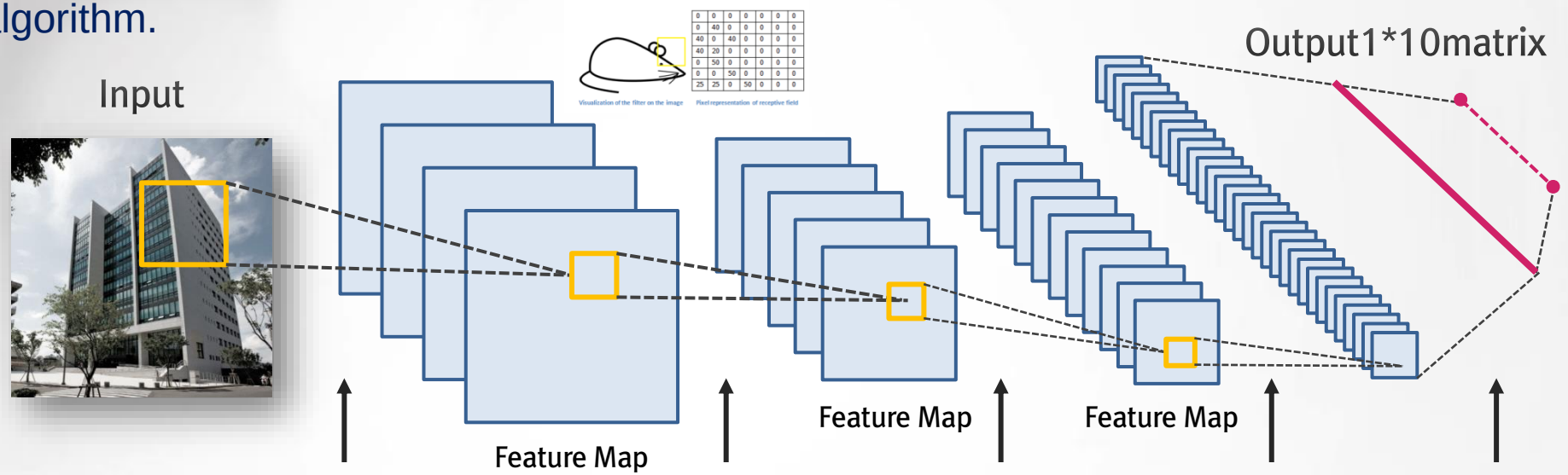
References

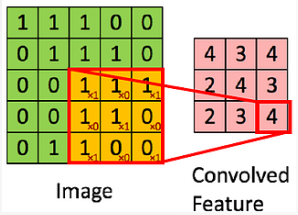
Lee S R, Jeon S W, Oh K Y, ***Lee M J***,* 2016, The spatial prediction of landslide susceptibility applying artificial neural network and logistic regression models: A case study of Inje, Korea, Open geosciences, 2016; 8:117–132

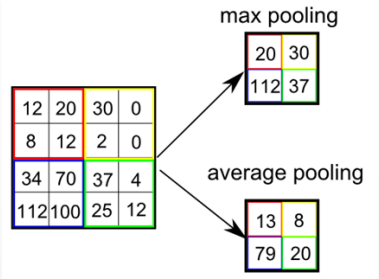
V. Composition of Deep Learning & Machine Learning

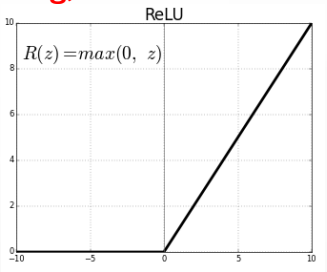
6 Convolutional Neural Network (LeNet5)

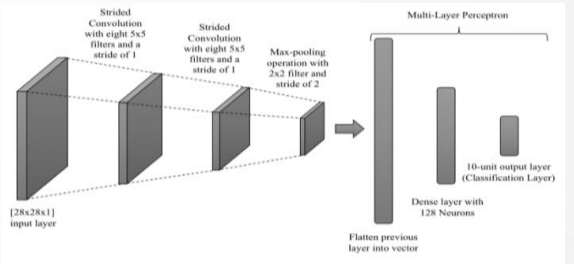
- ✓ CNN was created by imitating a person's optic nerve structure, and CNN was able to extract the characteristics of the data to determine the pattern of Feature.
- ✓ Convolution layer, Pooling layer and Full connected layer.
- ✓ Structure suitable for learning two-dimensional data, and is trained by a back propagation algorithm.





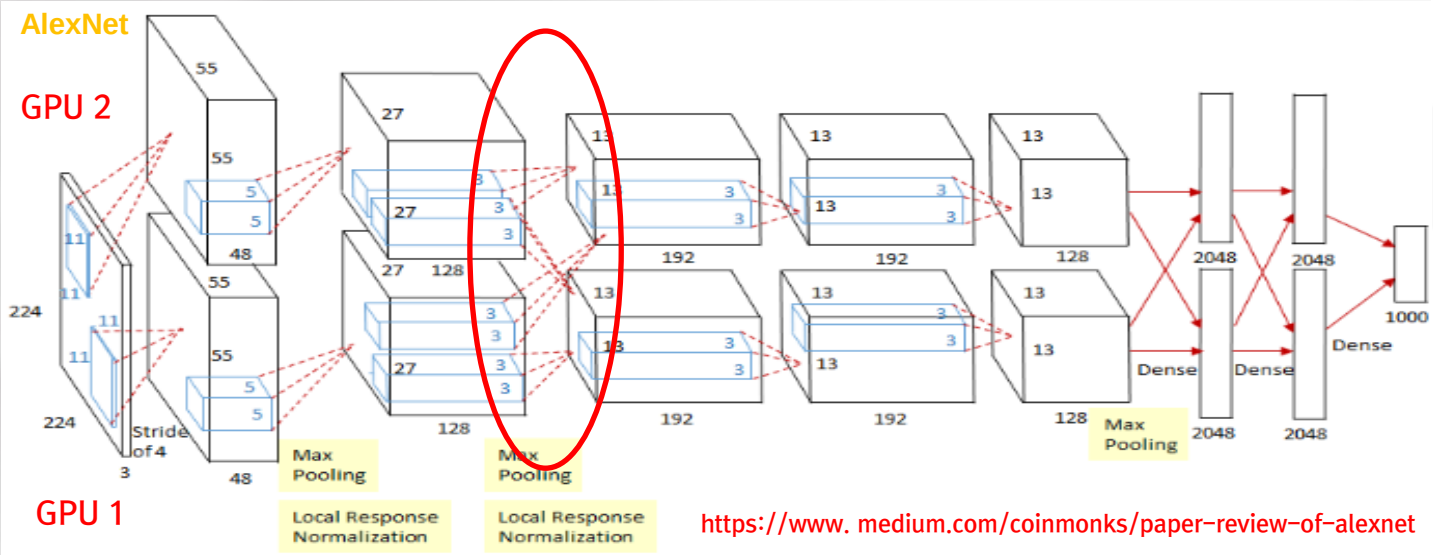






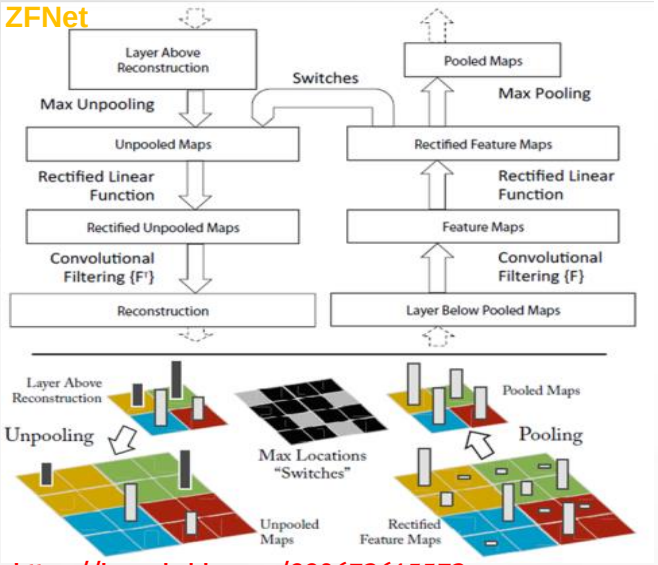
V. Composition of Deep Learning & Machine Learning

7 AlexNet & ZFNet



https://www.mdpi.com/2072-4292/9/8/848

https://www. medium.com/coinmonks/paper-review-of-alexnet



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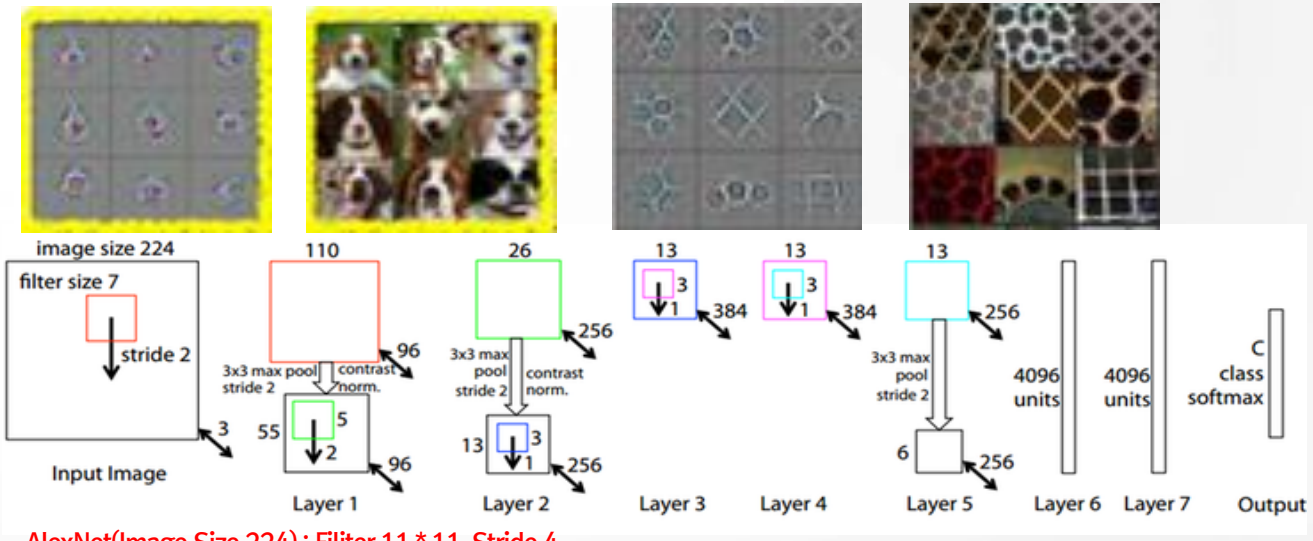
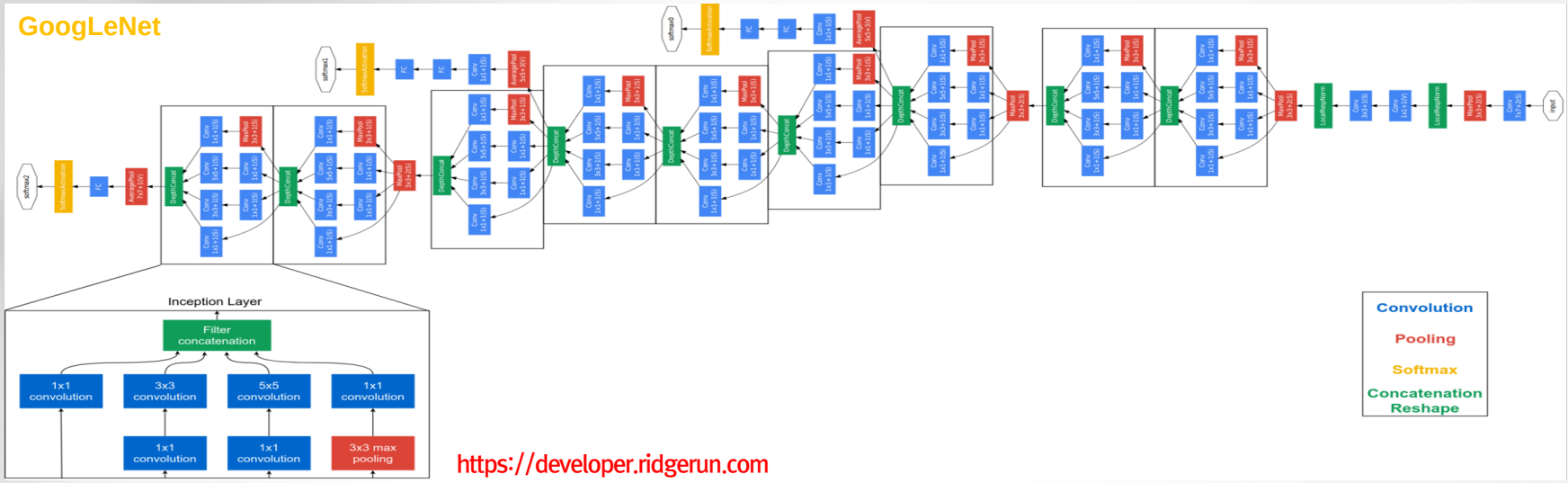


AlexNet(Image Size 224) : Filiter 11 * 11, Stride 4

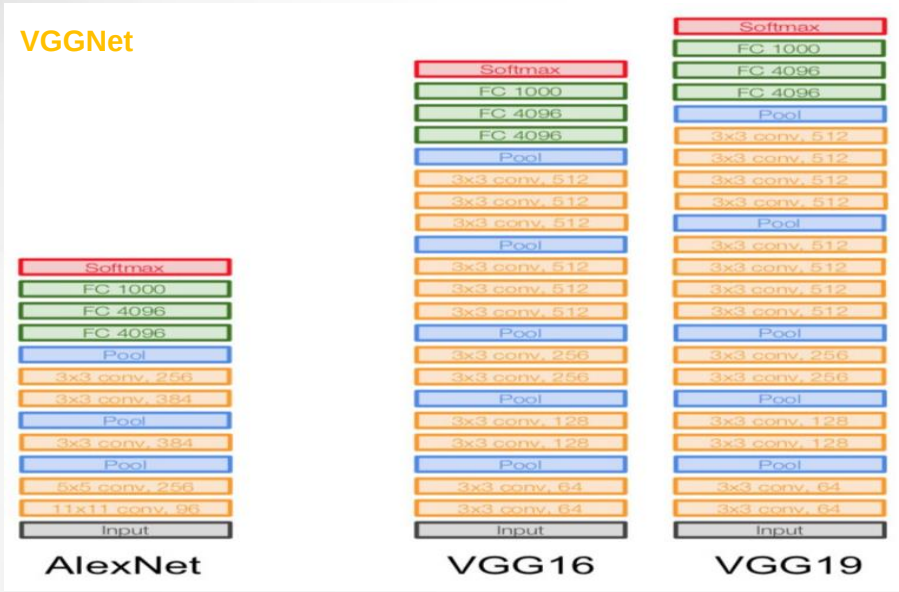
ZfNet(Image Size 224) : Filiter 7 * 7, Stride 2

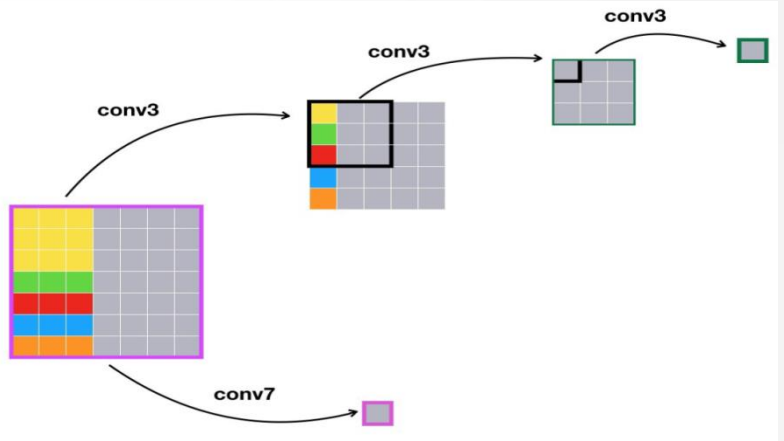
Ⅴ. Composition of Deep Learning & Machine Learning

8 GoogLeNet & VGGNet



https://developer.ridgerun.com



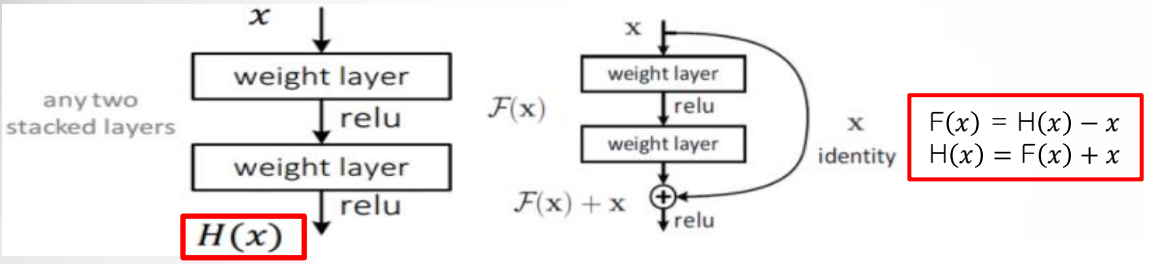


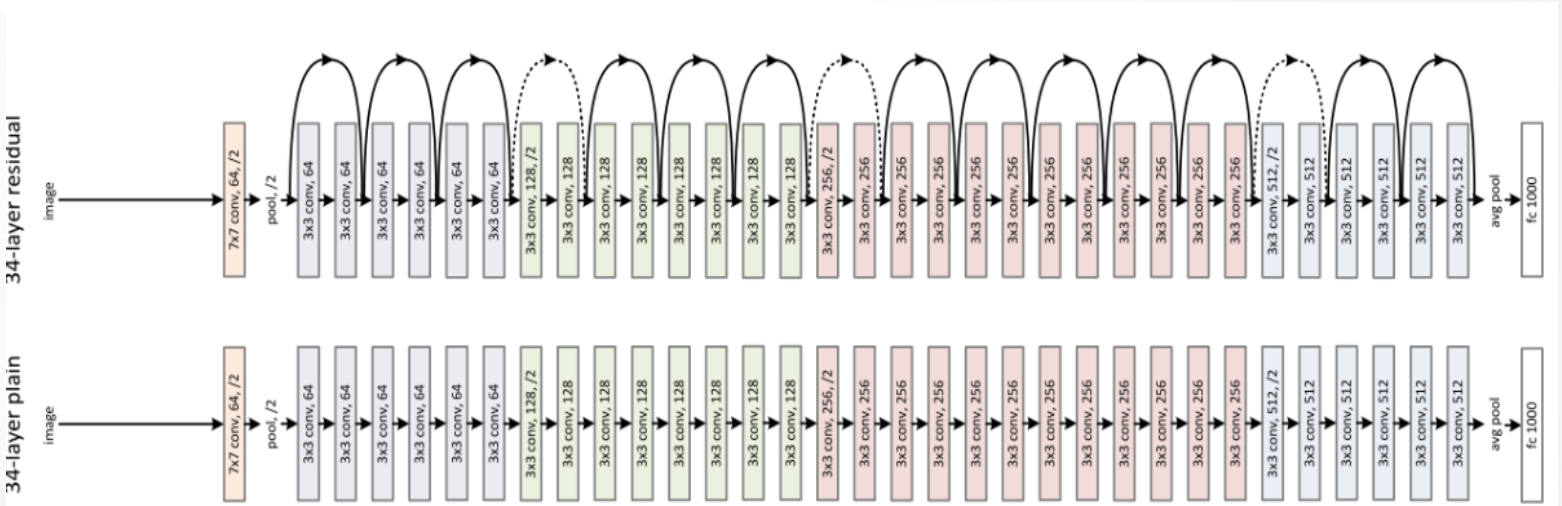
https://medium.com/deep-learning-g/cnn-architectures-vggnet

V. Composition of Deep Learning & Machine Learning

9 ResNet

- ✓ The championship in 2015 by ImageNet Large Scale Visual Reconstruction Challenge (ILSVRC)
- ✓ It has 152 layers, a huge depth, and a different form from the CNN structure
- ✓ The fact that F(x) is zero means that no training is required for that pixel. Therefore, it can move on to other pixels and reduce amount of computation during this process.

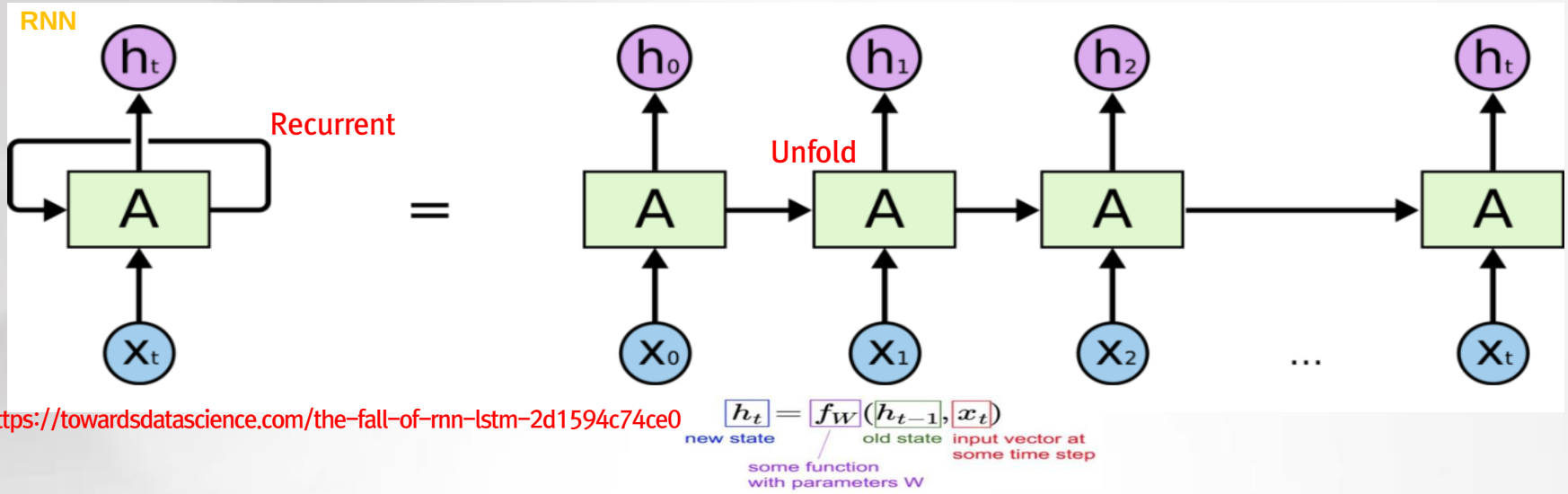




https://medium.com/@pierre_guillou/understand-how-works-resnet

V. Composition of Deep Learning & Machine Learning

10 RNN (Recurrent Neural Network) & LSTM (Long Short Term Memory)

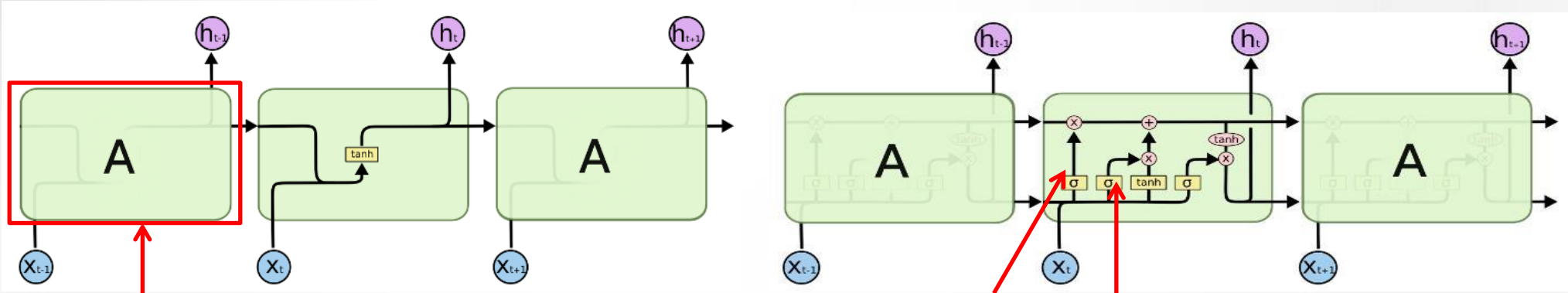


https://towardsdatascience.com/the-fall-of-rnn-lstm-2d1594c74ce0

$$h_t = f_W(h_{t-1}, x_t)$$

new state — old state — input vector at some time step

some function with parameters W

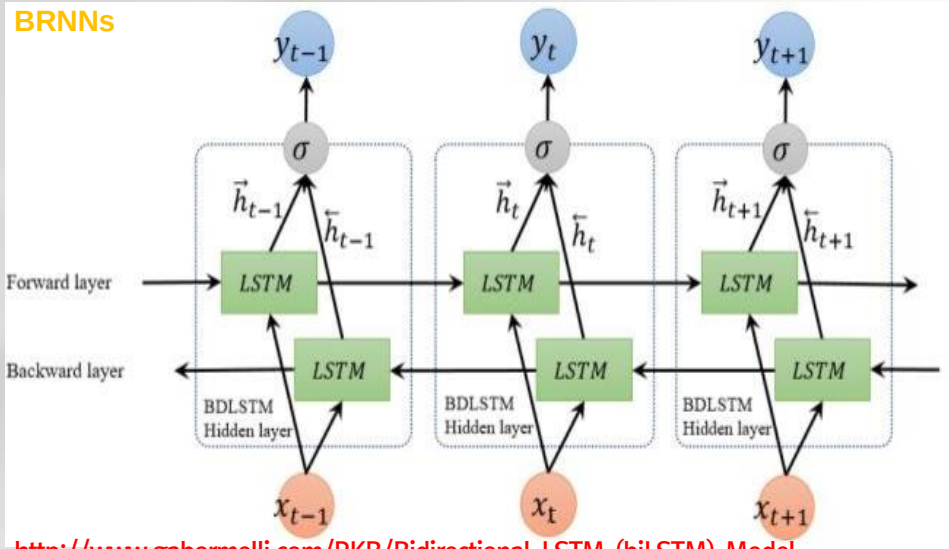


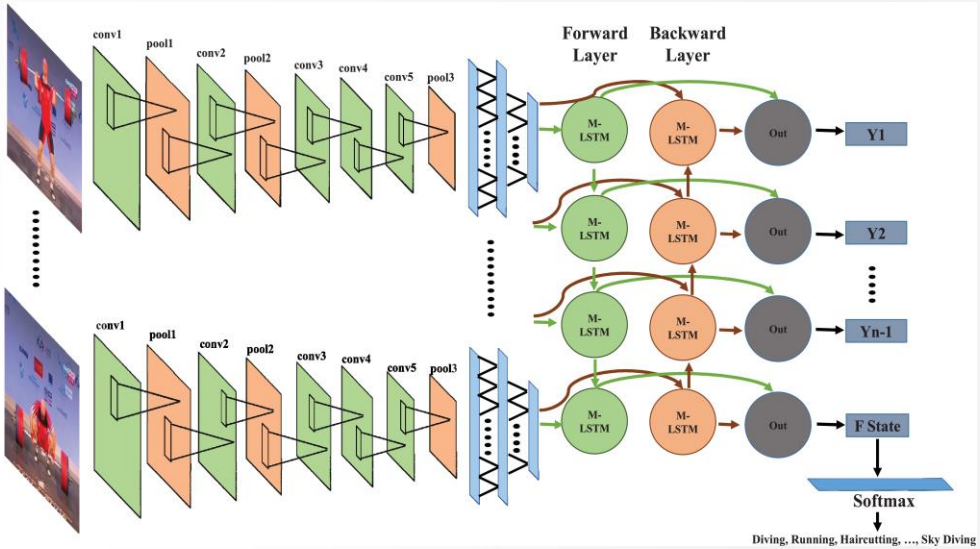
https://towardsdatascience.com/the-fall-of-rnn-lstm-2d1594c74ce0

V. Composition of Deep Learning & Machine Learning

11 Bidirectional RNN(BRNNs) & GRU (Gated Recurrent Units)

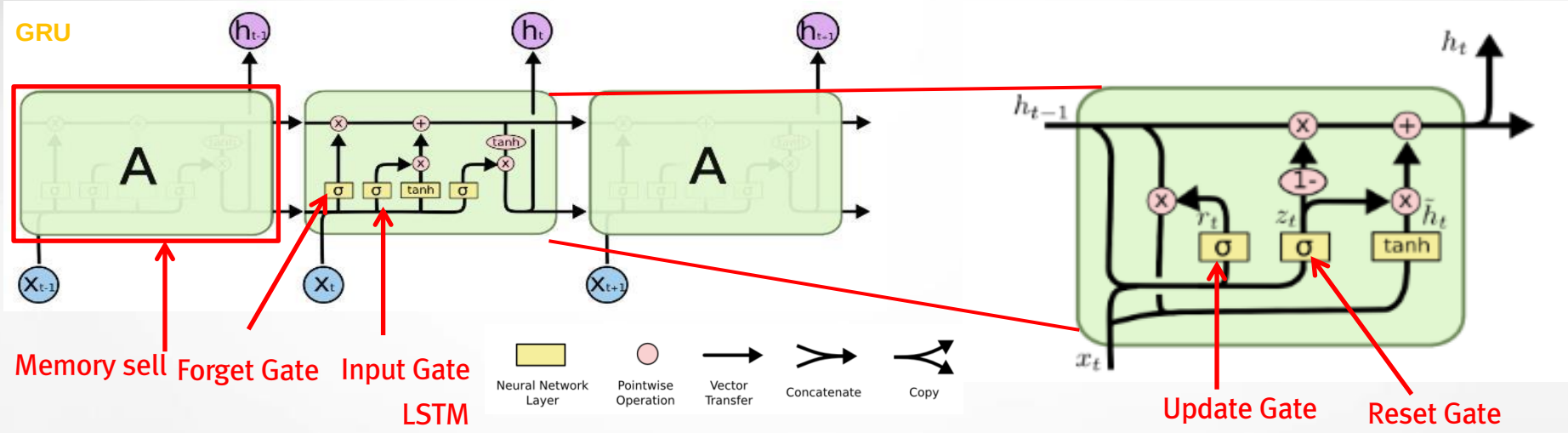
BRNNs





http://www.gabormelli.com/RKB/Bidirectional_LSTM_(biLSTM)_Model

GRU



https://towardsdatascience.com/what-is-a-recurrent-nns-and-gated-recurrent-unit-grus

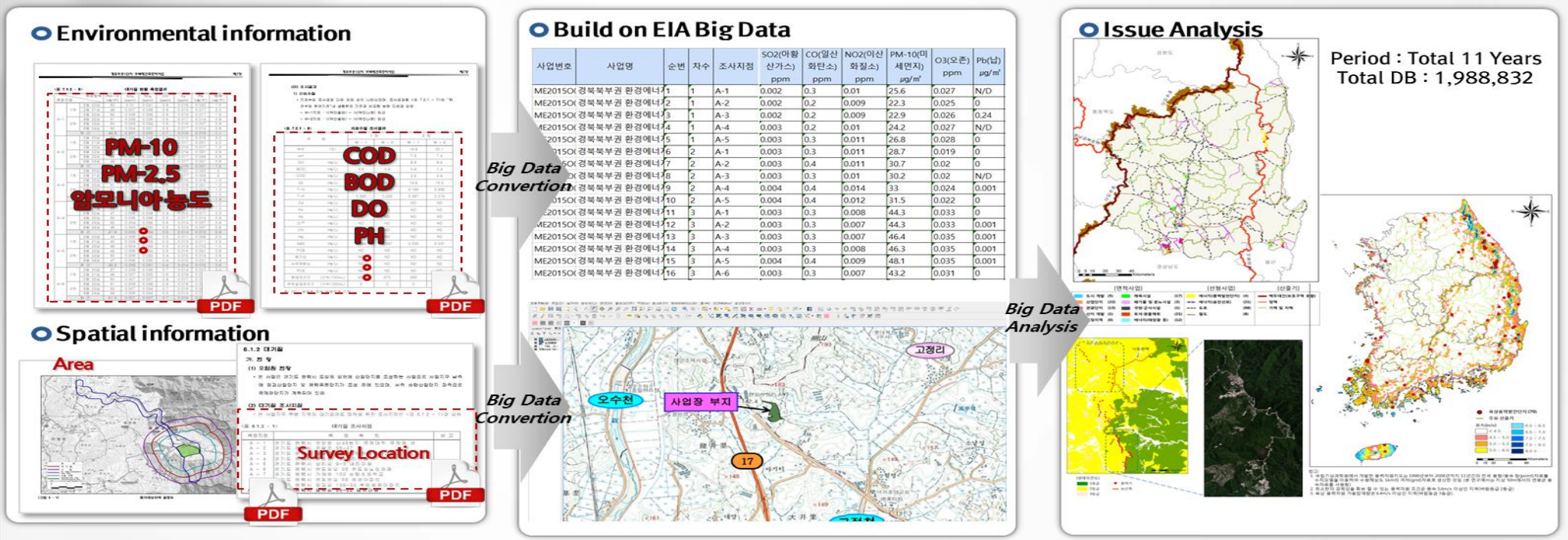
V. Related Research

1 Big Data & AI Project

01 A Study on the Establishment of Big Data Development System for Environmental Assessment Monitoring and Utilization

✓ Main topics : Build on EIA (Environmental Impact Assessment) big data 행정안전부 NIA NATIONAL INFORMATION SOCIETY AGENCY

SCI 1
KCI 2



References Jo N W, ***Lee M J**,*, 2017, Use of Environmental Geospatial Information to Support Environmental impact Assessment Follow-Up Management, Korean Journal of Remote Sensing, 33(5), 799-807

Jo N W, ***Lee M J**,*, 2019, Data Based Conversion of Environmental Impact Assessment using Long-Term Monitoring Data - Focusing on South Korea -, Korean Society of Environmental Impact Assessment, 42(3), 150-161

V. Related Research

1 Big Data & AI Project

02 Development of Intelligent Environmental Impact Assessment Support Services

✓ Main topics : Application of RNN (Natural language and Spatial data) and segmentation in EIA data

Utilization data

- EIA Big Data
- 환경공간정보서비스
- Air korea
- 물환경정보시스템 Water Environment Information System
- 기상청 날씨누리
- DATA 공공데이터포털 .GO.KR

Spatial Statistical Analysis

Overlay, Adjoin, Time series, Correlation and Interrelation analysis etc,

AI Analysis

Text Mining (Association Anlysis, Cluster Anlysis, Frequency Analysis, Sensitivity Analysis etc)
RNN & LSTM etc

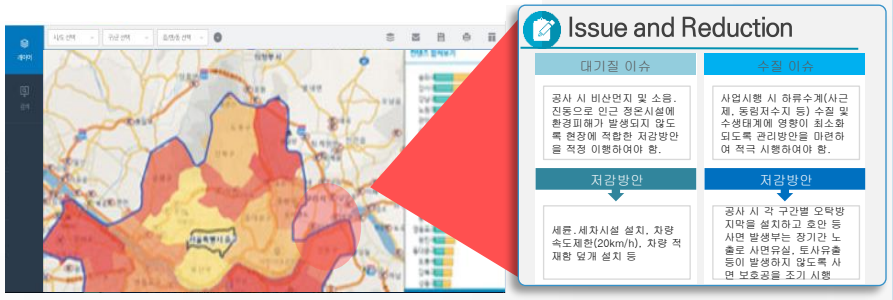
Machin Learning

Decision tree, Random Forests, Boosted Tree etc

All method is integration of hybrid

Location justification base on Big Data

Issue & Reduction base on AI



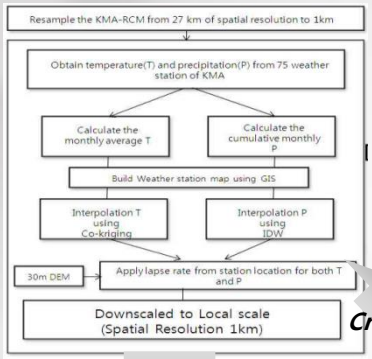
V. Related Research

1 Big Data & AI Project

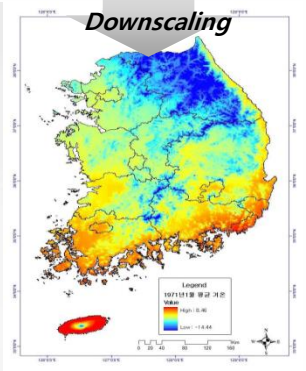
03 Build on Climate Change Big Data and Analysis of Damage in the National and Industries

✓ Main topics : Climatic change scenario downscaling and threshold application

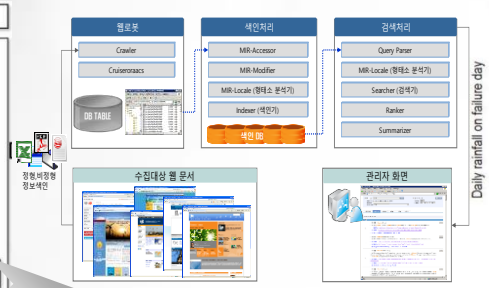
SCI 2
KCI 1



Downscaling

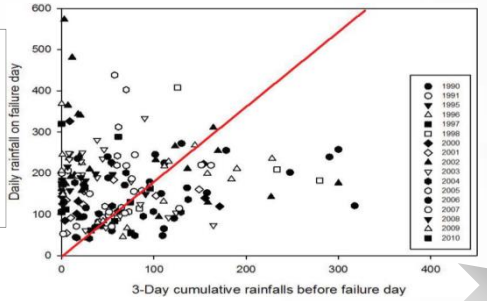


Crawling



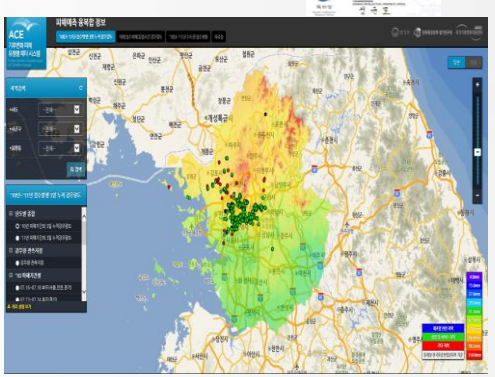
Text Mining

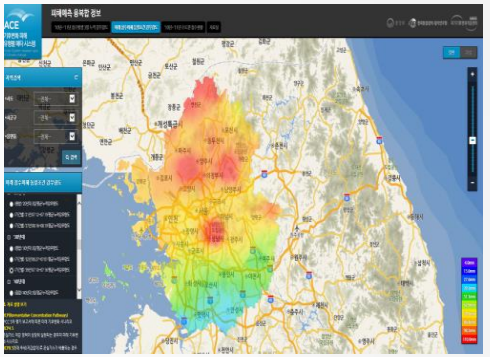
Threshold Analysis



Web GIS System

http://ace.kei.re.kr





References

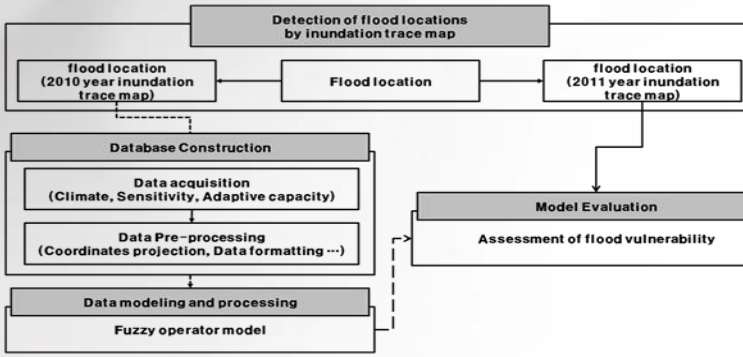
Lee S, Jeon S W, Jeon S W, ***Lee M J*.,*** 2016, Spatial Landslide Hazard Prediction Using Rainfall Probability and a Logistic Regression Model, Korea, Math Geosci, 2015; 47:565–589

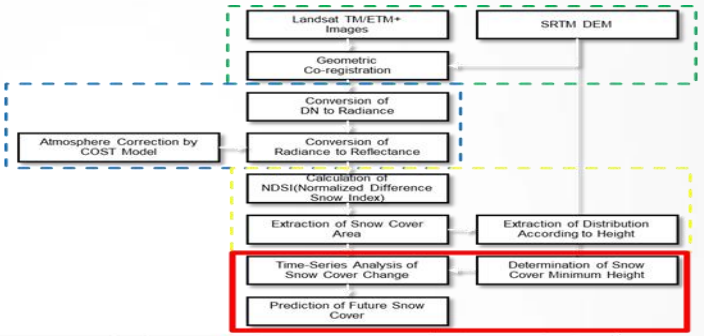
V. Related Research

2 Research and Development

01 Development and Application of Appropriate Technologies Using Geospatial Correlative Intergration focused on the Increase Extreme Climate Change

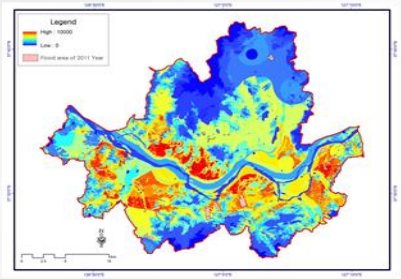
✓ Main topics : Flood vulnerability using Machine Learning, Time series data analysis

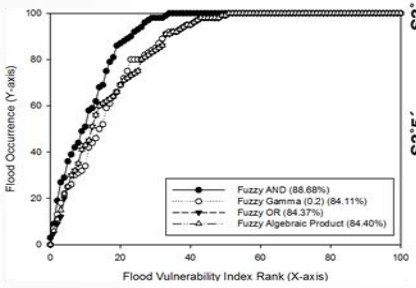


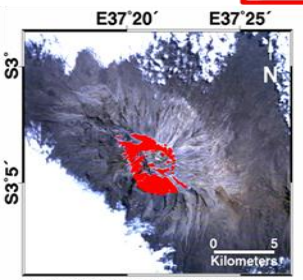


SCI 4
KCI 9
A foreign book 2
Policy report 1

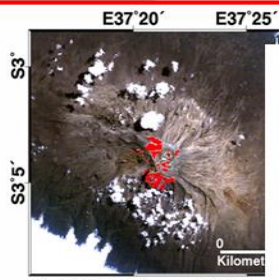
Snow cover area about 28% and equivalent to a 73% reduction 2120 year decreased (0.34 km2/yr)



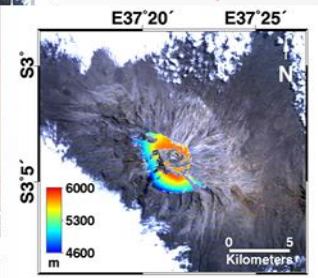




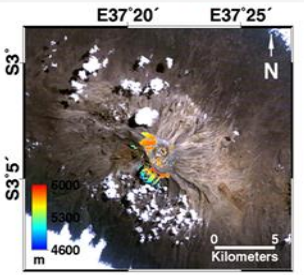
24 Jun. 1984 Total area = 9.01km2



21 Jul. 2011 Total area = 2.54km2



24 Jun. 1984, Minimum height = 4,645 m



21 Jul. 2011, Minimum height = 4,934 m

References ***Lee M J****, Kang J E, Kim G H., 2015, Application of Fuzzy Combination Operators to Assess Flood Vulnerability in Seoul, Korea, Geocarto International; 30(9), 1052-1075

Lark S H, ***Lee M J.*** Jung H S, 2016, Spatiotemporal analysis of snow cover variations at Mt. Kilimanjaro using multi-temporalLandsatimagesduring27years, Journal of Atmospheric and Solar-Terrestrial Physics, 2016; 143-144:37–46

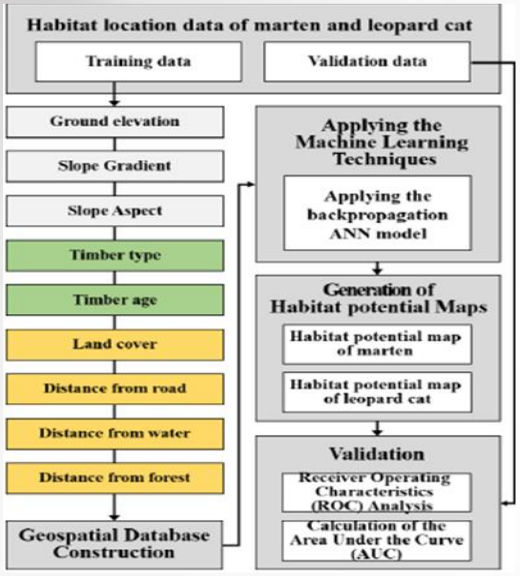
V. Related Research

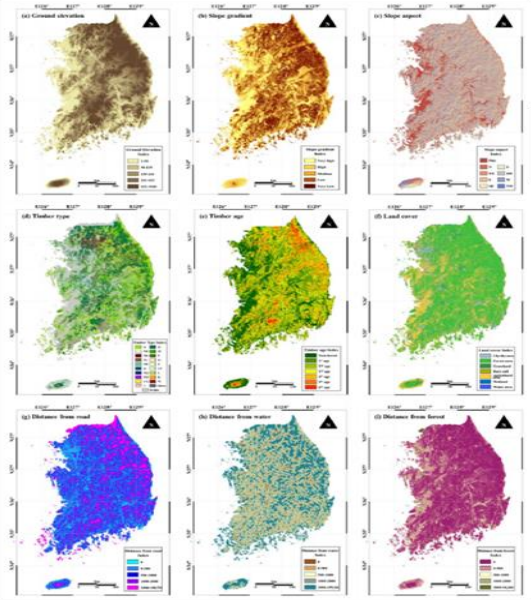
2 Research and Development

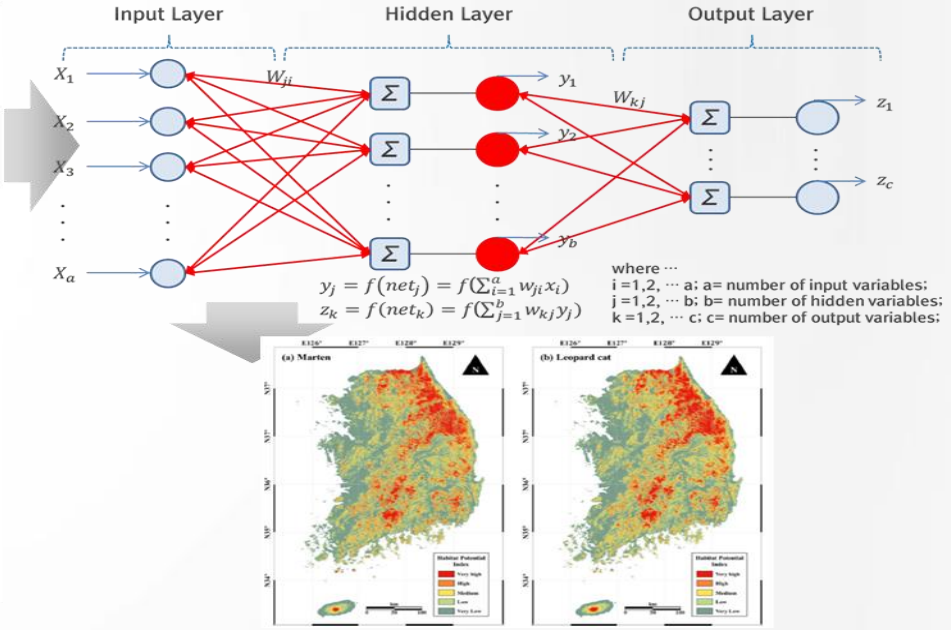
02 Correlation analysis of cause and phenomenon for climatic disasters utilizing Big Data, prediction future impact analysis based on development of Artificial Intelligence

✓ Main topics : Development and application of deep learning, machine learning and build on big data climate disaster

SCI 6
KCI 5







References

Lee M J*, Song W K, Lee S R., 2015, Habitat Mapping of the Leopard Cat (Prionailurus bengalensis) in South Korea Using GIS, Sustainability; 7, 4668-4688; doi:10.3390/su7044668

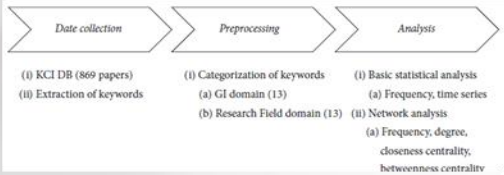
V. Related Research

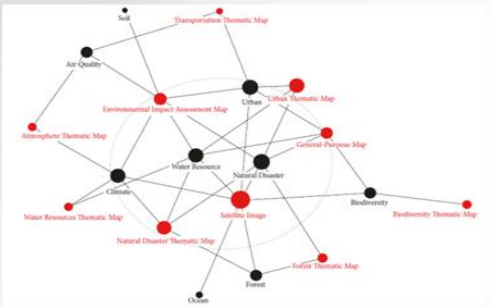
3 Research and Development

03 Establishment of a System for Applying Spatial Information in Addressing Environment Issues by Considering the Trend of ICT Development

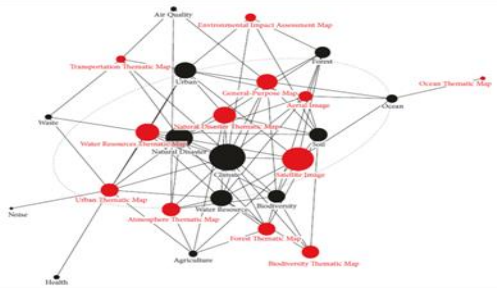
- ✓ Main topics : Spatial information text mining analysis
- ✓ Period and Budget : 2017 ~ 2018 year, 800,000,000won

SCI 1
KCI 2

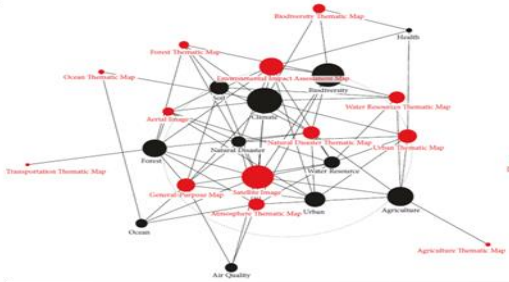




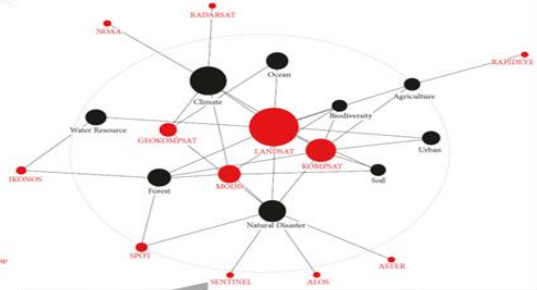
1st period (1996–2000). The red nodes are GI domains, and black nodes are Research Field domains.



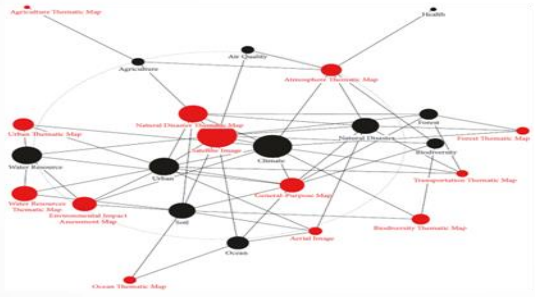
GI–Research Field network, 2nd period (2001–2005).



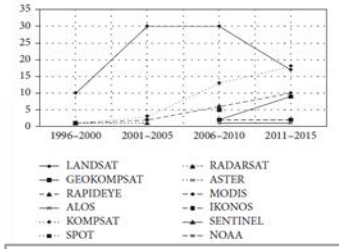
GI–Research Field network, 4th period (2011–2015).

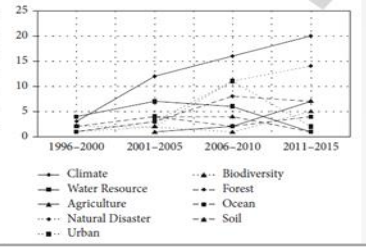


Satellite Image–Research Field network (1996–2015). The red nodes are Satellite Image domains, and black nodes are Research Field domains.



GI–Research Field network, 3rd period (2006–2010).





Text Mining (Association Anlysis, Cluster Anlysis, Frequency Analysis, Sensitivity Analysis etc)

References

Oh K Y, ***Lee M J*.,*** 2017, Research Trend Analysis of Geospatial Information in South Korea Using Text-Mining Technology, Journal of Sensors; doi.org/10.1155/2017/2765256

V. Related Research

1 Other Related Project

01 Environmental Impact Assessment Information Support System

✓ Main topics : EIA Based on ICT

02 Development of integrated model for climate change impact and vulnerability assessment and strengthening the framework for model implementation

✓ Main topics : Build on big data to climate change and application of ANN

03 Development of Technology for Multiple Natural Hazards to Analyze the Casual Relationship between cause of occurrence and damage status and to Predict Spatio-Temporal Damage

✓ Main topics : Application of deep learning algorithm to multiple natural hazards

References

Lee S M, Lee S, ***Lee M J****, Jung H S., 2018, Spatial Assessment of Urban Flood Susceptibility Using Data Mining and Geographic Information System (GIS) Tools, Sustainability, doi:10.3390/su10030648

Park S J, Lee C W, Lee S, ***Lee M J****., 2018, Landslide Susceptibility Mapping and Comparison Using Decision Tree Models: A Case Study of Jumunjin Area, Korea, Remote Sensing, doi:10.3390/rs10101545

SCI 2 paper

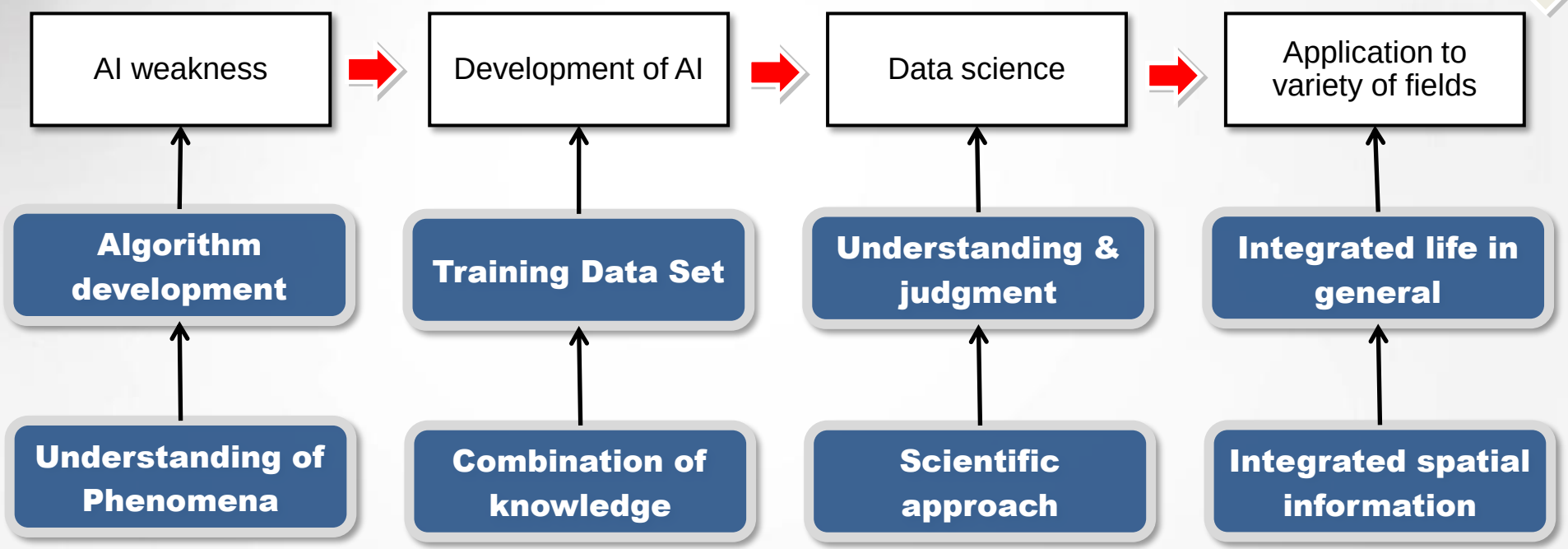
V. Related Research

1 Future Research Plan

01 **Overcoming just AI weakness and the enhancement of data science**

02 **Expanded as an infrastructure technology (AI) and co-study with various spatial information**

03 **Dissemination and development of big data & AI knowledge**



V. Related Research

1 Future Research Plan

02 Expanded as an infrastructure technology (Big Data & AI) and cooperative study with various spatial information

Contribution to Society

- *Responsible Research*
- *Efforts for a Better Society in the Spatial Information*

Integrated Research

- *Environmental Remote Sensing*
- *Drone and Satellite Photogrammetry*
- *Disaster Research for Climate Change*
- *Intelligent Transportation Systems*
- *Ecological Climate Remote Sensing*
- *Geo Computing*
- *Hyperspectral Remote Sensing*
- *GIS Modeling*

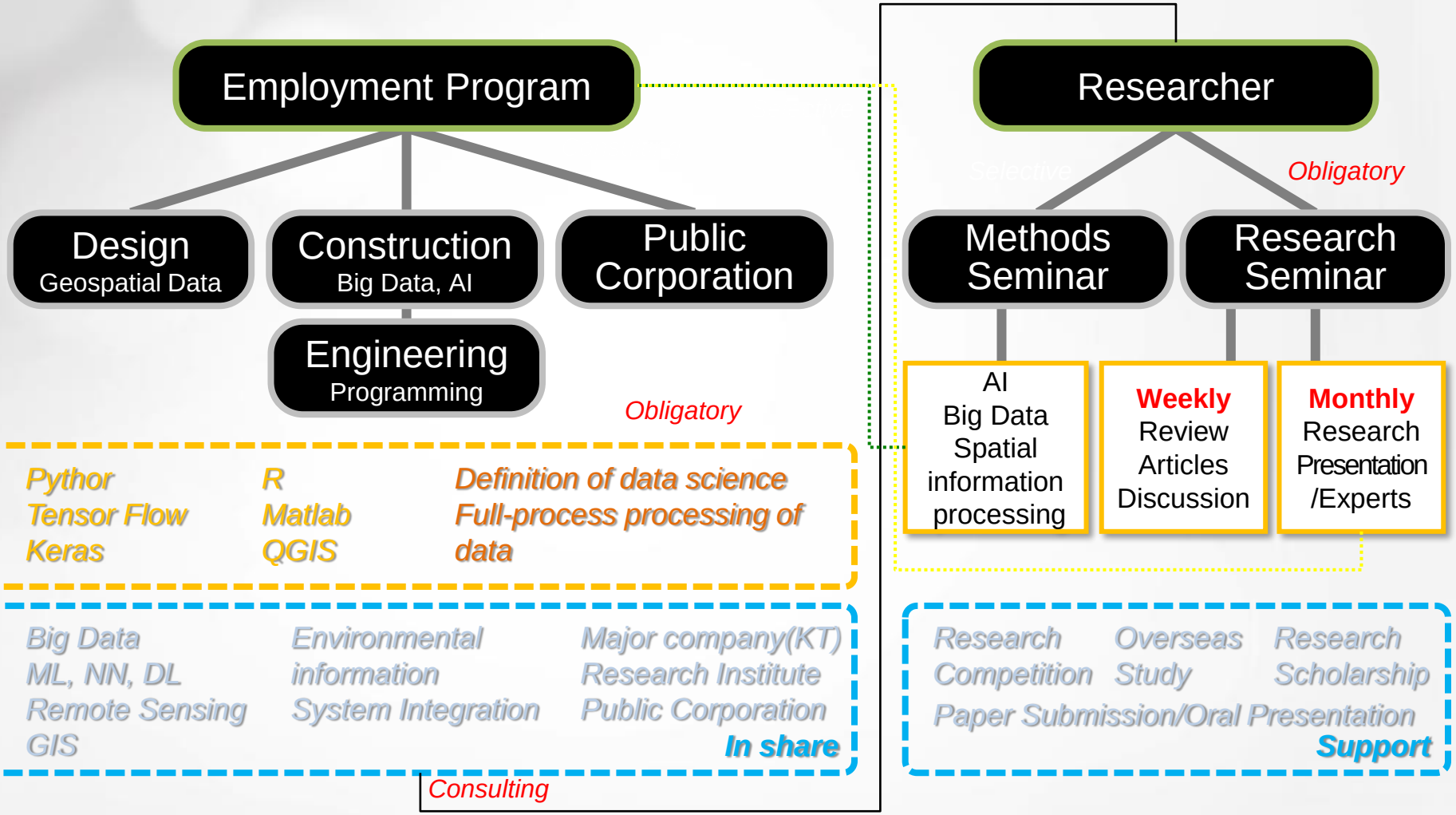
Collaboration

- *Big Data in a variety of environments*
- *Use of AI*
- *Extend and link to a variety of research*

V. Related Research

1 Future Research Plan

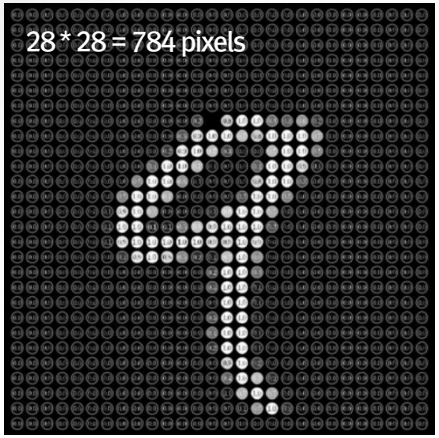
03 Dissemination and development of big data & AI knowledge

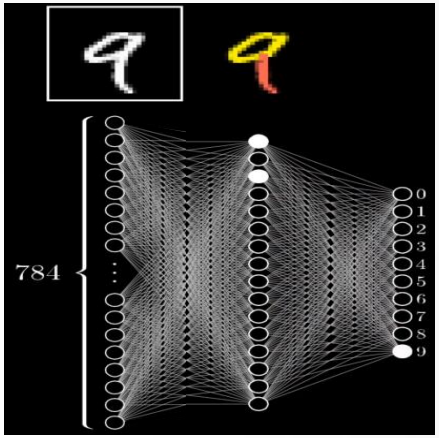


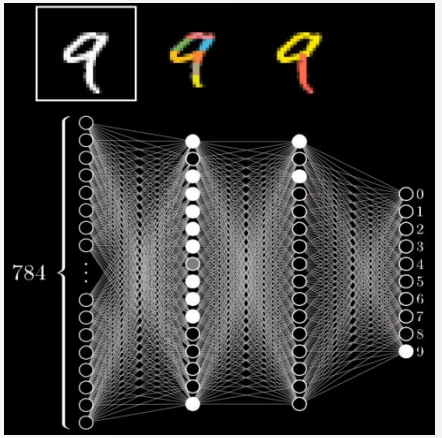

Thank you

Neural Network

MNIST: National Institute of Standards and Technology database

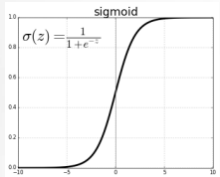






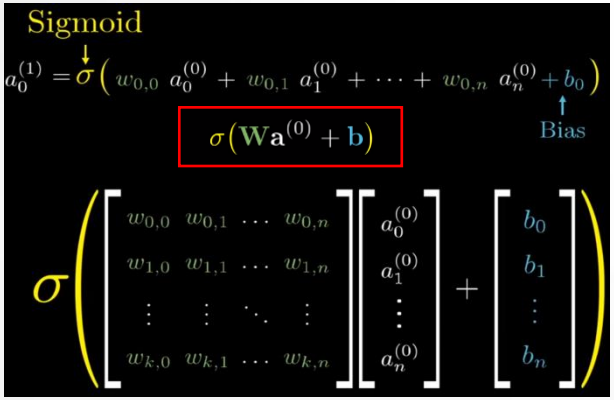
www.youtube.com/watch?v=aircAruvnKk

Sigmoid function

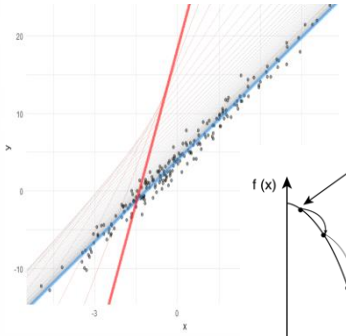


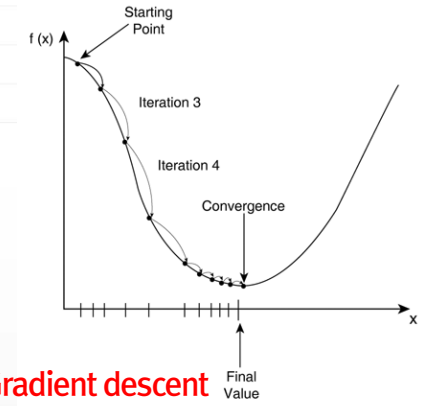
Biases

$$\sigma(w_1a_1 + w_2a_2 + w_3a_3 + \cdots + w_3a_3 \; - 10)$$



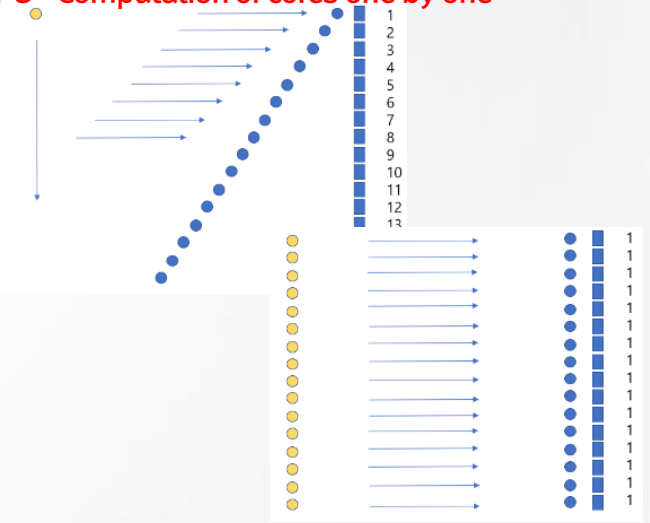
Linear Regression





Cost function, Gradient descent

CPU : Computation of cores one by one



GPU : Multiple cores handled in parallel at once