AI Teacher Education in Korea

Hee-chan Lew
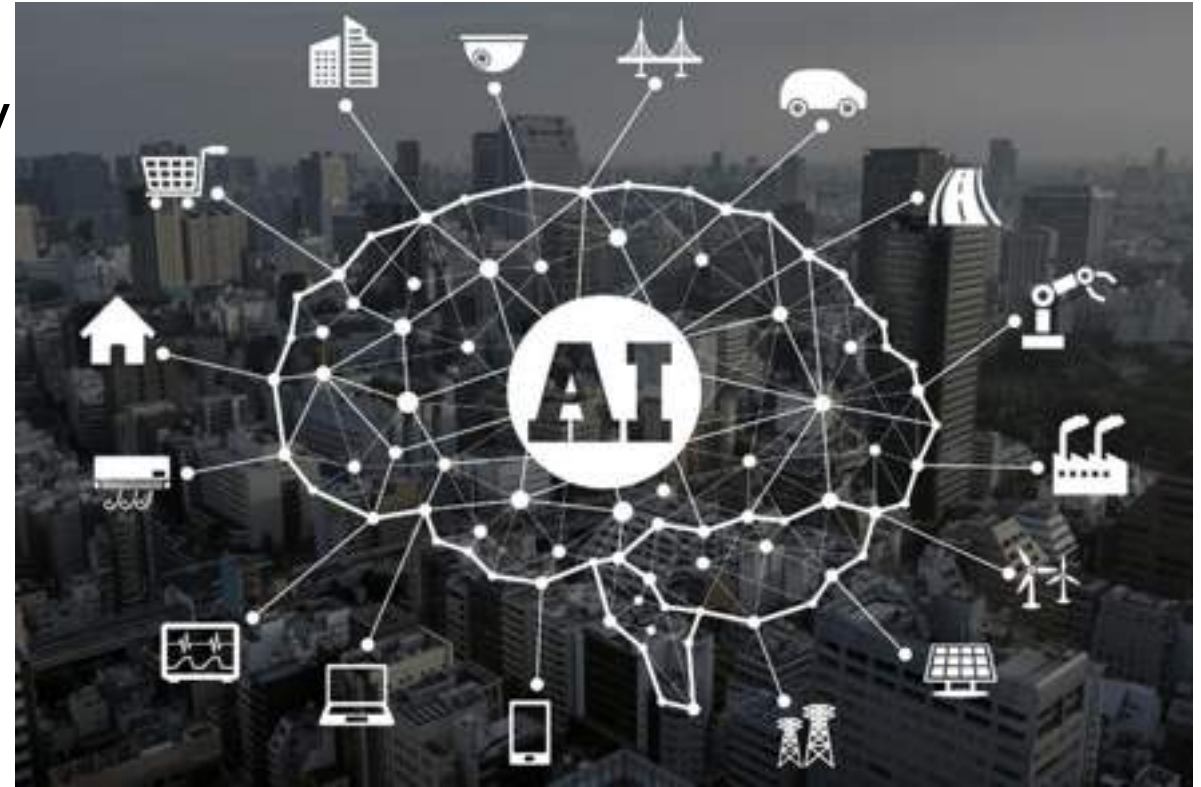
Korea National University of Education

APEC-Tsukuba Conference XV (Webinar)

Feb 10, 2021

AI as a key cornerstone in Society 4.0

- AI is a key cornerstone that underlies our society in the sense that it is a basis of highly sophisticated technologies driving the Fourth Industrial Revolution.
- What is AI?
- AI has three concepts:
  - AI as Machine Systems
  - AI as PS Strategy
  - AI as Social Norms

AI as a Machine System

- AI is a machine system to implement a variety of recognition, thinking, and learning that have been performed by only human intelligence.

- Autonomous driving vehicle has AI system which can recognize quickly various environmental information.
- AI math teacher we could see in the near future has AI system which can teach mathematics well without giving up.

AI as PS strategy

- AI is a problem solving strategy to make a machine or a computer think efficiently.

- Machine learning and deep learning are typical examples.

- The right picture "Irises" was pained by Gogh in 1889. But what kind of Irises the flower is?

- We can get the answer by applying the problem solving strategy of "Nearest Neighbors" to the big data we have.

Vincent van Gogh(1853-1890) **Irises**, 1889
J. Paul Getty Museum

AI as Social New Norm

- AI is a new Social Norm itself in this industry 4.0 where AI and humans coexist.

- The right picture was painted by AI Robot Painter at the LG Science Hall located in Seoul.

- Questions: What is a difference between the pictures painted by AI and human? Is AI just a tool for creating art or is it a new artist in itself? Does AI's creation need to be preserved?

- These questions are the new norms that have been seriously discussed in the "Next Rembrandt" project.

Robot Painter

Do we need to teach AI in school?

- Many people might claim that it is enough for high-level experts only to know about AI.
- AI education might be too much burden for ordinary students.

- Basic education should be the key to elementary and secondary schools.
- It is better to teach professional knowledge of AI, after faithfully teaching basic knowledge.

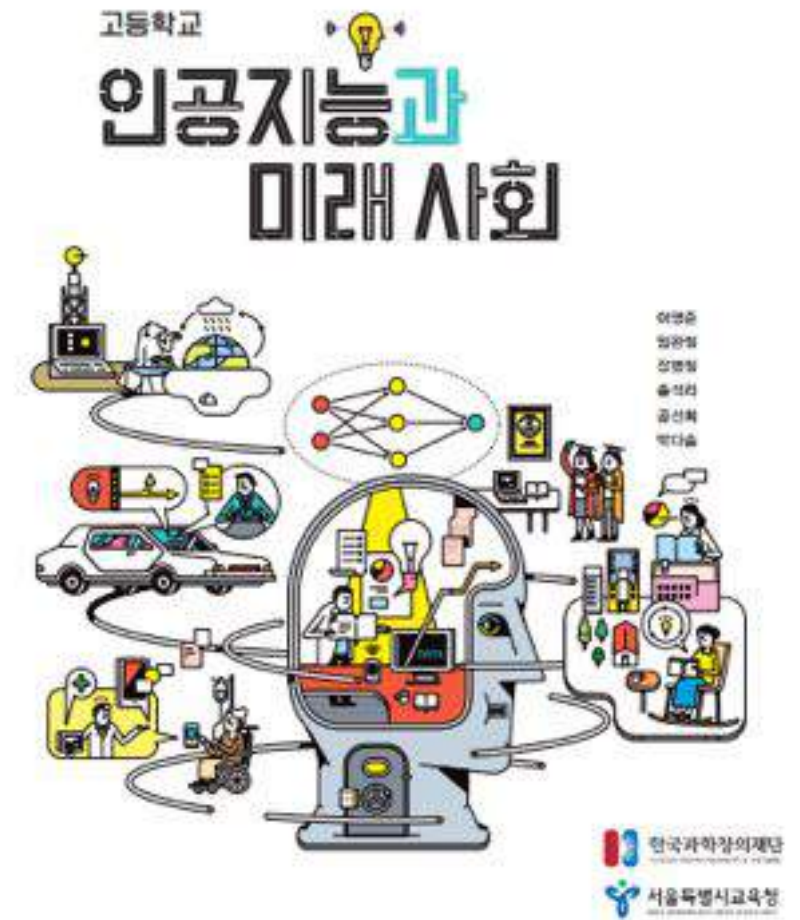**Ordinary Students are not happy in even the traditional curriculum**

Why AI in school?

- On the other hand, many others argue that AI education is so urgent from the 4 perspectives:
- <u>Humanistic perspective</u>: AI system & strategy are a human heritage.
- <u>Ordinary life perspective</u>: AI to help human life already exists next to us.
- <u>Developmental perspective</u>: AI technique is a p-s strategy to develop students' thinking
- <u>Social developmental perspective</u>: AI will change our future society.

New change in education: School Curriculum

- Although the new curriculum will be announced in 2022, new subjects of "AI Basic" and "AI Mathematics" were added into the new chapters of the current national high school curriculum in 2020. This was unusual!!

- High school textbooks for "AI Basic" and "AI Mathematics" are being developed for public education, which will be used from this year Fall semester.

고등학교
인공지능과
미래 사회

High School Textbook of AI: "AI and Future Society"(2020) by Seoul Metropolitan Government

New contents of "AI Basic" (Information)

Key Concepts		Contents
Understanding of AI	AI and Society	Concepts and Characteristics of AI, Development of AI Technology and Social Change
	AI and Agent	Concepts and Roles of Intelligent Agents
Principles of AI and Application	Recognition	Sensor and Recognition, Computer Vision, Speech Recognition and Language Understanding
	Exploring and Reasoning	Exploring Problem Solving, Representing and Reasoning
	Leaning	Concept and Application of Machine Learning, Concept and Application of Deep Learning
Data and Machine Learning	Data	Properties of Data, Structured Data and Unstructured Data
	Machine Learning Model	Classification Model, Machine Learning Model Implementation
Social Impact of AI	Impact of AI	Social Problem Solving, Data Bias
	Ethics of AI	Ethical Dilemma, Social Responsibility and Fairness

New contents of "AI Mathematics" (Mathematics)

Key Concepts	Contents
AI and Mathematics	Mathematics related to AI
Representation of Data	Representation of Text Data
	Representation of Image Data
Classification and Expectation	Classification of Data
	Tendency and Expectation
Optimization	Optimization and Decision Making

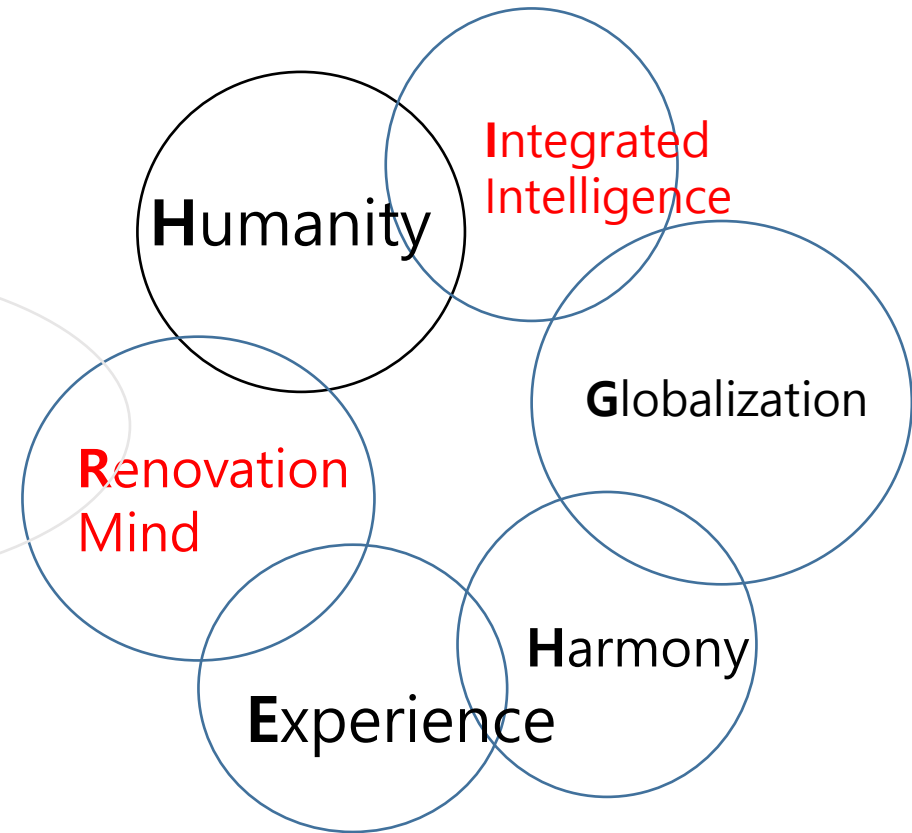# The new challenge of teacher education Pre-service teachers for Software Education

- From 2018, in Korea, all elementary pre-service teachers must have mandatory "software education" for :
  - Securing the coding education leadership of elementary teachers with ENTRY blocking coding language.
  - Fostering the interdisciplinary talents of elementary students.
  - Strengthening the logical thinking power of elementary teachers.

ENTRY is South Korea's programming language platform

The new challenge of teacher education: In-service teachers for AI Education

- In 2019 South Korean Government decided to train 5000 AI teachers who are responsible for leading the new era of the fourth industrial revolution.

- For 5 years, they will receive master's degrees from the second semester of 2020.

- KNUE will train about 160 in-service teachers every year from this year based on its H-I-G-H-E-R vision.

Humanity

Integrated Intelligence

Globalization

Renovation Mind

Harmony

Experience

"HIGHER" Vison of KNUE

KNUE AI Teacher Education

- The program was launched with the goal of <u>convergence education related to AI</u> which is to develop a convergent eye to teach their subjects through AI based teaching methods.

- Compulsory: 18 credits of 6 courses including **AI programming I,** <u>II</u> and **AI Education I**, <u>II</u>, <u>AI and school</u> and <u>AI Ethics and Education in School</u>.

- Elective: 9 credits of 2 courses and 1 Independent Study course from each graduate student's major subject.
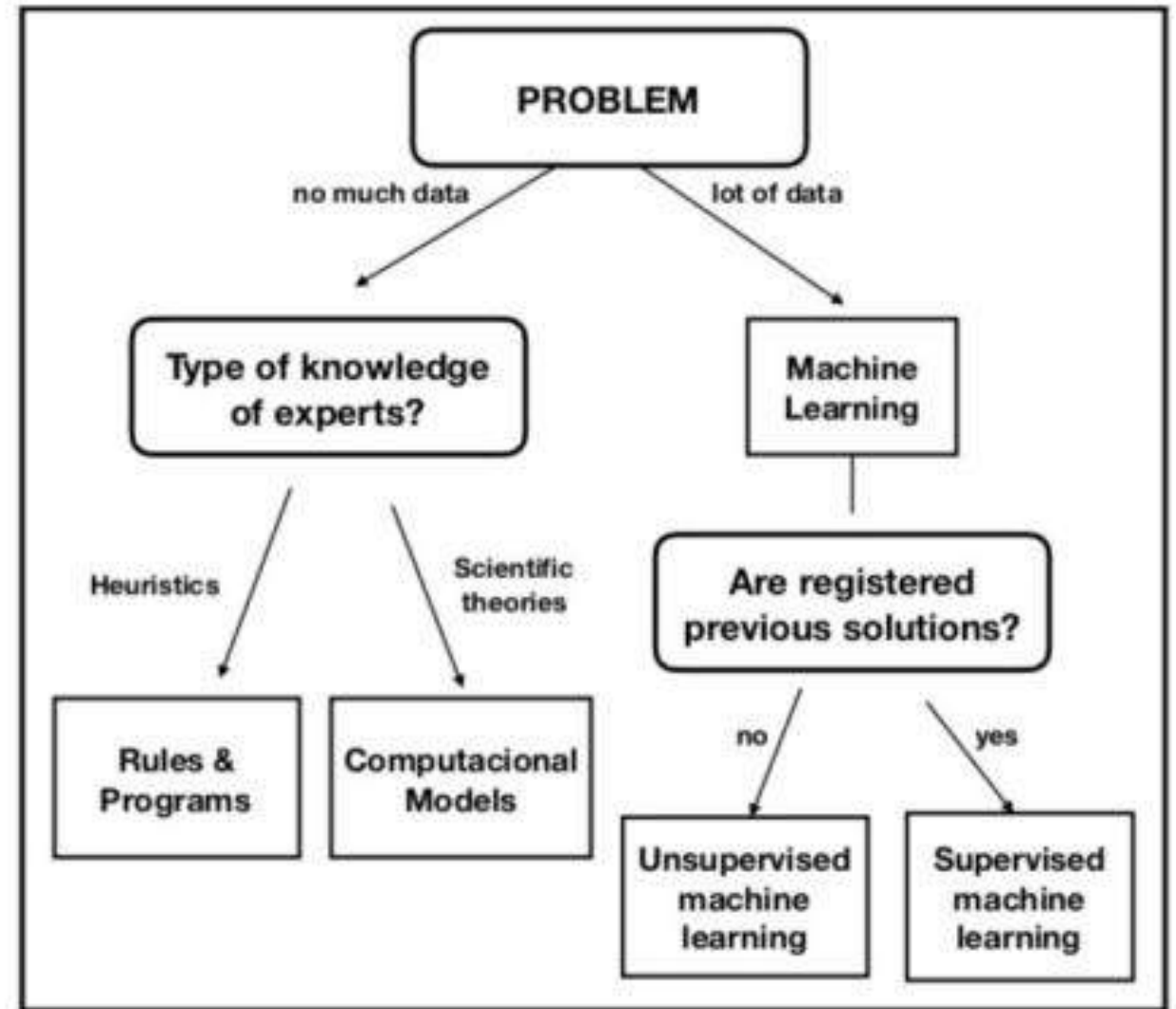
Lecture Note Cover of AI Programming I for KNUE AI Teacher Education

Syllabus of "AI programming I" and "AI Education I"

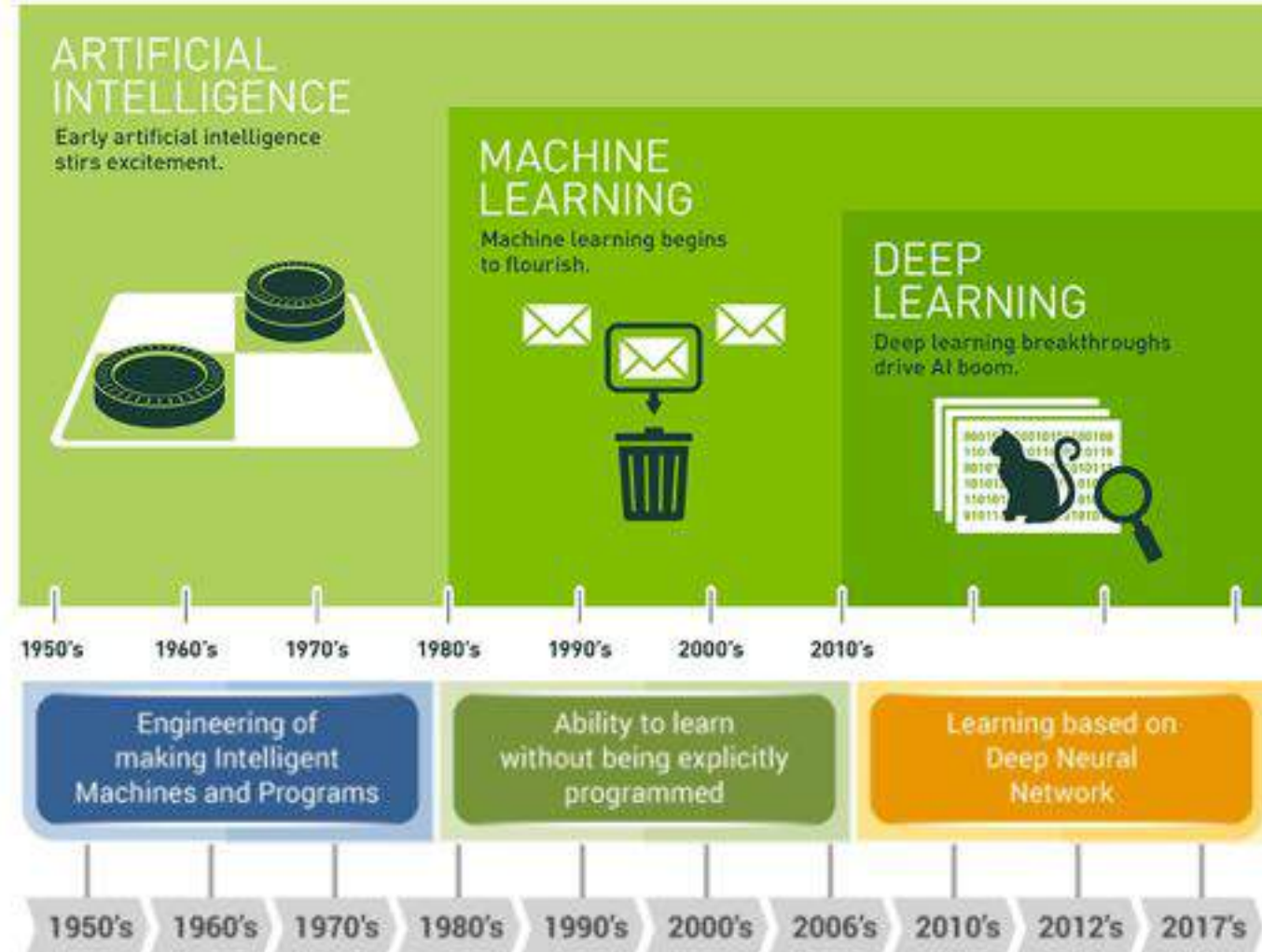| AI Programming I	AI Education I
Basic Concepts of AI	**Concepts and History of AI**
How to Learn Machine Learning	**Introduction of Machine Learning**
Programming Languages for AI Education	Computing Basic for AI Implementation (1)
Environment Settings for Machine Learning for Kids (ML4Kids)	Computing Basic for AI Implementation (2)
ML4Kids Voice Projects: Laser Eye and New Words Dictionary	Computing Basic for AI Implementation (3)
ML4Kids Text Projects: SNS Emotion Analyzer and Travel Information	Programming Environment for Machine Learning
ML4Kids Image Projects: Fools and pets	The History of Machine Learning and the Implementation of Basic Models
ML4Kids Number Projects: OX games, Pacman	Implementation of Artificial Neural Network Model and Understanding Learning Concepts through Linear Regression
Interdisciplinary AI Coding	Machine Learning for Classification
Individual Task Presentation	Individual Task Presentation

4 kinds of Computational Thinking

- In the green parts, teachers learn 4 kinds of CT strategies shown in the right figure:
- Algorithmic Thinking by Rules and Programs,
- Mathematics Modeling by Computational Models,
- Unsupervised Machine Learning Thinking without previous solution and
- Supervised Machine Learning Thinking with previous solution

4 kinds of Computational Thinking Strategies (Masami & Araya, 2020)

Framework for School Curriculum and Teacher Education Programs

- The 4 kinds of CT strategies have been introduced as powerful tools in the history of AI which is a software system to solve various problems.
- Therefore the CT strategies are the important framework for developing AI school curriculum as well as AI teacher education programs.

Final Words

- So far, we have looked at about three things:
  - Concepts of AI and why should AI be taught in school education?
  - A new curriculum and textbook development for AI Education
  - A new challenge of AI Teacher Education
- Many people worry that it might be a hasty decision, but many others believe that it is an understandable decision.
- No one can predict success, but Korea's new effort is believed to be a good touchstone for APEC countries regardless of whether it is successful or not.