ARTIFICIAL INTELLIGENCE AND NATIONAL HEALTH INSURANCE

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History of Artificial Intelligence

- **Alan Turing**
  - 1936 Turing Machine for breaking the Enigma code(Bombe)
  - 1946 Universal Turing Machine
  - 1950 Computing machinery and intelligence(Turing test)

A. M. Turing (1950) Computing Machinery and Intelligence. *Mind 49:* 433-460.

COMPUTING MACHINERY AND INTELLIGENCE

Can machines think?
Can machines behave intelligently?

I propose to consider the question, "Can machines think?" This should begin with
of the meaning of the terms "machine" and "think." The definitions might be
s to reflect so far as possible the normal use of the words, but this attitude is
If the meaning of the words "machine" and "think" are to be found by
ıow they are commonly used it is difficult to escape the conclusion that the
d the answer to the question, "Can machines think?" is to be sought in a
ırvey such as a Gallup poll. But this is absurd. Instead of attempting such a
shall replace the question by another, which is closely related to it and is
ı relatively unambiguous words.

Why are you interested in Artificial Intelligence?

- **Because, machine win the game**
  - 1996 IBM “Deep Blue” vs world champion “Garry Kasparov”
  - 2011 IBM “Watson” vs Ken Jennings & Brad Ruttner
  - 2015 Google “Alphago” vs 이세돌

Why are you interested in Artificial Intelligence?

AI's amazing precision

Average precision (%) by disease site.

	First run	Middle run	Latest run
Colon	68	81	98
Rectal	61	88	96
Bladder	24	75	91
Pancreatic	5	91	94
Kidney	12	87	91
Ovarian	41	97	95
Cervical	6	100	100
Endometrial	12	83	89

(Watson at ASCO 2014)

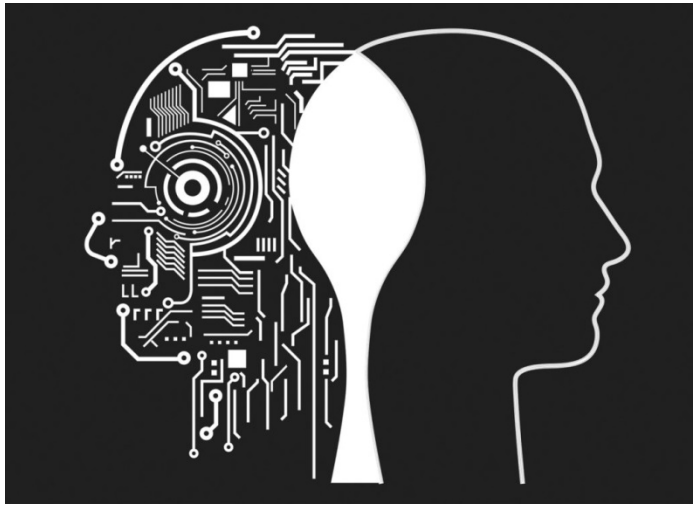
JAMA | Original Investigation | INNOVATIONS IN HEALTH CARE DELIVERY

Development and Validation of a Deep Learning Algorithm for Detection of Diabetic Retinopathy in Retinal Fundus Photographs

Varun Gulshan, PhD; Lily Peng, MD, PhD; Marc Coram, PhD; Martin C. Stumpe, PhD; Derek Wu, BS; Arunachalam Narayanaswamy, PhD; Subhashini Venugopalan, MS; Kasumi Widner, MS; Tom Madams, MEng; Jorge Cuadros, OD, PhD; Ramasamy Kim, OD, DNB; Rajiv Raman, MS, DNB; Philip C. Nelson, BS; Jessica L. Mega, MD, MPH; Dale R. Webster, PhD

- Sensitivity= 87~90%,
- Specificity= 98%
- AUC= 0.99

Concern about Artificial Intelligence



"Can Artificial Intelligence replace physicians?"

"How much is the Artificial Intelligence fee?"

What is Artificial Intelligence?-categories(1)

- **There is no single definition of AI**

- **Stuart Russell and Peter Norvig, *Artificial Intelligence: A Modern Approach (3rd Edition)* (Essex, England: Pearson, 2009).**
  1) Systems that think like humans
  2) Systems that act like humans
  3) Systems that think rationally
  4) Systems that act rationally

What is Artificial Intelligence?-categories(2)

- **Frank Chen(venture capitalist)'s general categories**
  1) Logical reasoning
  2) Knowledge representation
  3) Planning and navigation
  4) Natural language processing
  5) Perception

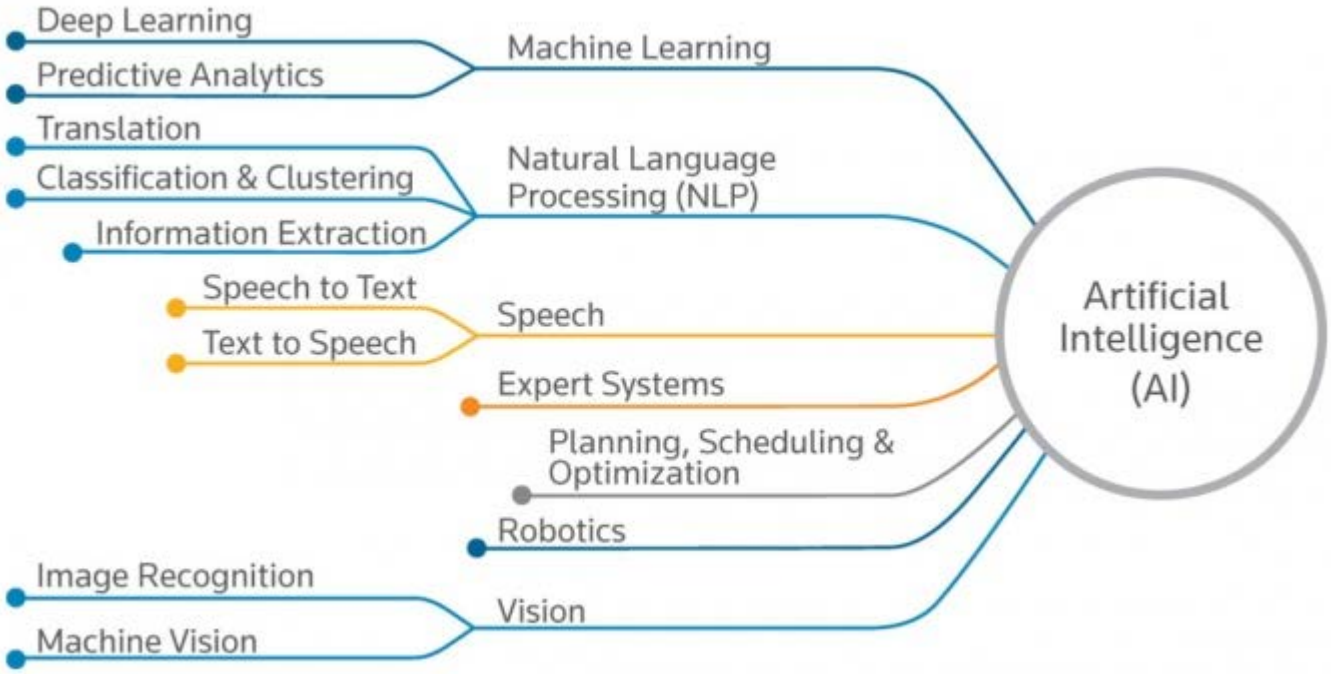
- **Pedro Domingos(AI researcher)'s AI Researcher type**
  1) Symbolists
  2) Connectionists
  3) Evolutionaries
  4) Bayesians
  5) Analogizers

What is Artificial Intelligence?-classification(1)

- ***Narrow*** **AI: playing strategic games, language translation, self-driving vehicles, and image recognition**
  - Underpins trip planning, shopper recommendation system, ad targeting, **medical diagnosis,** education, and scientific research
- ***General*** **AI: Exhibit apparently intelligent behavior at least as advanced as a person across the full range of cognitive tasks**
  - General AI will be not be achieved for at least decades(private-sector expert, NSTC Committee)

What is Artificial Intelligence?-classification(2)

Artificial Intelligence Categories



Artificial Intelligence Methods

- **KNOWLEDGE BASED**
  - ISSUE: Speech understanding, Knowledge representation & acquisition
  - MAIN: Expert system, Intelligent information search, Semantic network

- **DATA BASED**
  - ISSUE: Machine Learning algorithm, Big data
  - MAIN: artificial neuro networks, deep learning

- **REINFORCEMENT LEARNING**
  - ISSUE: Training algorithm
  - MAIN: Markov decision processes learning, Q-learning, Policy Gradient Method

Artificial Intelligence Characters

	Classic AI	Simple Neural Network	Biological Neural Network
Examples	WATSON	Deep Learning	Hierarchical Temporal Memory(HTM)
Associated terms	Expert systems	Artificial Neural Nets(ANN), Machine Learning	Machine intelligence
Data sources	Rules from experts	Large datasets	Data streams
Training	Programmed by experts	Derived from labeled databases	Derived from unlabeled data streams
Outputs	Answers to questions	Classification	Prediction Anomaly detection Classification
Batch vs. Conti. Learning	Batch	Batch	Continuous
Need to know what you are looking for	YES	Requires labeled data	NO
Many individual models	HARD	HARD	Easy
Biological basis	NONE	Simple	Realistic
Provides roadmap to machine intelligence	NO	NO	YES

Technologies for Artificial Intelligence

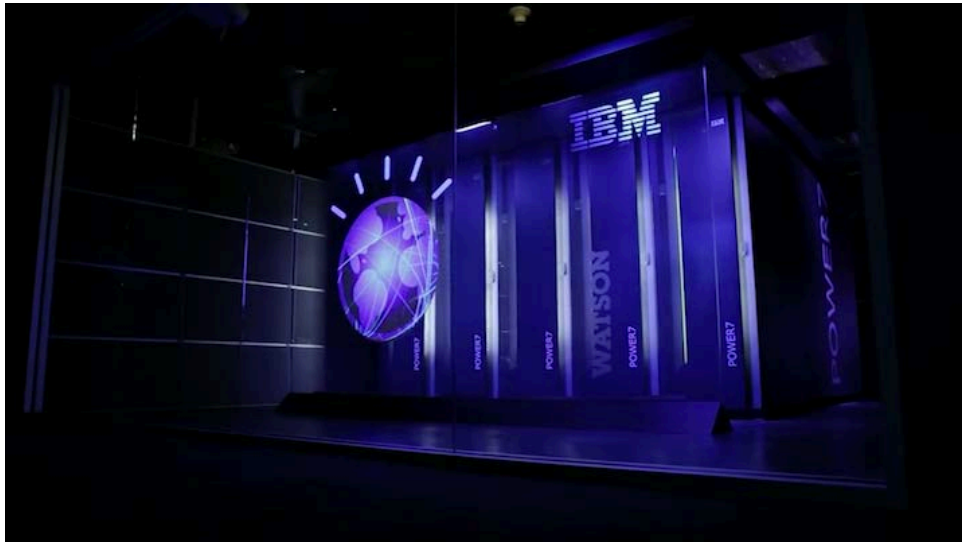
Big Data Computer Science Algorithm

The National Strategic Plan-Whitehouse Report

- Strategy1: Make long-term investments in AI research
- Strategy2: Develop effective methods for human-AI collaboration
- Strategy3: Understand and address the ELSI(ethical, legal, and societal implications)
- Strategy4: Ensure the safety and security of AI systems
- Strategy5: Develop shared public datasets and environments for AI training and testing
- Strategy6: Measure and evaluate AI technologies through standards and benchmarks
- Strategy7: Better understand the national AI R&D workforce needs

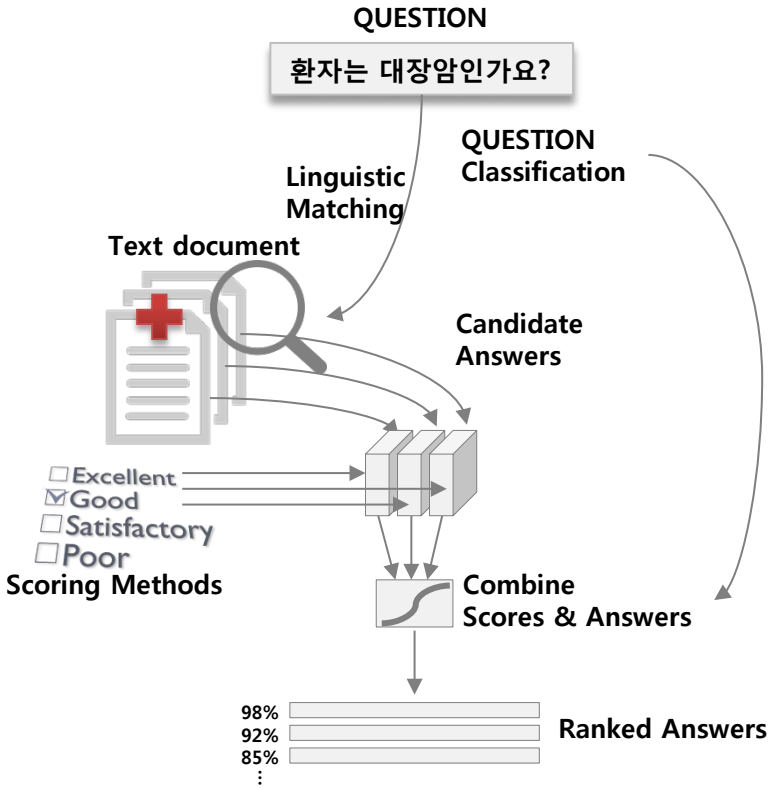
IBM Watson Health

- **IBM Watson Health-Cognitive Healthcare Solutions**
  - IBM Watson for oncology
  - Watson Care Manager
  - Life sciences
  - Value-based care
  - Imaging
  - IBM Watson Health-Genomics



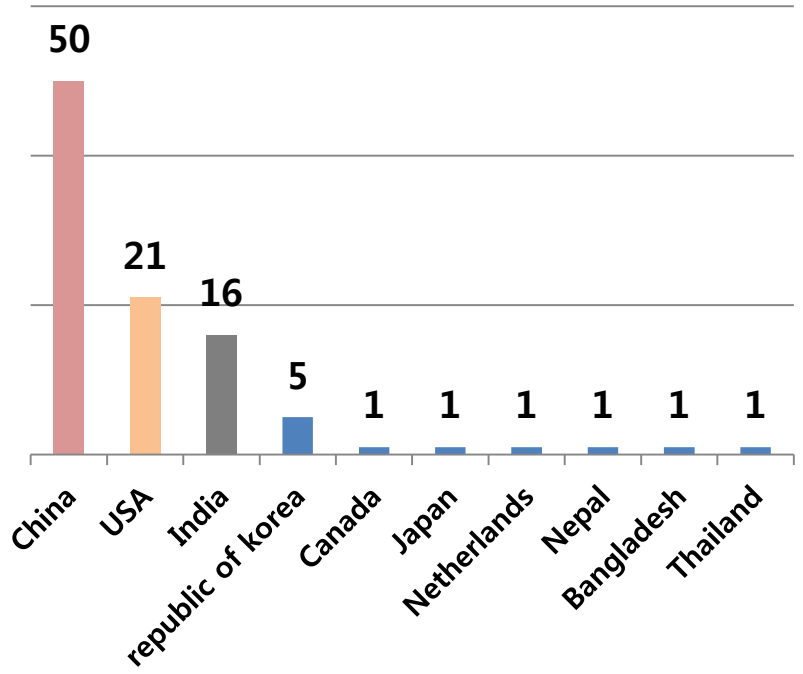
IBM Watson for oncology

- Multiple interpretations of a question
- Search the Text document from sources
- Prepare the candidate answers
- Scoring the sources
- Combine scores and answers
- Suggest ranked answers



Introducing of IBM Watson for oncology

- Only India allow consultation with Watson for oncology to be made available to the patient in real life
- Another countries use the Watson for oncology as a reference, not a replace physicians
- But, Watson for oncology help lower rate of misdiagnosis clearly
- Improving the quality of medical service



Regulation of Artificial Intelligence in KOREA

- **IBM Watson training at 2013**
  - 0.6 million medical certificates
  - 2 million text books
  - 1.5 million patient records

- **Watson is not a Medical Device in Korea, because it just searches for known paper.**

"인공지능(AI) 의사 '왓슨', 의료기기 아니다"

식약처, 허가심사 가이드라인 발표

[2016년 12월 30일 10시 28분]

'인공지능 의사'로 불리는 IBM의 '왓슨(Watson)'이 의료기기에 포함되지 않을 전망이다. 문헌검색을 통해 정보를 제공하는 기기는 의료기기에 해당하지 않는다고 정부가 결론 내렸다.

식품의약품안전처는 29일 의료용 빅데이터와 AI를 적용한 의료기기에 대한 허가 심사 가이드라인 초안을 발표했다. 의료용 AI에 대한 가이드라인이 나온 것은 이번이 처음이다.

식약처는 이 초안을 토대로 다음달 14일까지 의견을 수렴한 뒤 최종 가이드라인을 확정한다는 계획이다.

초안에 따르면 질병진단법 치료법 처방전목록 의약품 정보를 논문 등 문헌에서 검색해 제공하는 제품은 의료기기에서 제외됐다.

식약처 관계자는 "길병원에서 도입해 활용하고 있는 왓슨이 대표적"이라며 "의사가 진단을 한 결과를 입력하면 이미 알려진 논문을 검색해 적합한 것을 알려주는 기기인 만큼 의료기기에 해당하지 않는다"고 설명했다.

Artificial Intelligence VS Regulation

- **General principle**
  - to protect public safety
  - requires collaboration between agency leadership, existing regulatory framework and regulatory practices generally, and technical expert

- **Need to be adapted to the addition of AI**
  - Increase the cost of compliance
  - Slow the development or adoption of beneficial innovation
  - Policymaker should consider

Artificial Intelligence AND National Insurance

- **Artificial Intelligence should be developed by National Strategic Plan as a medical device**
  - US has a NSTC subcommittee dedicated to AI and machine learning with 'The national Artificial Intelligence R&D Strategic Plan'

- **Evidence level of Artificial Intelligence is very low**

- **Should apply medical insurance fee as a health technology supporting clinical decision**

Conclusion

Artificial Intelligence will be not replace physicians

- Because, propose of development is supporting physician
- However, If physician does not study and use artificial intelligence, he will get away

Artificial Intelligence need Regulation & National Insurance

- Security, Private information, Public safety
- Increase the cost of compliance
- Slow the development or adoption of beneficial innovation
- Pay for improving the quality of medical service by AI