Impact of Artificial Intelligence on Employment

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“Technology is a gift of God.

After the gift of life it is perhaps the greatest of God’s gifts.

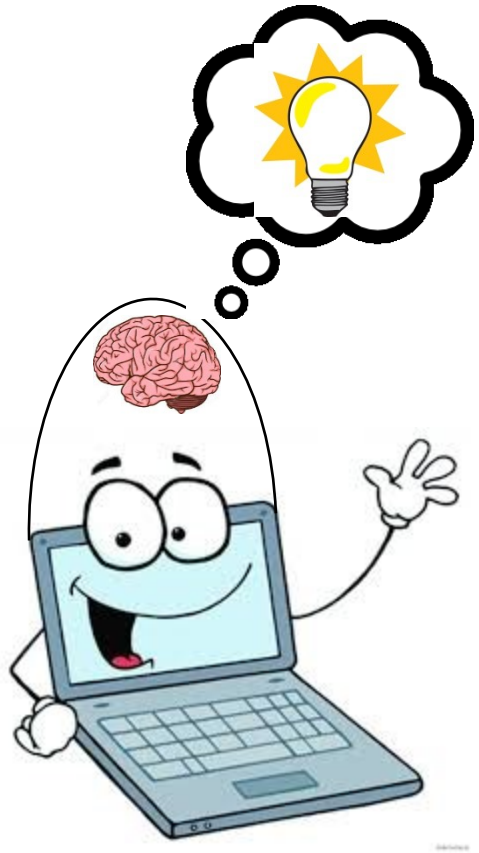
It is the mother of civilizations, of arts and of sciences.”

— Freeman Dyson

Contents

- What is Artificial Intelligence?
- Use-cases of AI
- Current State of Research in AI
- AI vs Employment
- Challenges for and Role of Government

(I) Artificial Intelligence?



The Beginning

- "Can machines think?"

- "We may hope that machines will **eventually** compete with men in all purely intellectual fields."

[A. M. Turing, Computing Machinery and Intelligence, *Mind*, Volume LIX, Issue 236, October 1950, Pages 433–460]

The Christening

- John McCarthy: Father of AI

- Coined the term Artificial Intelligence in 1955.

[John McCarthy, et al., A Proposal for the Dartmouth Summer Research Project on Artificial Intelligence. 1955. Available online: http://raysolomonoff.com/dartmouth/boxa/dart564props.pdf. Accessed July 27, 2019]

AI – Mechanizing Intelligence – is an Art

"It is

the science and engineering

of

making

intelligent machines,

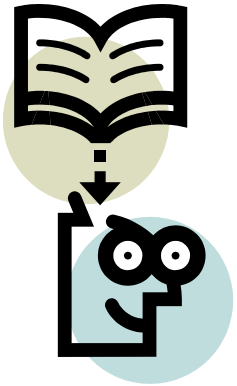
especially

intelligent computer programs."

[John McCarthy, *What Is Artificial Intelligence?*, November 12, 2007]

What is Intelligence

Intelligence is the **capability**



of **acquiring**

'**Knowledge**' and '**Skills**'

and then **applying**

these knowledge and skills

in **Familiar** or **Unforeseen**

Circumstances and/ or **Environments**

Defining Intelligence

- A broad view on intelligence may be taken as:

"intelligence is that **quality** that enables an **entity** to function appropriately and with foresight in its environment."

[Nils J. Nilsson, *The quest for artificial intelligence: A history of ideas and achievements*, Cambridge University Press, 2010]

Defining Artificial Intelligence (#1)

- Ability of Machines to **perform the tasks** requiring intelligence.

- "AI refers to the ability of machines to perform **cognitive tasks** like thinking, perceiving, learning, problem solving and decision making."

[NITI Aayog Discussion Paper on 'National Strategy for Artificial Intelligence', June 2018]

Defining Artificial Intelligence (#2)

- AI is a **constellation of technologies** that enable machines to act with higher levels of intelligence and emulate the human capabilities of **sense**, **comprehend** and **act**.

[NITI Aayog Discussion Paper on 'National Strategy for Artificial Intelligence', June 2018]

Defining Artificial Intelligence (#3)

- AI can be considered an umbrella term covering a group of technologies that are capable of **autonomously** performing tasks that, if performed by a human being, would be considered to require intelligence.

[ITU Issue paper on Emerging Trends in ICTs, "Assessing the Economic Impact of AI", September 2018]

Defining Artificial Intelligence (#4)

- Some Interesting readings:

B. Marr, The Key Definitions of Artificial Intelligence (AI) That Explain Its Importance, Forbes, February 14, 2018.

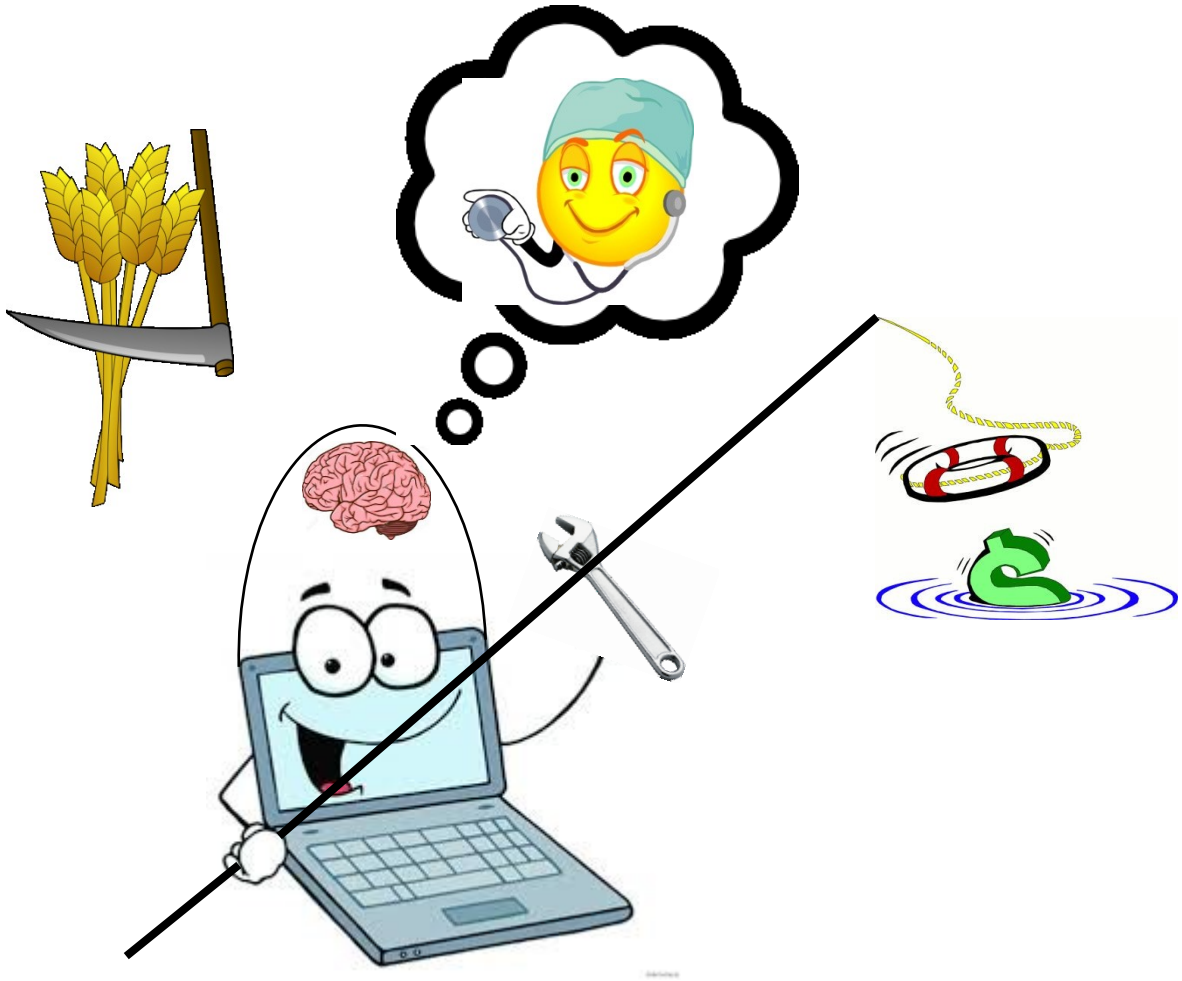
https://www.forbes.com/sites/bernardmarr/2018/02/14/the-key-definitions-of-artificial-intelligence-ai-that-explain-its-importance/#6268887e4f5d

J.R. Searle, Minds, brains, and programs, Behav Brain Sci., 1980, 3(3), 417-457.

https://doi.org/10.1017/S0140525X00005756

R. Cellan-Jones, Artificial intelligence - hype, hope and fear. BBC News, p.3, October 16, 2017. http://www.bbc.co.uk/news/technology-41634316

(II) Use-cases of AI



Some Applications of AI Technologies (#1)

- Face Recognition
- Speech Recognition

Virtual Assistants, e.g. Alexa, Siri

- Driverless Cars
- AI-based recommender systems – Online search optimization and digital ad targeting

Some Applications of AI Technologies (#2)

- Emotion detection from EEG signal and facial expressions
- Training computers to read and interpret pathology reports
- Robotics – Home/ Service Robots, Industrial robots
- Voice Search

Some Applications of AI Technologies (#3)

- Computer assisted language learning
- Human-machine Dialogue
- Speech synthesis
- Speech summarization

Some Applications of AI Technologies (#4)

- Handwriting Recognition

- Text Recognition

- R.L. Adams, 10 Powerful Examples of Artificial Intelligence in Use Today, Forbes, January 10, 2017.

https://www.forbes.com/sites/robertadams/2017/01/10/10-powerful-examples-of-artificial-intelligence-in-use-today/#5590a7c9420d

Applications Areas for AI Technologies

- Applications will be most numerous in sectors in which a large proportion of time is spent collecting and synthesising data:

  - financial services,
  - retail and trade,
  - professional services,
  - manufacturing and
  - healthcare.

[The State of AI 2019: Divergence, MMC Ventures and Barclays US Ventures, 2019]

New Possibilities Enabled by AI in Five Fields of Enquiry

Knowledge	Medical diagnosis	Drug creation	Media recommendation
	Financial trading	Information synthesis	Consumer targeting
Reasoning	Legal analysis	Asset management	Application processing
	Games	Autonomous weapons	Compliance
Planning	Logistics	Fleet management	Navigation
	Network optimisation	Predictive maintenance	Demand forecasting
Communication	Voice control	Intelligent agents	Customer support
	Real-time transcription	Real-time translation	Client service
Perception	Autonomous vehicles	Medical imaging	Authentication
	Augmented reality	Surveillance	Industrial analysis

[Image Credit: The State of AI 2019: Divergence, MMC Ventures and Barclays US Ventures, 2019]

Sector-wise Use-Cases

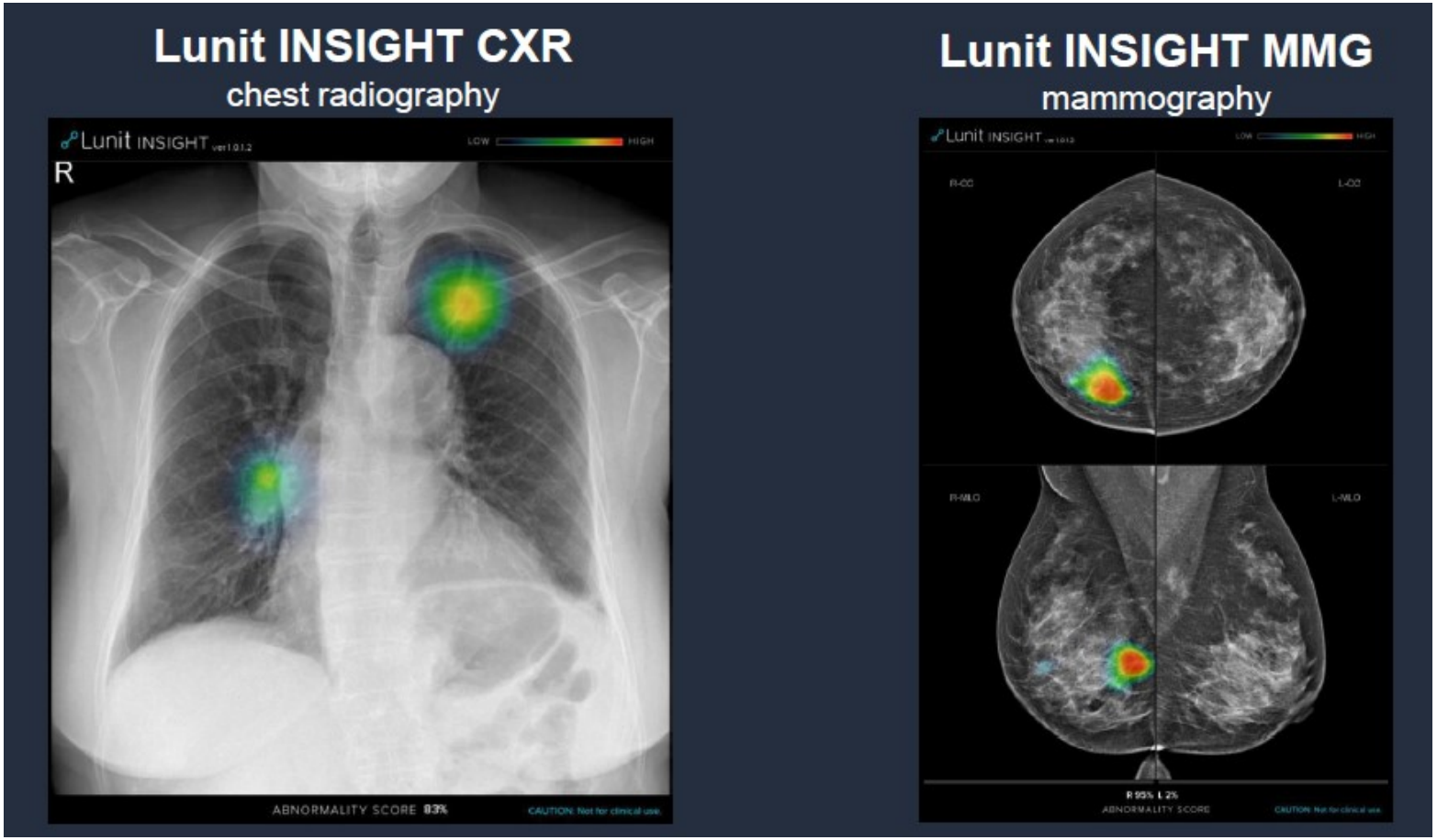
Sector	Core use cases:			
Asset Management	Investment strategy	Portfolio construction	Risk management	Client service
Healthcare	Diagnostics	Drug discovery	Monitoring	
Insurance	Risk assessment	Claims processing	Fraud detection	Customer service
Law & compliance	Case law	Discovery and due diligence	Litigation strategy	Compliance
Manufacturing	Predictive maintenance	Asset performance	Utility optimisation	
Retail	Customer segmentation	Content personalisation	Price optimisation	Churn prediction
Transport	Autonomous vehicles	Infrastructure optimisation	Fleet management	Control applications
Utilities	Supply management	Demand optimisation	Security	Customer experience

[Image Credit: The State of AI 2019: Divergence, MMC Ventures and Barclays US Ventures, 2019]

HEALTH-CARE

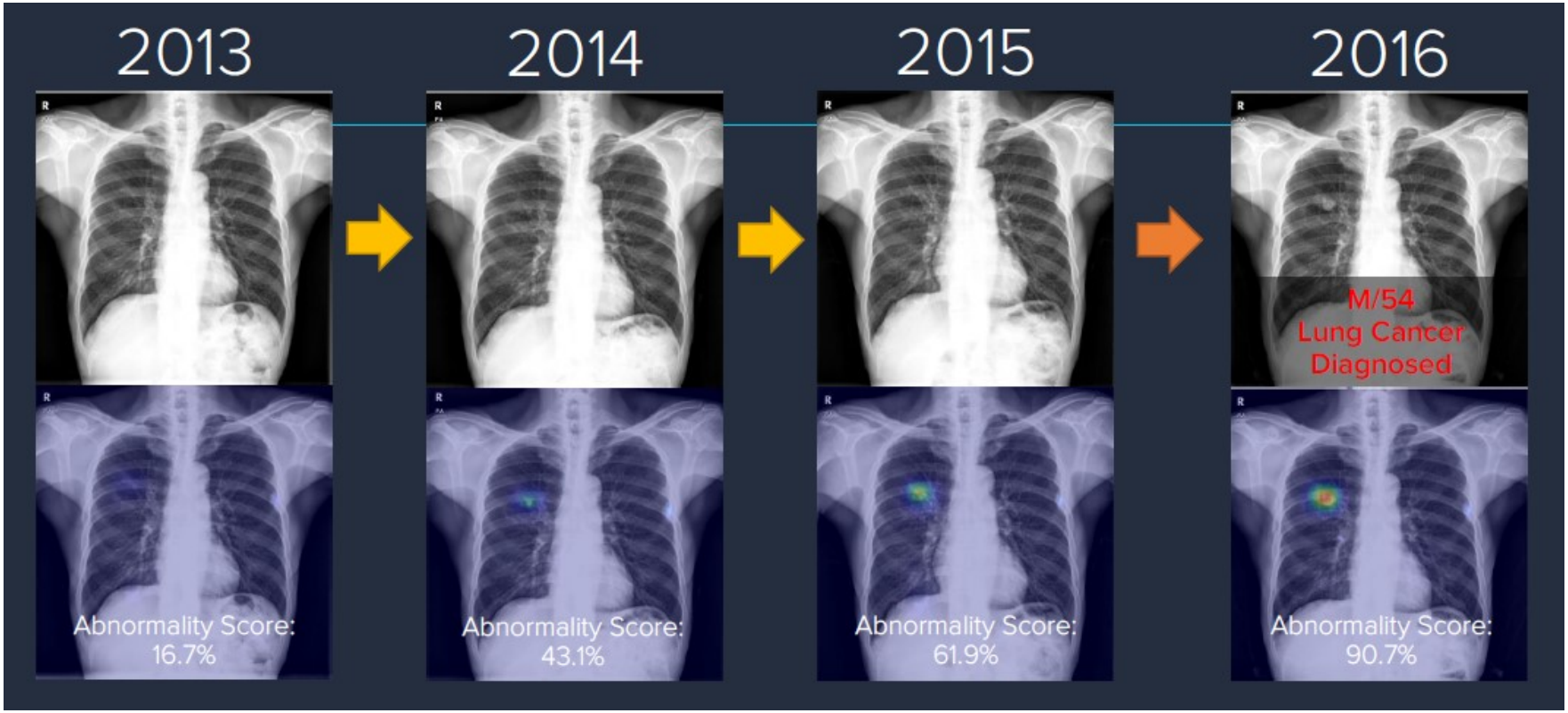
- Early Detection of Cancer, TB, etc. using AI.
- The radiographic images may be analyzed by AI algorithms for presence of Cancer, etc.
- Best results are obtained by ‘Human Expert + AI’ combinations

Using AI for Diagnosis



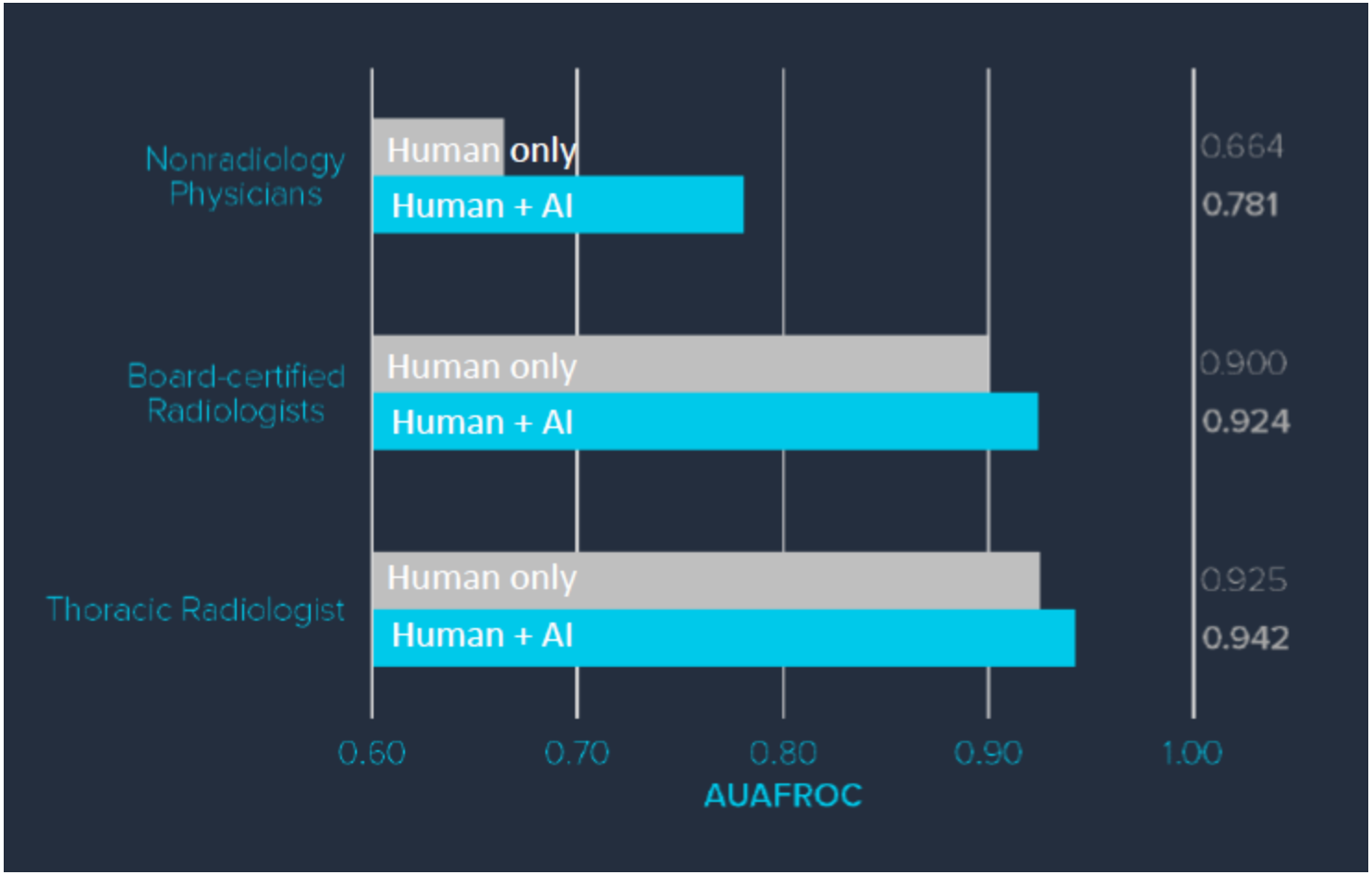
[Image Credit: M/s Lunit, a start-up in Republic of Korea]

Early Detection using AI



[Image Credit: M/s Lunit, a start-up in Republic of Korea]

Significant Improvements with AI Assistance



[Slide/ Image Credit: M/s Lunit, a start-up in Republic of Korea]

FIN-TECH

- Some of the AI-based solutions are:

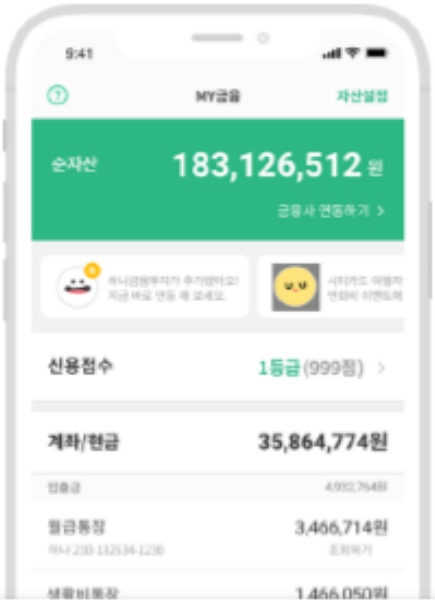
- Presence-less, paper-less, cash-less, and consent-based financial transactions.
- Risk-assessment and determining credit-worthiness.
- Predicting investment opportunities with right-timing advice and helping in managing risk in investment decisions.

[Report of the Artificial Intelligence Task Force, March 2018]

AGGREGATE FINANCE DATA AND ANALYZE

Everything about your finance

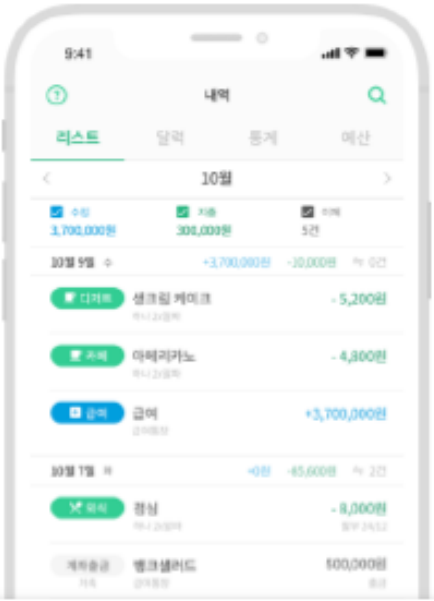
My Finance



Covers 80% of Korean financial institutions

Record everyday transaction

Money book

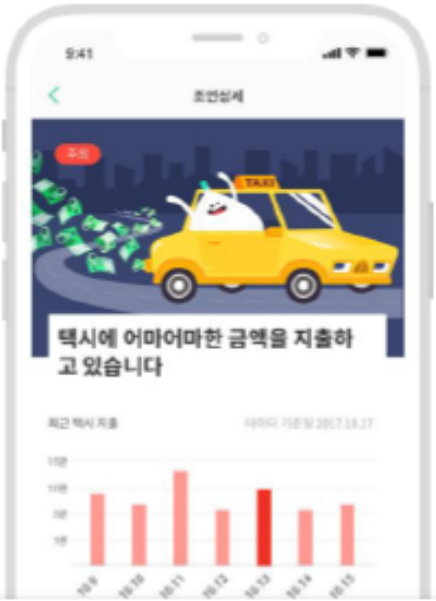


4M+ members

(90% of downloads joined the service)

From personalized report to solutions

Finance assistant



In-app message open rate 60%+

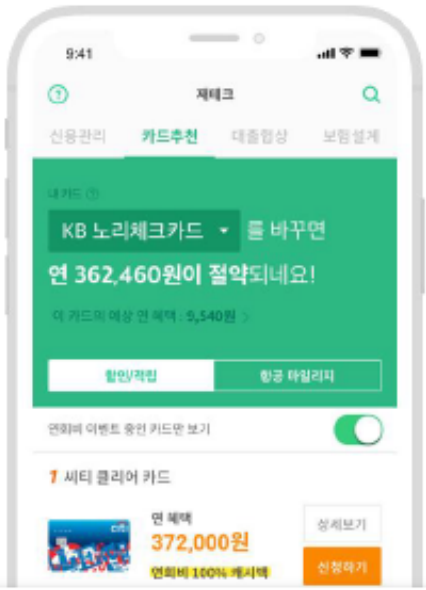
70% of users saved 20% in 3 months

[Slide/ Image Credit: M/s Rainist Co. Ltd., a start-up in Republic of Korea]

Personalized Financial Recommendation based on Each User's Data

Card that is for me

Credit card recommendation



Users saves 2-7% after changing credit cards

USD 10M saving annually

Check credit score with one click

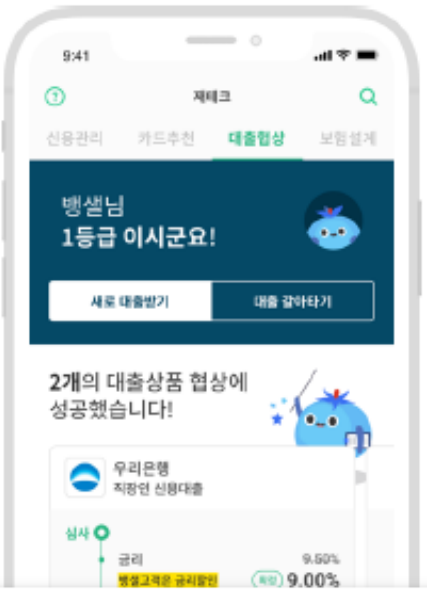
Credit score management

235,200 improved in total

(91,752, 20-30 age group)

Fixed interest rate loan

Loan



K-bank, Hana bank

Top tier bank products included

[Slide/ Image Credit: M/s Rainist Co. Ltd., a start-up in Republic of Korea]

Personalized Financial Recommendation based on Each User's Data

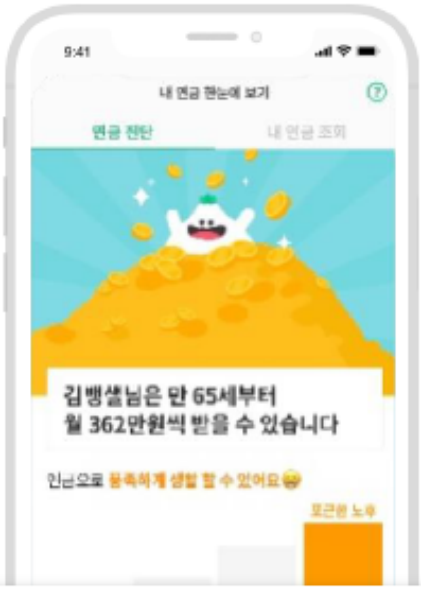
Health and money management together

Insurance plan

CTR improved 800%
in insurance

One click retirement planning

Pension inquiry



Pension management feature
Diagnose and management retirement plan

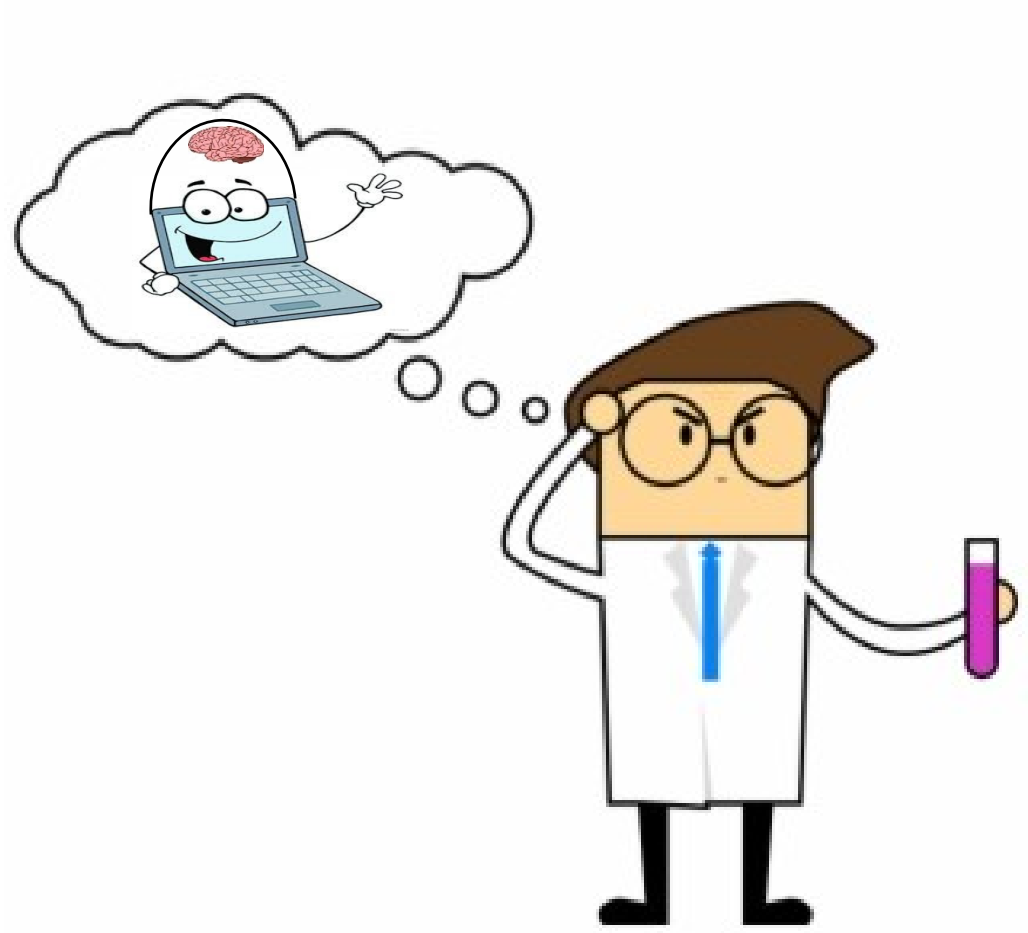
Easy on and off insurance

Switch insurance

First service form financial sandbox program
Totally new insurance on-boarding experience

[Slide/ Image Credit: M/s Rainist Co. Ltd., a start-up in Republic of Korea]

(III) Current State of Research in AI

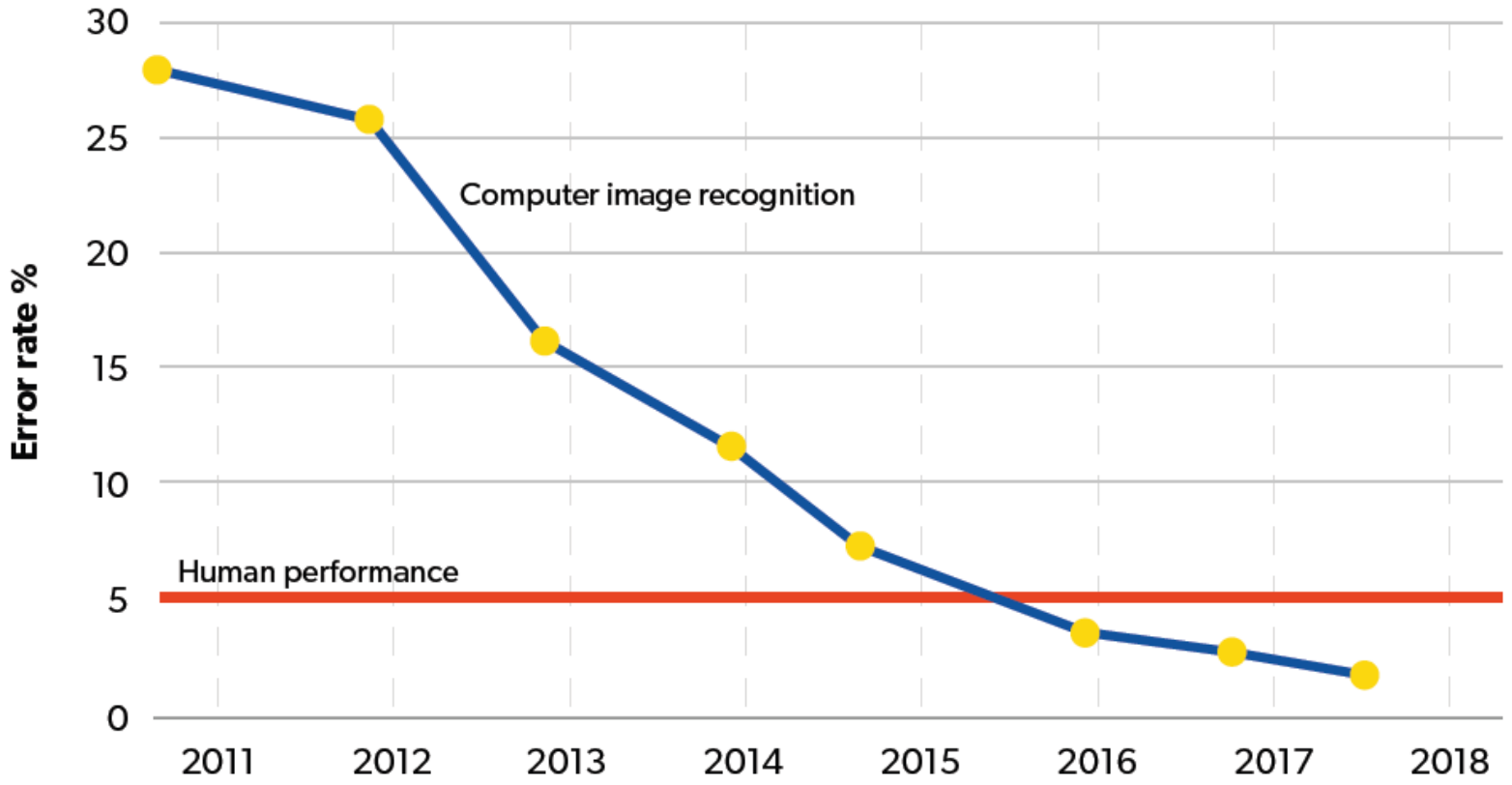


Seven Enablers of AI

- Improved Algorithms.
- Increased availability of Data
- Specialized Hardware
- Cloud-based AI services
- Open-source AI software frameworks
- Increased Investment
- Greater awareness

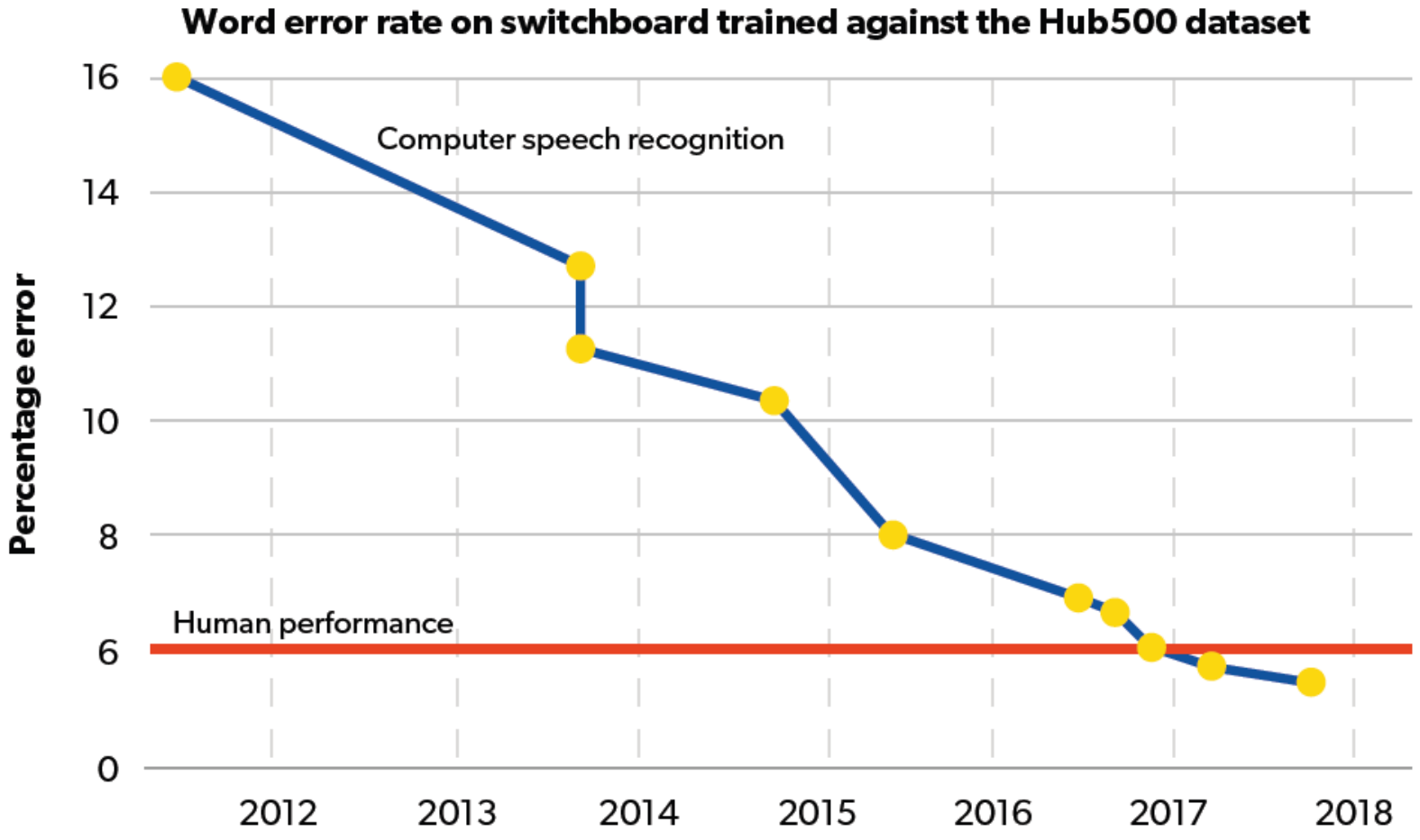
[The State of AI 2019: Divergence, MMC Ventures and Barclays US Ventures, 2019]

IMAGENET IMAGE RECOGNITION



[Image Credit: The State of AI 2019: Divergence, MMC Ventures and Barclays US Ventures, 2019]

Speech Recognition



[Image Credit: The State of AI 2019: Divergence, MMC Ventures and Barclays US Ventures, 2019]

Algorithms

- Reinforcement Learning (RL) – creating powerful AI Agents, playing games (e.g. Go), Autonomous Vehicles
- Transfer Learning (TL) – use of pre-trained networks
- Generative Adversarial Networks (GAN) – artificially creating real-like media

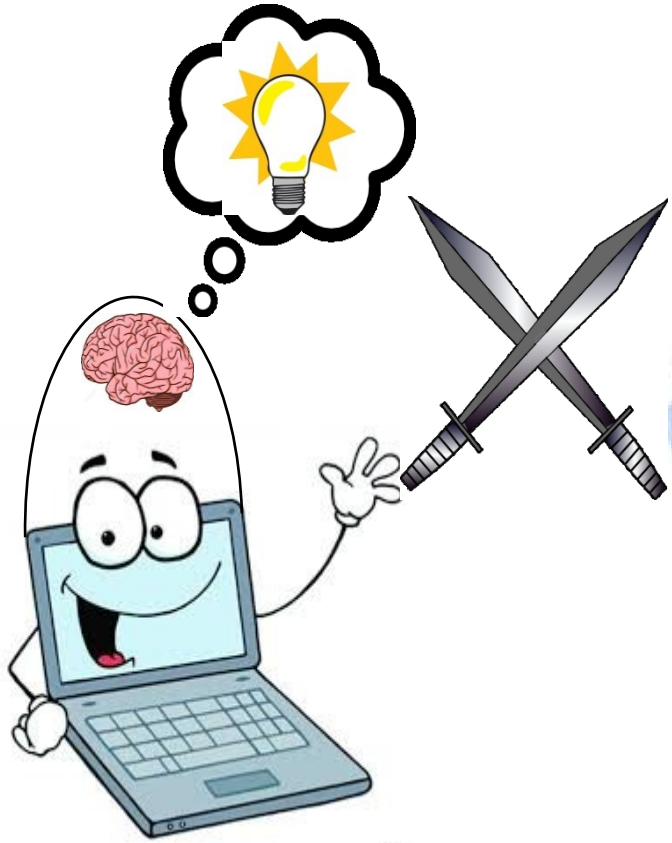
[The State of AI 2019: Divergence, MMC Ventures and Barclays US Ventures, 2019]

Hardware

- CPUs, GPUs, TPUs, IPUs
- Google's TPU: An Application-specific IC
- 1G: May 2016; 2G: May 2017; 3G: May 2018
- Post GPU era: Custom Silicon
- Quantum Computing, Quantum Hardware, Quantum Neural Network

[The State of AI 2019: Divergence, MMC Ventures and Barclays US Ventures, 2019]

(IV) AI vs Employment



The Big Picture

- In approximately 60% of occupations, at least 30% of constituent activities are **technically automatable** by adapting currently proven AI technologies.

(McKinsey Global Institute)

[The State of AI 2019: Divergence, MMC Ventures and Barclays US Ventures, 2019]

A Critical Question (*The Yaksh Prashn*)

Whether AI will result in

widespread job-losses?

There are no Easy

Or

Straight-forward

Answers

A Peep into the History

- AI is envisaged to be a major driver of Fourth Industrial Revolution (Industry 4.0).
- We have witnessed three Industrial Revolutions leading to widespread automation across all spheres of Economy and Society.
- Whether there were widespread job-losses in earlier Industrial revolutions?

A Peep into the History

What History Tells Us

- Generally, advent of new technologies renders some of existing workforce redundant.
- However, in long run, new types of job are created.
- It is not a sudden phenomenon, it is a continuous and gradual process.

And In Case of AI…..?

- In short term, AI will, probably, replace tasks rather than jobs; And, AI is also expected to create new types of jobs.

- However, it is more difficult to foresee the kinds of jobs that AI may lead to than to assess the probable losses in existing jobs.

["Artificial Intelligence and Life in 2030." One Hundred Year Study on Artificial Intelligence: Report of the 2015-2016 Study Panel, Stanford University, Stanford, CA, September 2016. Doc: http://ai100.stanford.edu/2016-report.]

AI Adoption Scenario

- Wide disparity across sectors/ companies in respect of adoption of AI:

1. Early-adopters/ leaders/ front-runners
2. Followers/ movers
3. Laggards/ non-adopters

- Similarly, there exists wide disparity across regions/ geographies in respect of adoption of AI.

Prospective Job Market Dynamics (#1)

- There will be changes in types of jobs.
- Certain types of jobs will become redundant and new types of jobs will emerge.
- Some sectors are more susceptible than others to job creation or job destruction.

Prospective Job Market Dynamics (#2)

- There might be a large shift from jobs entailing repetitive tasks and low ICT skills to jobs with non-repetitive tasks and high ICT skills.
- Jobs requiring creativity are comparatively more immune – but not for long.
- The jobs that are the most vulnerable are the ones at the lowest level of wages.

Prospective Job Market Dynamics (#3)

- The emerging job market may exhibit higher inequalities in terms of income, social status as well as employment opportunity.
- Though the speed and scale of transition is obscure yet, it is certainly faster and wider than earlier disruptions.
- The effect on job market in terms of speed and scale may vary across companies/ sectors/ regions.

Prospective Job Market Dynamics (#4)

- There might be net addition to the employment.

- However, for this to happen, Governments and other stake-holders need to take care of maintaining employability of old workforce and ensuring employability of new workforce.

Prospective Job Market Dynamics (#5)

A critical requirement will be

to **anticipate** the future skill needs,

and accordingly,

establish an enabling ecosystem of **education & training**,

specifically in **digital & ICT skills** (specialist/ generic), **STEM subjects**, and **soft skills**

leading to

re-skilling/ up-skilling of existing workforce and

preparing the future generations

for new challenges/ job requirements.

Opportunities: Increased Efficiency & Lower Costs

- Increased use of AI and automation in industries would lead to increased efficiency and more wealth to society at large.

- Resultant lower costs of goods and services would effectively make everyone richer. [AI100]

Opportunities: 'AI + Human' Team

- AI is merely a tool to enhance human capabilities.
- In many cases, human+AI combination gives the best results rather than AI or Human working alone.
- The real potential of AI lies in teaming with humans, complementing each other's capabilities and thus compensating the weaknesses of both.

Opportunities: Developing Cognitive Technologies in Regional Langauges

- In order to be useful for larger population, AI solutions using NLP and other cognitive technologies need to be developed in local languages taking into account written symbols, spoken language as well as translation of one language into other. [AITF]

- This field is still in nascent stage and this opens up **huge employment opportunities**, especially for the youth. [AITF]

Types of Skill-Sets Required

- In reference to AI, two types of skill sets are required:

- Developing the AI based systems/ solutions – requirement of high-level skills.

- Handling the above systems/ solutions in order to get/ facilitate intended services/ benefits – requirement of low-level/ operative skills.

Opportunities: Technology-Human Interface (#1)

- The second skill set (operative skills) will be required by a large number of people leading to huge employment opportunities.

- e.g., health-care-assistants required to communicate/ interface between AI based solutions and the patients.

Opportunities: Technology-Human Interface (#2)

- Similarly, in agriculture and education sectors, human interface would be required between the AI systems and the target users.

- Summarily, wherever AI solutions are to be employed on a large scale, huge trained manpower would be required as interface between the technology and the end user.

Opportunities: Data Generation

- AI systems require large amount of Data for training.
- Most often, this data is generated by humans.
- This creates employment opportunities, especially for people at lower-middle level and in rural areas merely requiring basic computer literacy. [AITF]

Opportunities: IT Services

- Some of new prospective jobs:
  - Data Scientists
  - Language Processing Specialists
  - AI Research Scientists

[AITF]

- Specific areas for re-skilling include:
  - NLP, Neural Networks, Pattern Recognition
  - Data Analytics
  - Tools: Python, Hadoop, R, etc.

[AITF]

(V) Challenges for And Role of Government

Challenges & Responsibilities (#1)

- Strike a balance between several dichotomies:
  - risks vs opportunities
  - man vs machine
  - constraints vs enablers

Challenges & Responsibilities (#2)

- Support "human-centered AI"
- Maintain a balance between **promoting innovation** and **ensuring Job security**.
- Accruing technical expertise about AI to Government officers.

Challenges & Responsibilities (#3)

- Accurately forecasting the likely impact of wide-spread adoption of AI on employment and taking pre-emptive corrective measures.

- Ensuring large-scale investment and creation of infrastructure as well as facilities for imparting requisite skills to the masses.

Challenges & Responsibilities (#4)

- **Creating social-security nets** to protect people from structural changes in Economy and imminent job losses due to adoption of AI by Industries.

- Developing and implementing AI based curriculum for education and skilling right from schools to higher education.

Half a Century Ago

As machines become

more and more efficient and perfect,

so it will become clear that

imperfection is the greatness of man.

Ernst Fischer
(1899-1972)

In a Recent Newspaper Ad

Machines make Everything perfect.

But it is **Imperfection**

That makes life

beautiful

[ellementry.com, Delhi Times of India, July 26, 2019]

References/ Suggested Readings

- NITI Aayog Discussion Paper on '*National Strategy for Artificial Intelligence*', June 2018.
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THANK YOU

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