

All Things
DATA
CONFERENCE
2017



AI-Powered Digital Innovation

장병탁 교수 / 서울대학교 컴퓨터공학부

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- Smart Machines

3. 인공지능의 미래

- Cognitive AI

1. 인공지능 기술과 산업 동향

인공지능(AI)의 개념

- 인공지능(AI): “사람처럼 생각하고 사람처럼 행동하는 기계”(컴퓨터, SW, 로봇)
 - 사람이 기계보다 잘 하는 일을 기계가 할 수 있도록 하는 연구
 - 지능을 필요로 하는 일을 기계가 할 수 있도록 하는 연구
 - 1950: Turing Test, 1956: “Artificial Intelligence (AI)”
 - 약인공지능(Weak AI), 강인공지능(Strong AI), 범용인공지능(AGI)
- 머신러닝(ML): 학습을 통해서 인공지능 시스템을 자동으로 개발하는 기술
- 딥러닝(DL): 신경망기반의 머신러닝 모델의 일종. 많은 층을 가진 복잡한 신경망



인공지능(AI)의 역사

➤ 1970-1980년대: 붐
전문가/지식기반 시스템

1982-1992:

제5세대 컴퓨터계획 (FGCS)

➤ 1990년대: 암흑기

뉴럴넷, 유전자 알고리즘, 퍼지로지
1990대 후반:

인터넷, 웹, 전자상거래

정보검색, 데이터마이닝

아마존, 이베이, 야후, 구글

➤ 2010년대: 부흥기

지능형 에이전트

머신러닝/딥러닝



IBM “Deep Blue” Chess Machine
Beats Human Champion (1997)

AI Grand Challenge: Thinking Machines

Deep Blue

Watson

AlphaGo



1997

2011

2016



Self-driving Cars



RHINO
Museum Tour Guide



DARPA
Grand Challenge



Google
Self-driving
Car



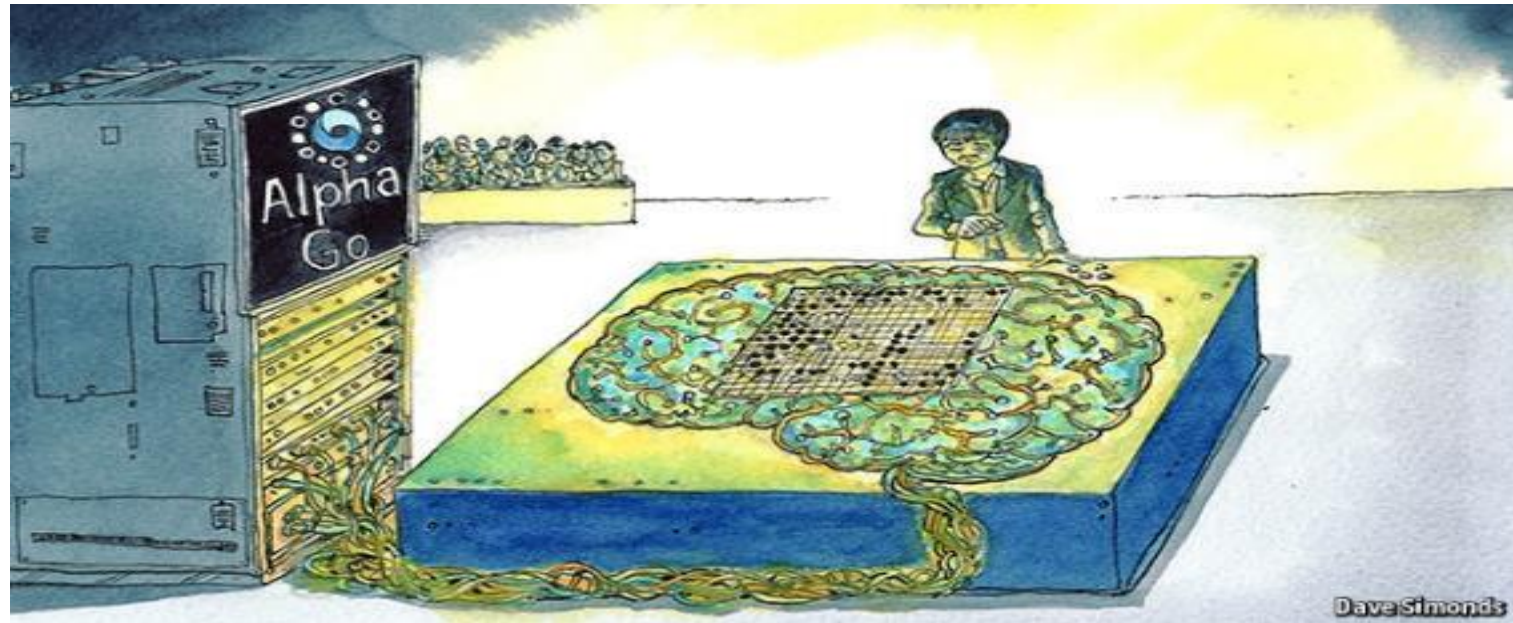
1997

2005

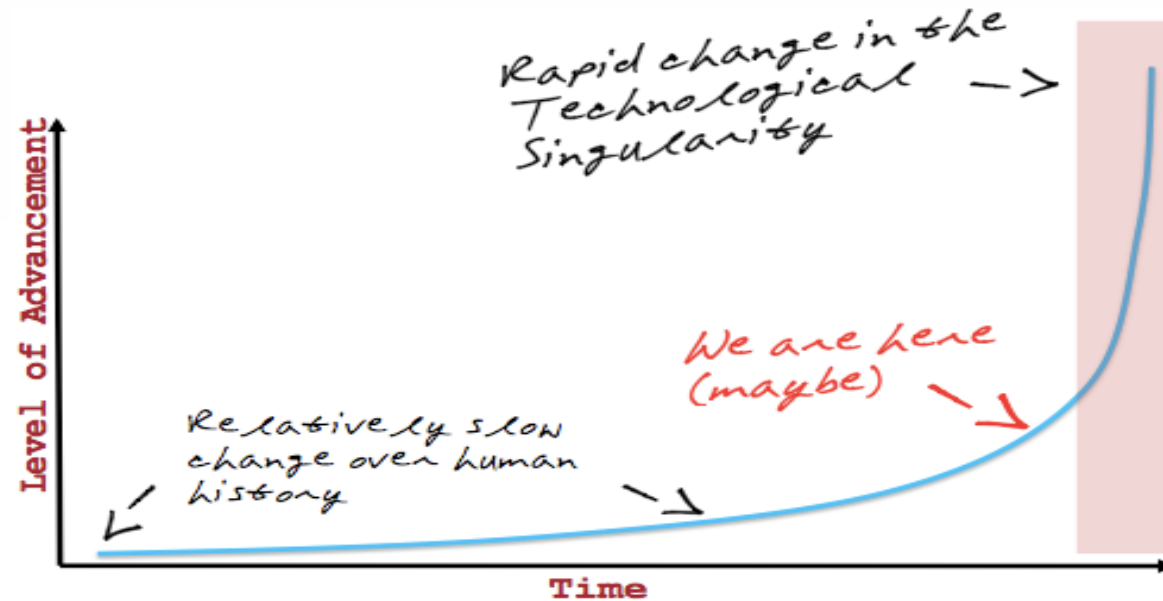
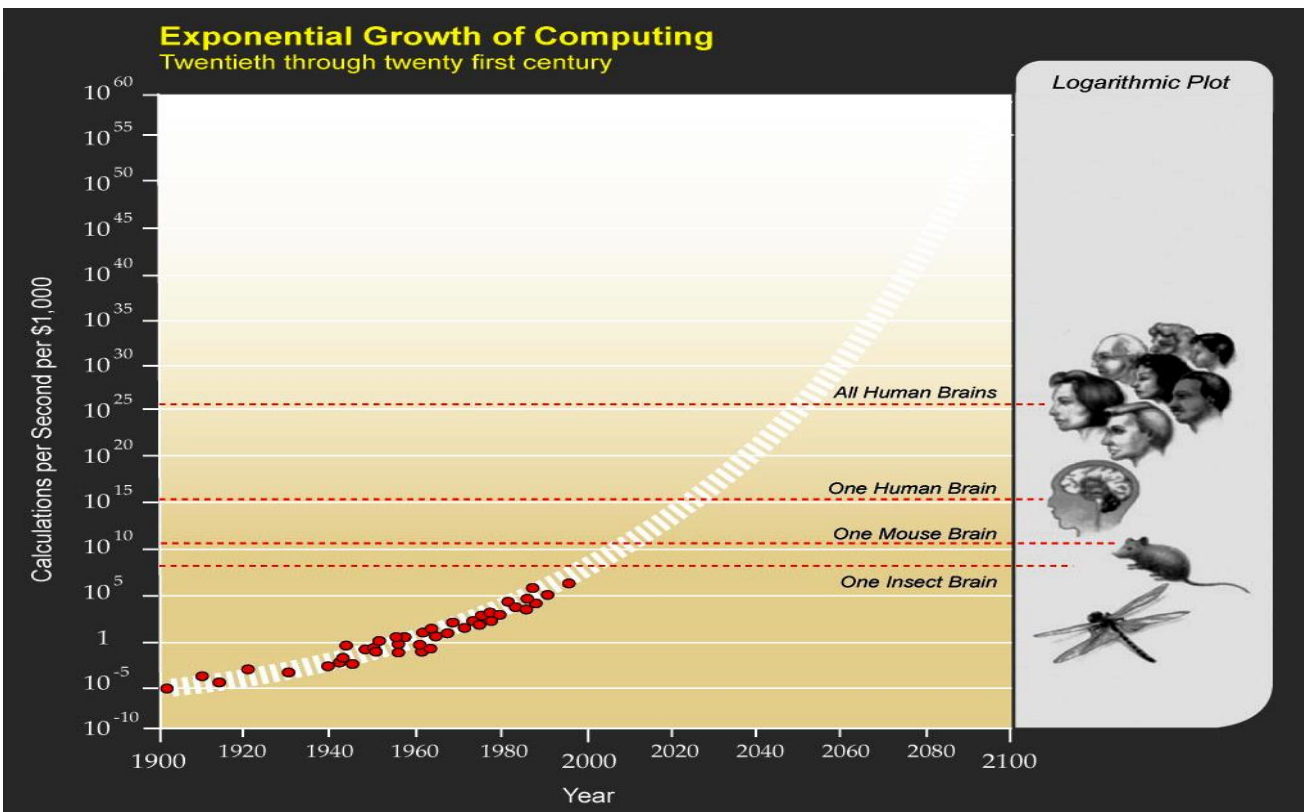
2010

AlphaGo and New AI

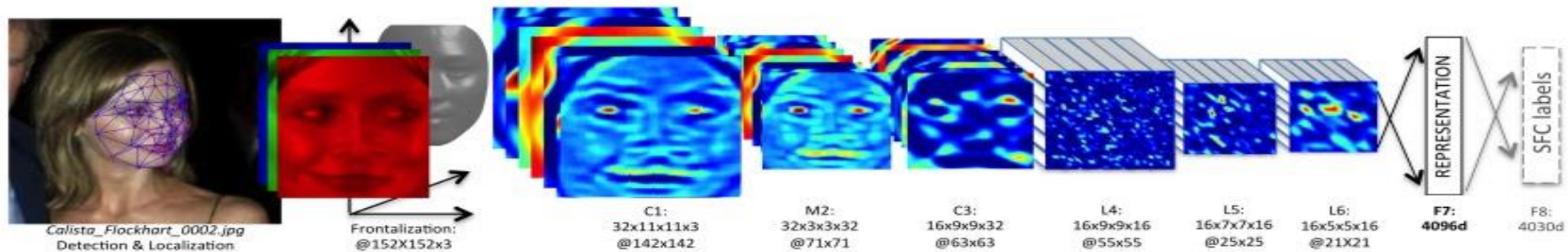
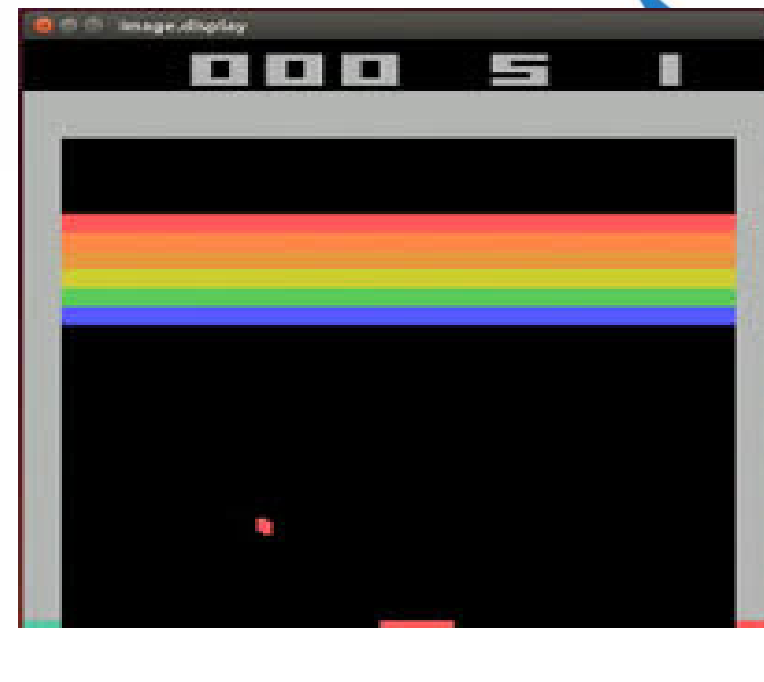
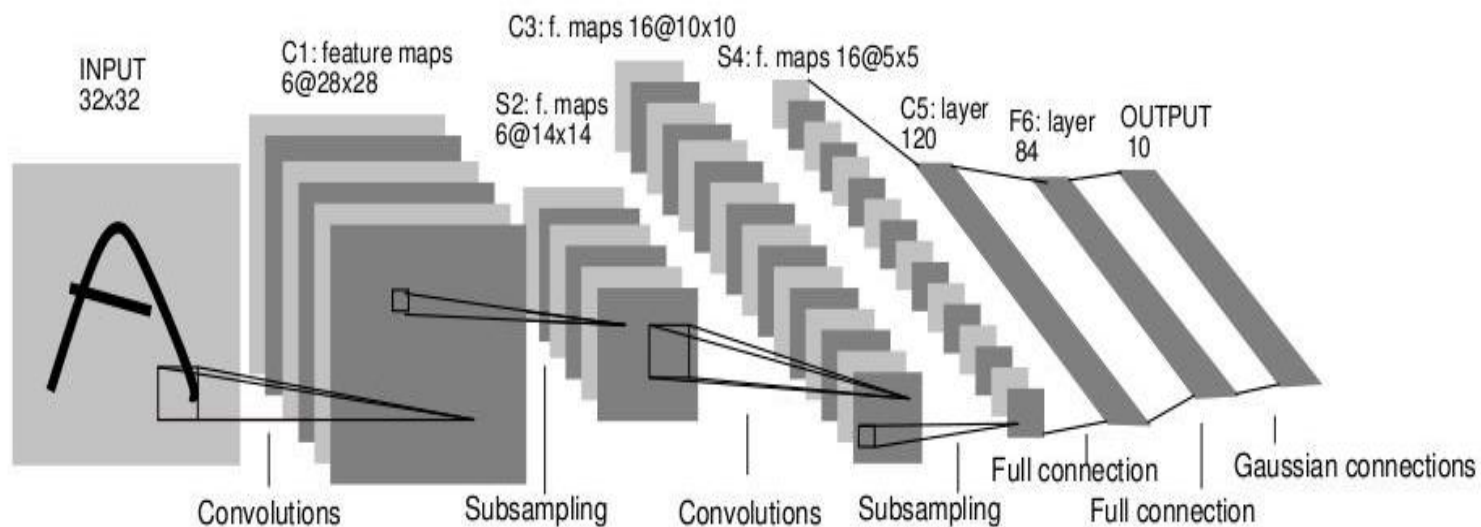
- 기존의 인공지능
 - 프로그래밍에 의해 사람의 지식을 기계에 주입하는 방식
 - 기계의 단순한 컴퓨팅 파워와 기억용량에 의존한 최적화에 기반
- 알파고
 - 딥러닝과 강화학습을 통해 게임의 전략까지도 스스로 학습
 - 자가학습을 통한 스스로 끊임없이 성능을 향상하는 능력
 - 인간의 약점을 극복하고 강점을 살리는 지능폭발의 가능성을 보여주는 사례



Intelligence Explosion and Singularity


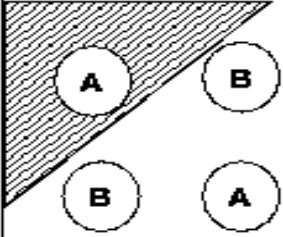
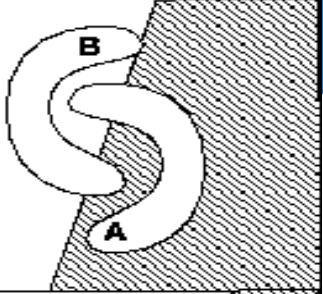
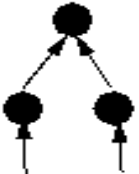
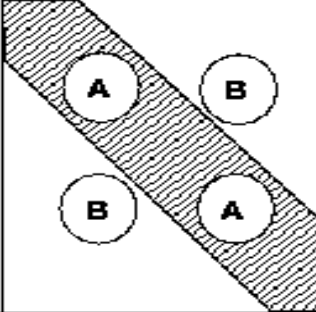
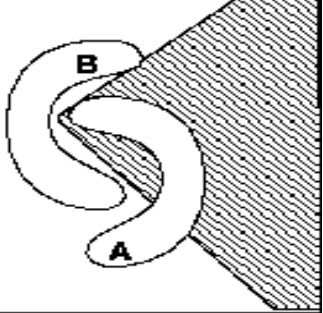
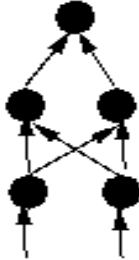
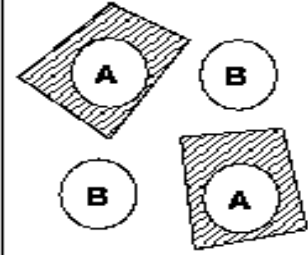
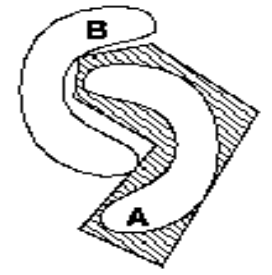


Enabling Technology for the Intelligence Explosion

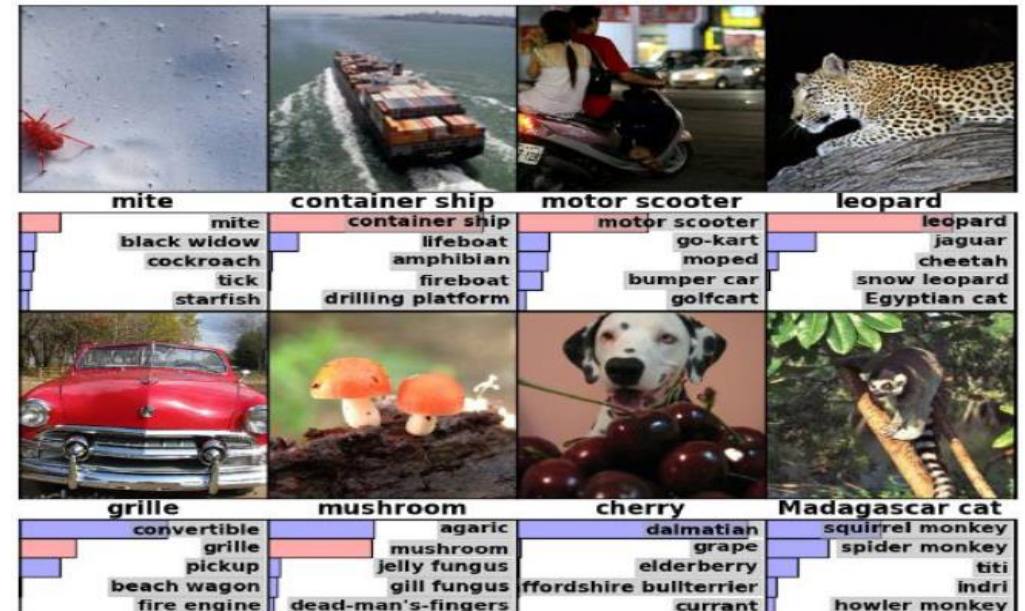
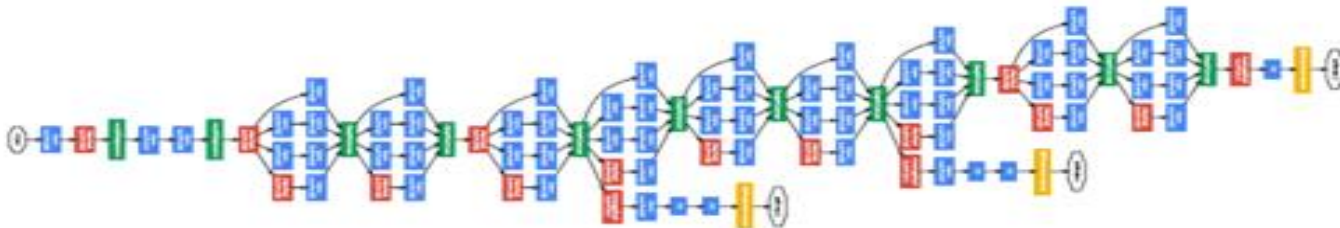


왜 딥러닝?

- Multiple boundaries are needed (e.g. XOR problem)
→ **Multiple Units**
- More complex regions are needed (e.g. Polygons)
→ **Multiple Layers**
- **Big Data + Deep Learning**
→ **Automatic Programming**

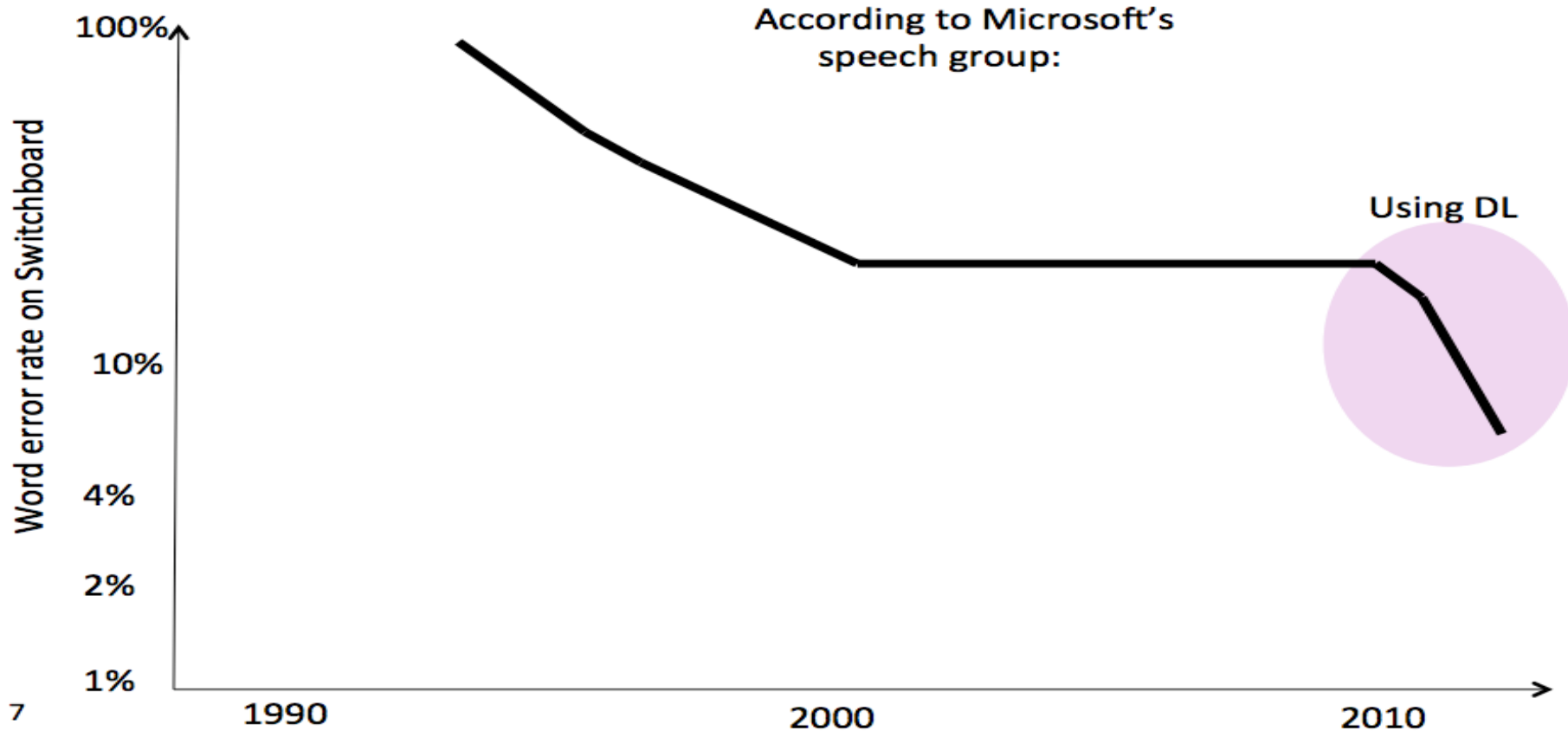
Structure	Regions	XOR	Meshed regions
single layer 	Half plane bounded by hyper-plane		
two layer 	Convex open or closed regions		
three layer 	Arbitrary (limited by # of nodes)		

- ImageNet Large-Scale Visual Recognition Challenge
 - Image Classification/Localization
 - 1.2M labeled images, 1000 classes
 - Convolutional Neural Networks (CNNs) has been dominating the contest since..
 - 2012 non-CNN: 26.2% (top-5 error)
 - 2012: (Hinton, AlexNet) 15.3%
 - 2013: (Clarifai) 11.2%
 - 2014: (Google, GoogLeNet) 6.7%
 - (pre-2015): (Google) 4.9%
 - Beyond human-level performance

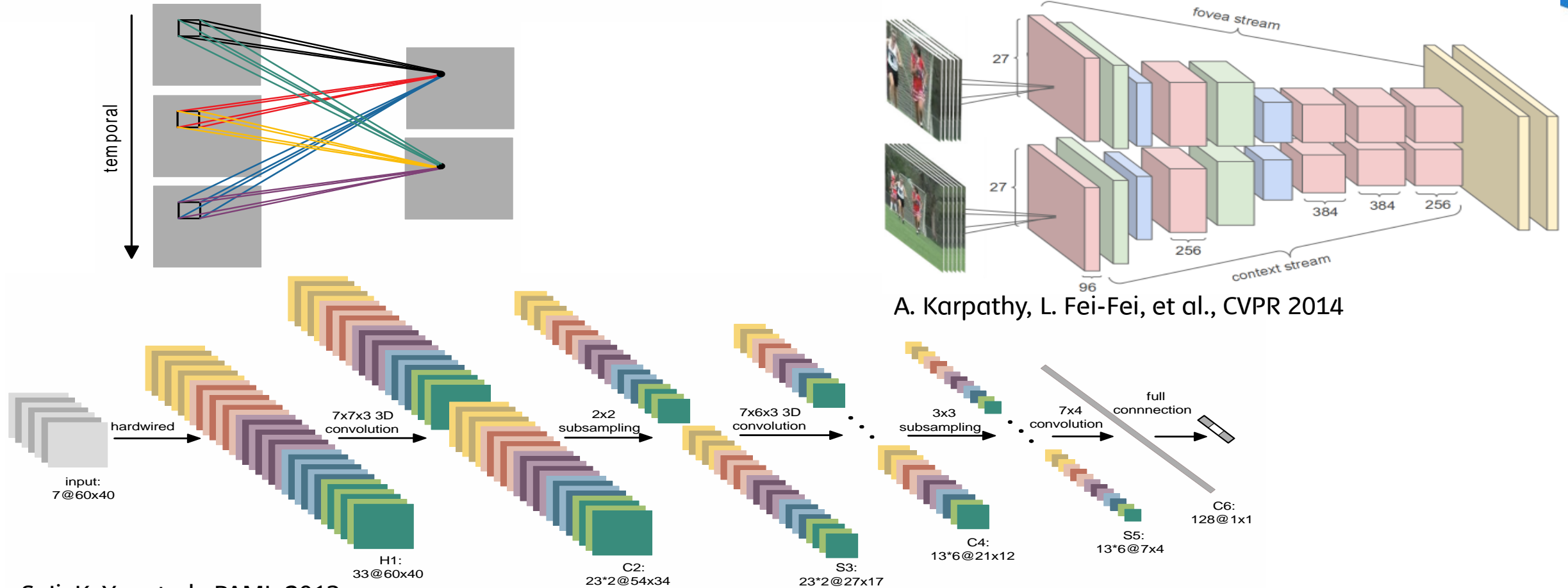


딥러닝 – 음성 인식 Big Data

- ~2010 GMM-HMM (Dynamic Bayesian Models)
- ~2013 DNN-HMM (Deep Neural Networks)
- ~Current LSTM-RNN (Recurrent Neural Networks)



- Use 3D CNNs to model the temporal patterns as well as the spatial patterns



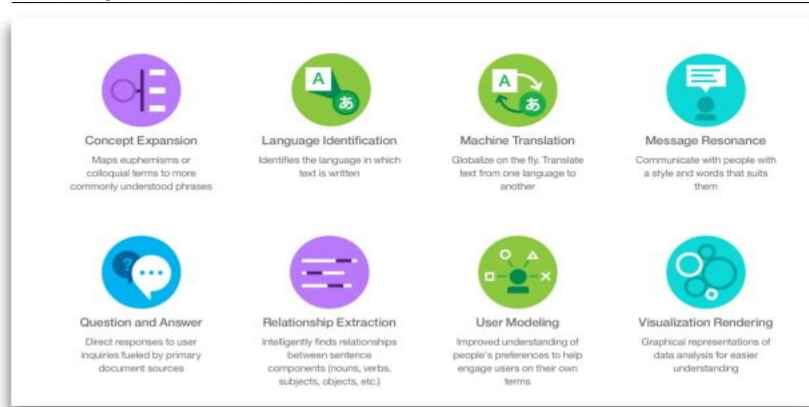
A. Karpathy, L. Fei-Fei, et al., CVPR 2014

IBM Watson API

Microsoft Oxford API

Google TensorFlow

I need you here Watson



A grid of eight icons representing Watson API capabilities:

- Concept Expansion:** Maps euphemisms or colloquial terms to more commonly understood phrases.
- Language Identification:** Identifies the language in which text is written.
- Machine Translation:** Globalize on the fly. Translate text from one language to another.
- Message Resonance:** Communicate with people with a style and words that suits them.
- Question and Answer:** Direct responses to user inquiries fueled by primary document sources.
- Relationship Extraction:** Intelligently finds relationships between sentence components (nouns, verbs, subjects, objects, etc.).
- User Modeling:** Improved understanding of people's preferences to help engage users on their own terms.
- Visualization Rendering:** Graphical representations of data analysis for easier understanding.

© 2013 IBM Corporation



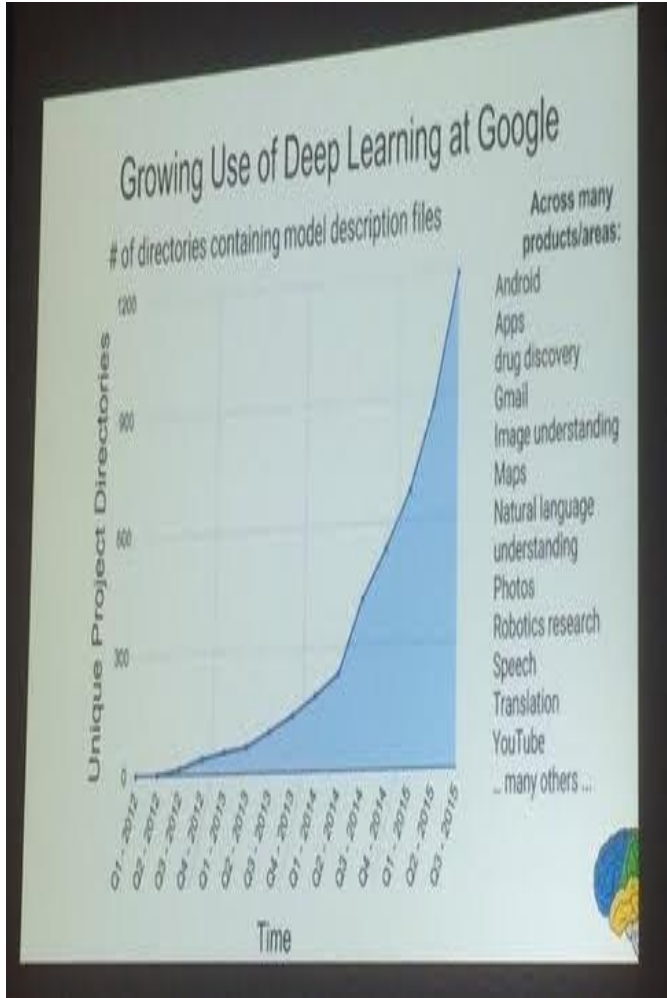
A screenshot of the Microsoft Oxford API emotion recognition interface. It shows a group of people with bounding boxes around their faces, each labeled "Happiness". Below the image is a legend for emotion levels:

Neutral:	=====	Anger:	=====
Happiness:	=====	Disgust:	=====
Surprise:	=====	Fear:	=====
Sadness:	=====	Contempt:	=====

Microsoft logo and "Get started for free at projectoxford.ai" are visible in the bottom right corner.

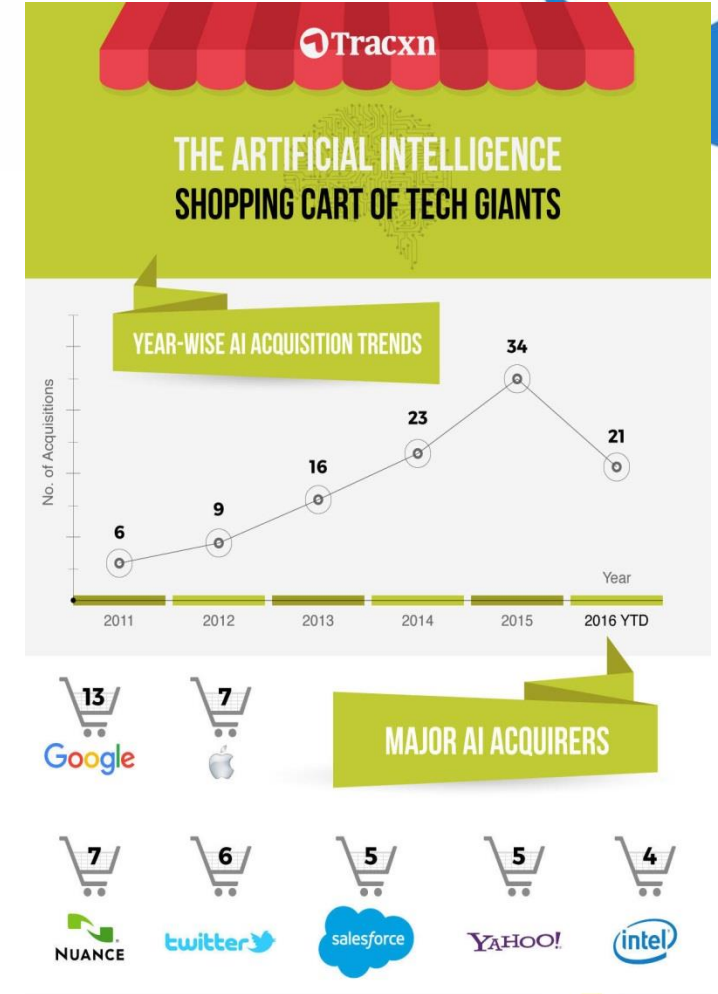
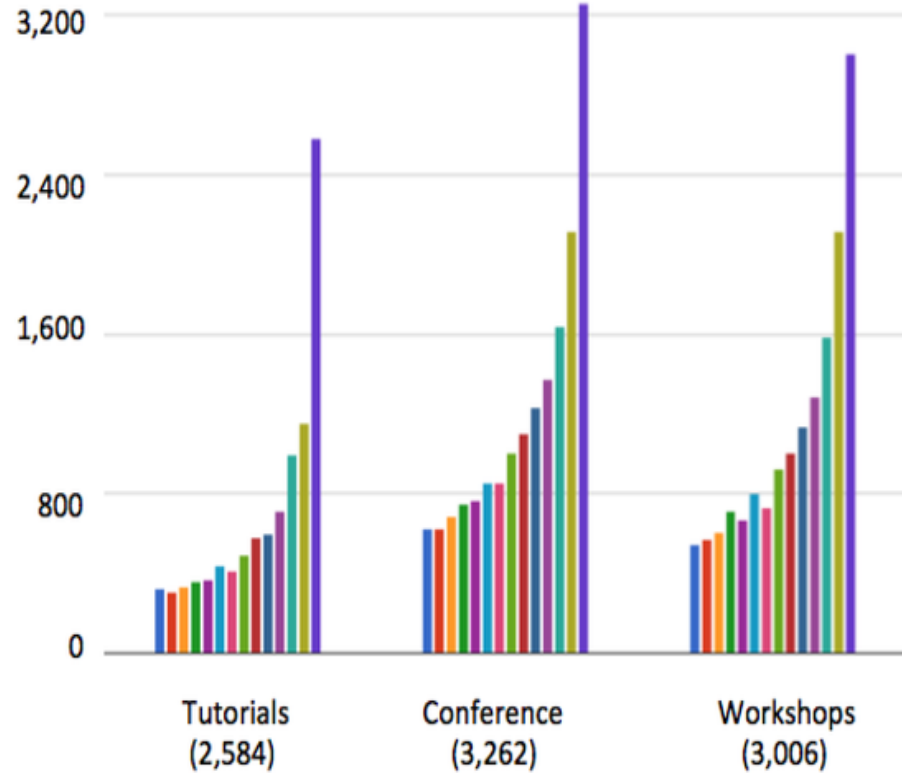


AI / Deep Learning Growth

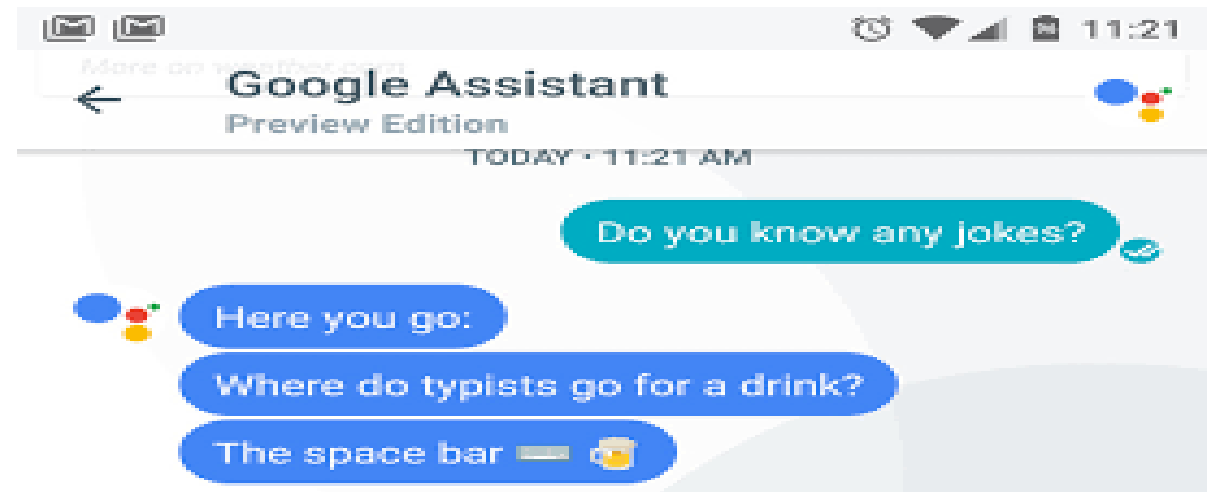


NIPS Growth

Total Registrations 3755



Personal Assistants / Chatbots



AI Devices / Smart Speakers

Amazon Echo

amazon echo

Always ready, connected, and fast. *Just ask.*



Google Home



SKT NUGU



Personal Robots



PR2 (Willow Garage)

Care-O-bot 4 (Fraunhofer)



Buddy (Blue Frog)



Pepper (SoftBank)



Sophia
(Hanson Robotics)



Atlas
(Boston Dynamics)



2. AI + Big Data에 의한 디지털 이노베이션

4차 산업혁명과 AI



제1차 산업혁명
18세기

증기기관 기반의
기계화 혁명



제2차 산업혁명
19~20세기 초

전기 에너지 기반의
대량생산 혁명



제3차 산업혁명
20세기 후반

컴퓨터와
인터넷 기반의
지식정보 혁명



제4차 산업혁명
(제2차 정보혁명)
21세기 초반~

[**지능정보기술**]

지능

AI SW

정보

빅데이터
IoT
클라우드

+

Smart Machines – 4차산업혁명시대 신산업



GE Digital
Predix



Siemens
MindSphere



FANUC
Preferred Networks



Amazon Robotics



UPS Chatbot

Meet the UPS chatbot

UPS is accelerating on an Artificial Intelligence (AI) learning journey. Our new chatbot leads the way.

UPS INVESTS \$1 BILLION A YEAR IN TECHNOLOGY

About the UPS chatbot: Available through Facebook Messenger, Skype and Amazon platforms. Identifies: @TheUPSBot on Facebook Messenger, The UPS Skill for Alexa on Amazon.

How it can help you: Assists with shipping rates, finding UPS locations and tracking packages. Responds immediately in conversational language. Accessible through Amazon's virtual assistant Alexa for customers with an Amazon Echo, Dash or Tap.

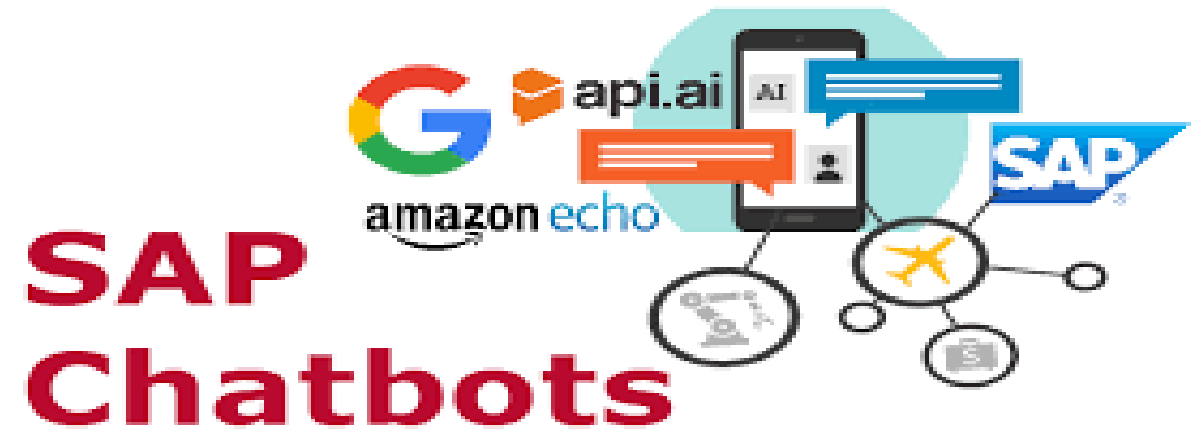
What's next for UPS and AI:

- UPS will enhance the chatbot to incorporate UPS My Choice, a service that lets consumers take control of their package deliveries.
- UPS will make chatbots an important communication channel for customers over the next few years.
- UPS is incorporating artificial intelligence throughout our customer-facing technologies.

Salesforce Einstein



SAP Chatbots



Google Nest



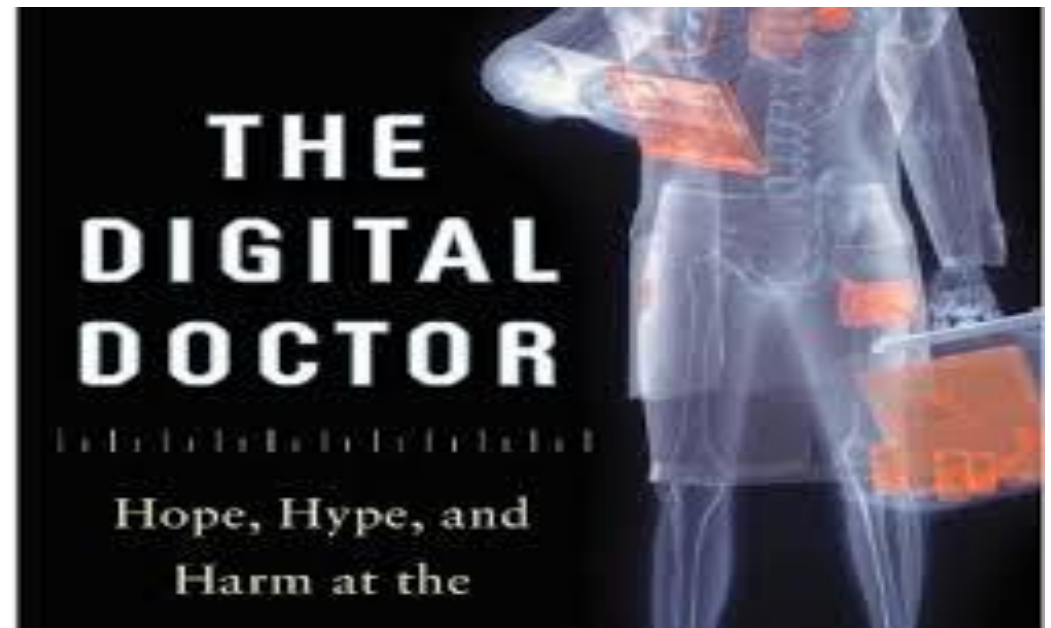
Apple HomeKit



Digital Health

Digital Medicine

Digital Doctor



Relay Hotel Delivery Robot



Pepper Service Robot



3. 인공지능의 미래

Humans (NI) and Machines (AI)

- Introspectionism – 1920

Psyche

- Behaviorism ↔ Cybernetics 1920–1950

Mind (= Computer)

- Cognitivism ↔ Symbolic AI 1950–1980

Brain

- Connectionism ↔ Neural Nets (ML) 1980–2010

Body

- Action Science ↔ Autonomous Robots 2010–

Environment

Embodied Mind / Mind Machine (= Smart Machine)



Her (2013)



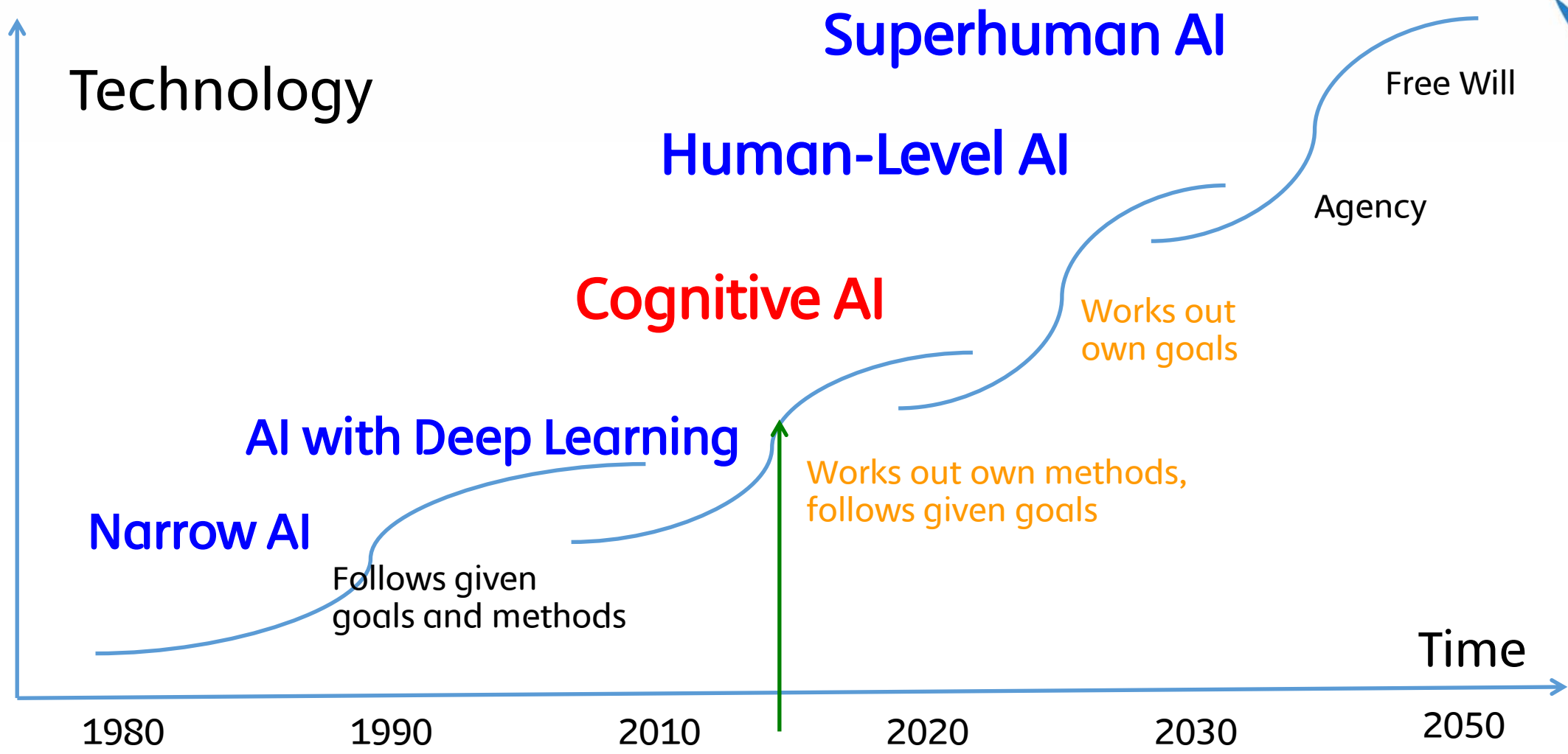
Robot & Frank (2012)

Bicentennial Man (1999)



Ex Machina (2015)





Modified from Eliezer Yudkowsky & David Wood

감사합니다