Advanced Technology Trend & Application for e-Governance (ICBMA)

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KOICA

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Professor/Lecturers

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<Working Experience>

- President, Korea ICT Convergence Research Association(Oct., 2014~)
- CEO, MOS Corporation(Jan., 2011 ~ Mar., 2013)
- Vice President, KT Corporation(Jan., 1984 ~ Dec., 2010)
- Researcher, Electronics and Telecommunications Research Institute(Apr., 1980 ~ Dec., 1983)

<Education Background>

- National Defense University/ Graduate Security Course(2005)
- Seoul University/ Business School MBA(1999)
- Yonsei University/ Electronic Engineering M.S.(1984)
- Ulsan Institute of Technology/ Electronic Engineering B.S.(1980)

Index

I. Application of Advanced Technology for e-Government

II. Advanced technology, ICBMA

1. IoT(Internet of Things)
2. Cloud Computing
3. Big Data
4. Mobile Network(5G)
5. AI(Artificial Intelligence)

Application of Advanced Technology for e-Government

Intellectualizing & informatization of SOC

Concept of SOC(Social Overhead Capital)

Facilities which government is operating, such things as roads, power transmission system, telecommunication, etc.

Scope of SOC

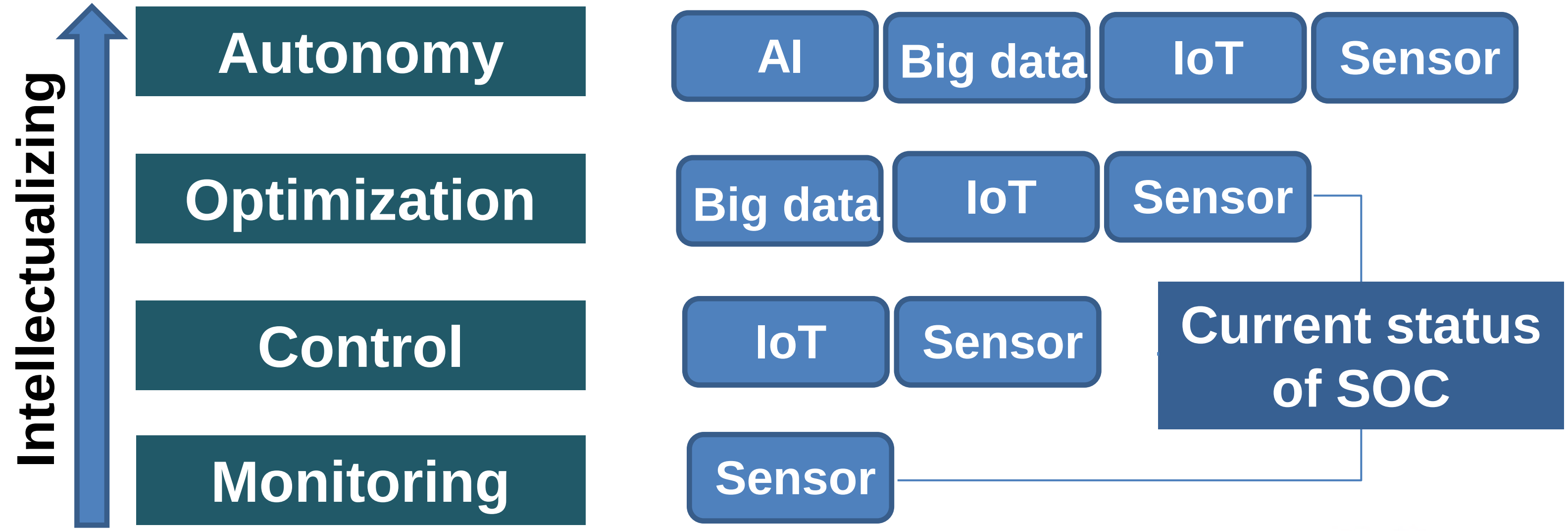
Transportation facility	>	Roads, airport, terminal etc.
Industrial facility	>	Electricity, Gas, Broadcast etc.
Environment facility	>	Sewerage, waste handling etc.
Safety facility	>	CCTV, underground area etc.
Public facility	>	School, museum, hospital etc.

Intellectualizing & informatization of SOC

The Intellectualizing and informatization of SOC is a phenomenon that has intelligence using IoT, big data and AI technology in all areas of national infrastructure

- **Digitalization(Sensor) → Data connection(IoT) → Analysis(Bigdata) → Optimization/autonomy(AI)**

Intellectualizing stage of SOC


Intellectualizing
Autonomy
AI
Big data
IoT
Sensor
Optimization
Big data
IoT
Sensor
Control
IoT
Sensor
Current status of SOC
Monitoring
Sensor

Application of Advanced Technology to e-Government

Aiming to become a world-class intelligent government

- Application of the Internet of Things (IoT)
  - The public sector: agriculture, livestock, marine products, and food
- Creation of Cloud computing environment
  - The National Computing and Information Service is being transformed into cloud-based computing (G-cloud).
- Laying the groundwork for the collection and wide-scale use of big data
  - Population movement, toxic substance of medicine, weather, and traffic volume information
- Development of Mobile Government Services
  - A mobile vehicle detaining system, parking monitoring system, fire engine control system, and population census system, as well as its mobile on-Nara (Business Process System) and mobile e-people (Personnel Policy Support System) systems

Advanced Technology, ICBMA(IoT, Cloud, Big data, Mobile, AI)

ICBMA ?

I

IoT (Internet of Things)

The inter-networking of physical devices, vehicles, buildings, and other items and network connectivity which enable these objects to collect and exchange data.

C

Cloud

Internet-based computing that provides shared computer processing resources and data to computers and other devices on demand.

AI

B

Big Data

Data sets that are so large or complex that traditional data processing application software is inadequate to deal with.

M

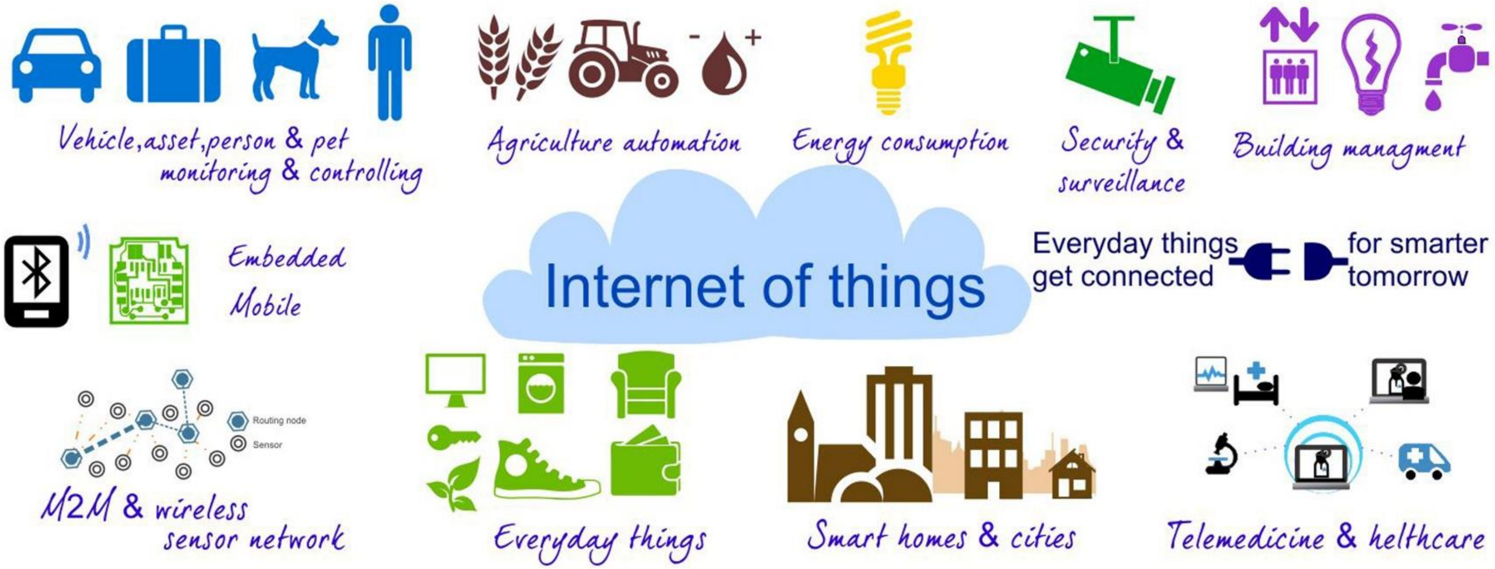
Mobile Network

Wireless communication infrastructure that can connect a smart device such as smartphone, tablet PC, smart watch … etc.

IoT (Internet of Things)

THE INTERNET of THINGS

What is the Things?


Vehicle,asset,person & pet monitoring & controlling
Agriculture automation
Energy consumption
Security & surveillance
Building managment
Embedded
Mobile
Internet of things
Everyday things get connected
for smarter tomorrow
Routing node
Sensor
M2M & wireless sensor network
Everyday things
Smart homes & cities
Telemedicine & helthcare

※ *Image Source: datasciencebe.com*

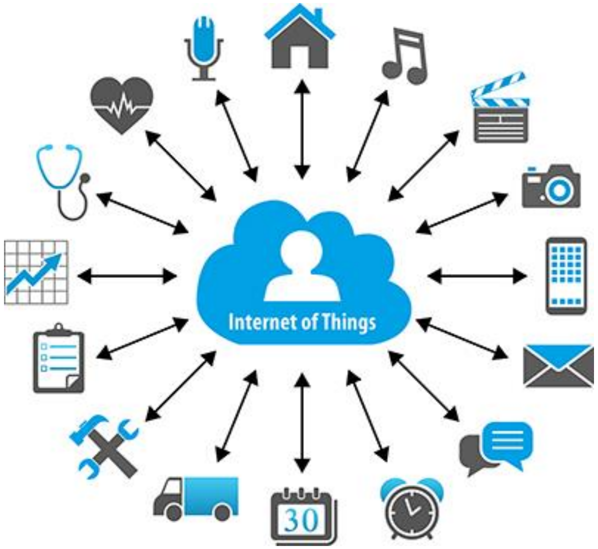
＋

- Embedded Computing Device
- Microcontroller based Device

Things are connected…

- < 5 Billion connected people
- Data meaningful in context
- From product…

Today



2025

- < 50 Billion connected things
- Data disassociated from any source
- …to everything delivered as a service

Things Provide…

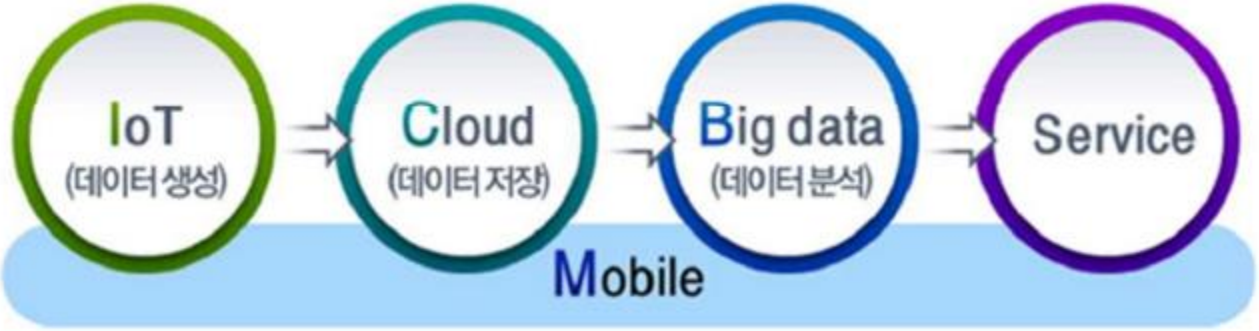
- **Identification and info storage** (RFID tags, MAC address) ※ MAC: Media Access Control
- **Information collection** (Sensor networks, store sensor values)
- **Information processing** (Understanding commands, filtering data)
- **Communications** (Transmit and receive messages)
- **Actuation** (Switch control, motor control)

IoT Structure & Function

IoT C-P-N-D-Se Model

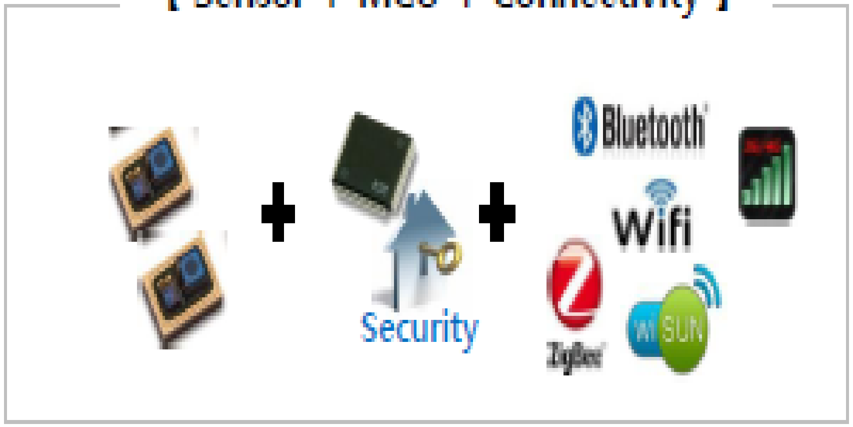
Service & Contents | Platform | Network | Device | Security

Service & Contents	**Platform**	**Network**	**Device**	**Security**
• Industry IoT, • Personal IoT, • Public IoT • Home IoT …	Open & Share & Data analysis …	•NFC/ZigBee •Bluetooth •USN •Mobile	•Smartphone •Sensor •Wearable device	Safety & Privacy


IoT
(데이터 생성)
Cloud
(데이터 저장)
Big data
(데이터 분석)
Service
Mobile

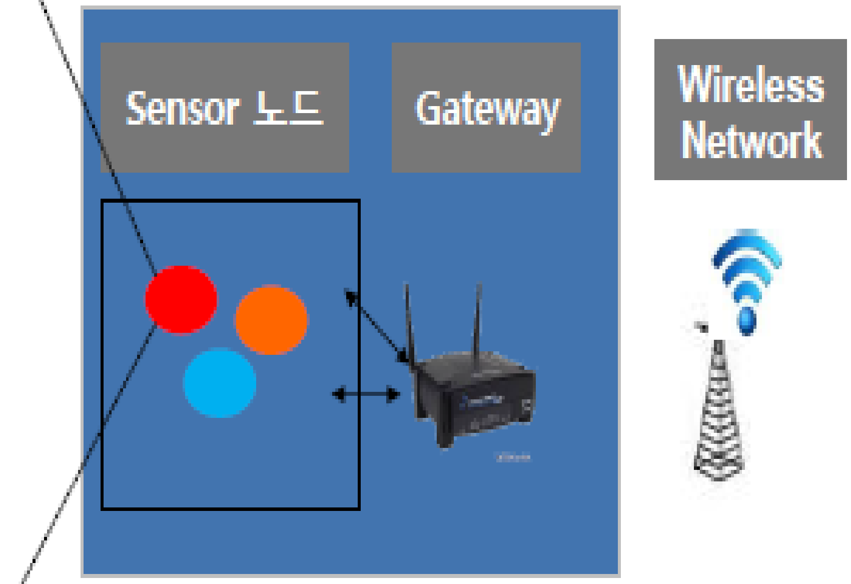
IoT Sensor: Basic Structure

[Sensor + MCU + Connectivity]

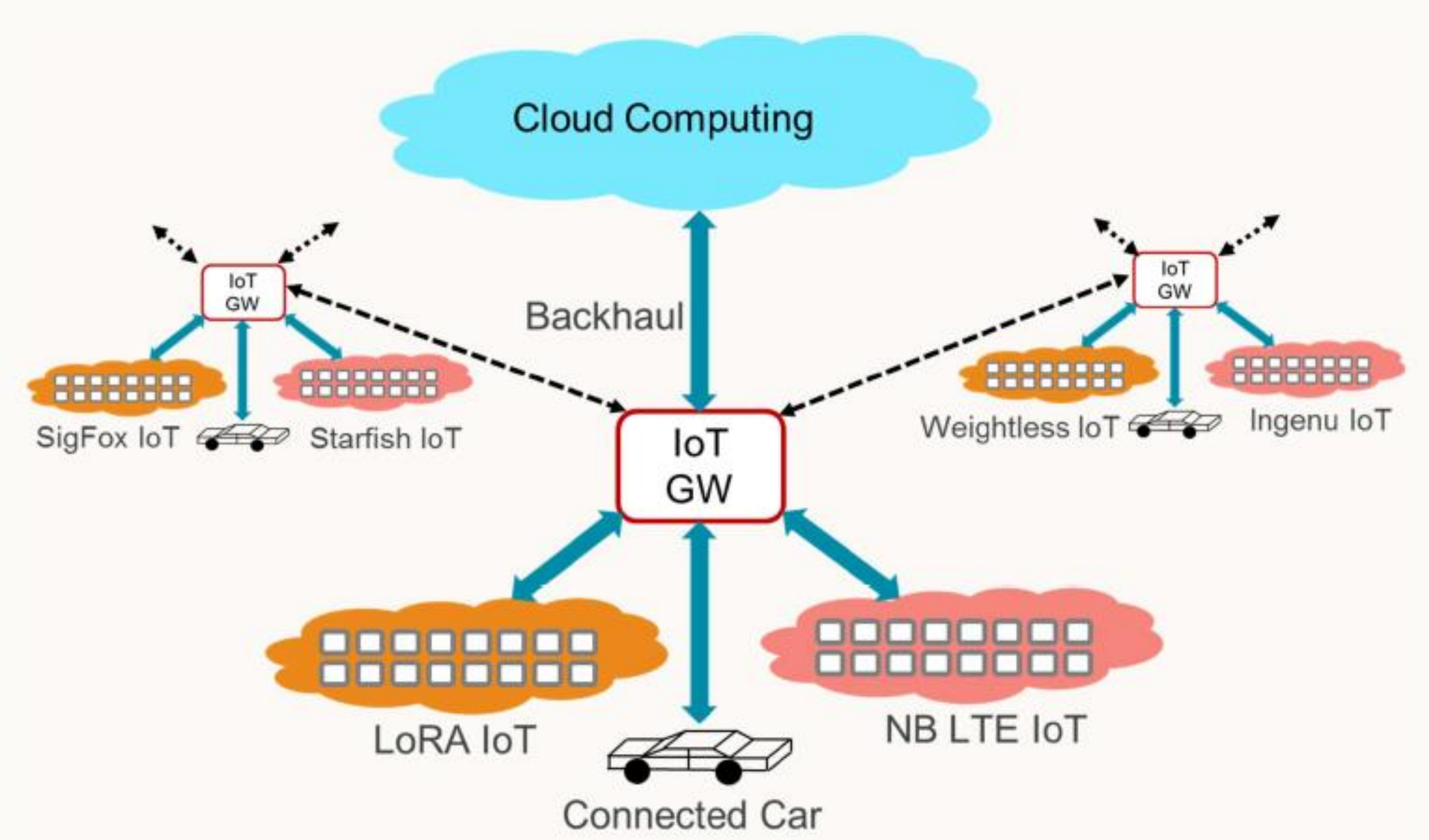

Security
Bluetooth
Wifi
ZigBee
wi SUN

	Sensor	MCU	Connectivity
Requirement	Low power	Low power	Low power
	High Accuracy	Security	Security
	Stability	Intelligence	Cost-Effective

[IoT Device 구성]


Sensor 노드
Gateway
Wireless Network

IoT: Dedicated network


Cloud Computing
Backhaul
IoT GW
IoT GW
IoT GW
SigFox IoT
Starfish IoT
Weightless IoT
Ingenu IoT
LoRA IoT
NB LTE IoT
Connected Car

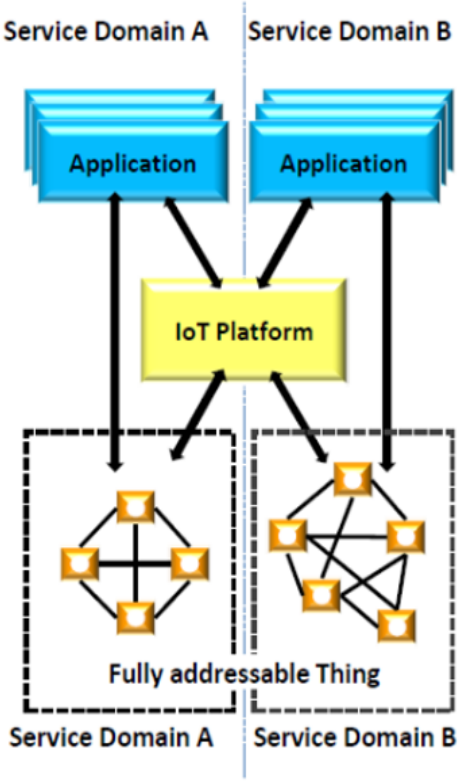
IoT: Dedicated network spec.

Classification	Low-power IoT dedicated network			Existing data network
	LoRa	NB-IoT	SigFox	LTE-M
Frequency band	Non-license (920MHz)	LTE Freq. band	Non-license (920MHz)	LTE Freq. band
Standardization	LoRa Alliance	3GPP LTE	ETSI	3GPP LTE
Cell coverage	~21km	~10Km	~10Km	~5Km
Transmission speed	~300Kbps	Hundreds of kbps	100~600bps	>10Mbps
Eco-system	• Open • Global	• Open • Global	• SigFox only	• Open • Global
Module price	~$5	$5 ~ $10		~$20

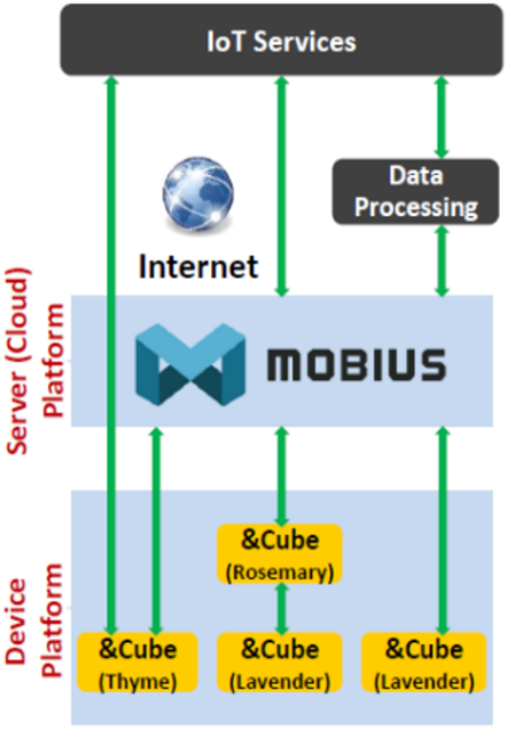
❖ LoRa: Long Rang / NB: Narrow Band

IoT: Platform

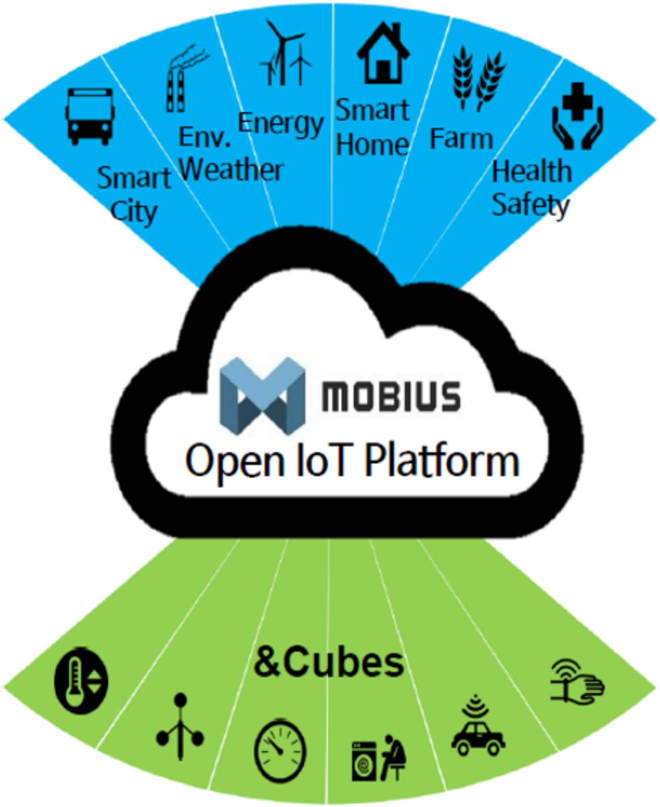
Mobius and Cube Platforms


Service Domain A
Service Domain B
Application
Application
IoT Platform
Fully addressable Thing
Service Domain A
Service Domain B

Horizontal IoT Platform Model


IoT Services
Internet
Data Processing
Server (Cloud) Platform
MOBIUS
Device Platform
&Cube (Rosemary)
&Cube (Thyme)
&Cube (Lavender)
&Cube (Lavender)

KETI's IoT Platform Model (Mobius and &Cube)

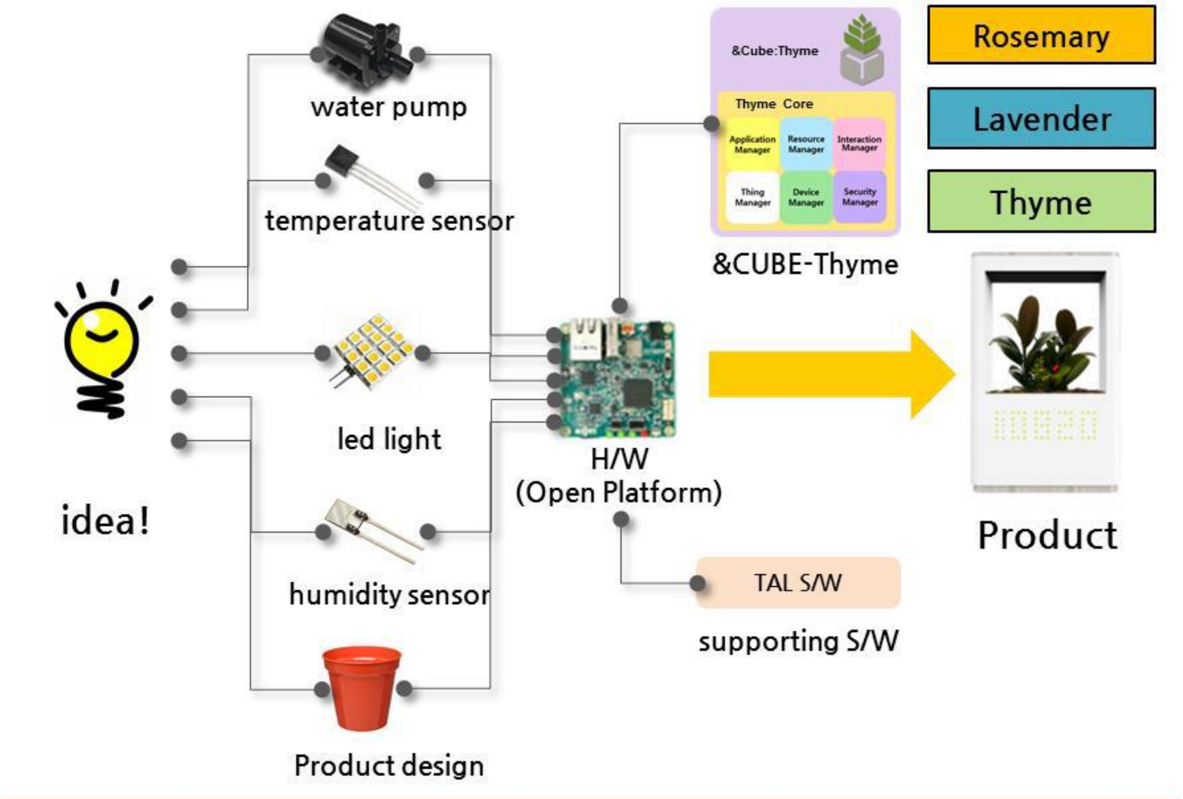

Smart City
Env. Weather
Energy
Smart Home
Farm
Health Safety
MOBIUS
Open IoT Platform
&Cubes

IoT Application Domains

❖ KETI(Korea Electronics Technology Institute) developed this platform

Development procedure for IoT Product

Product = Idea + H/W + &CUBE + TAS

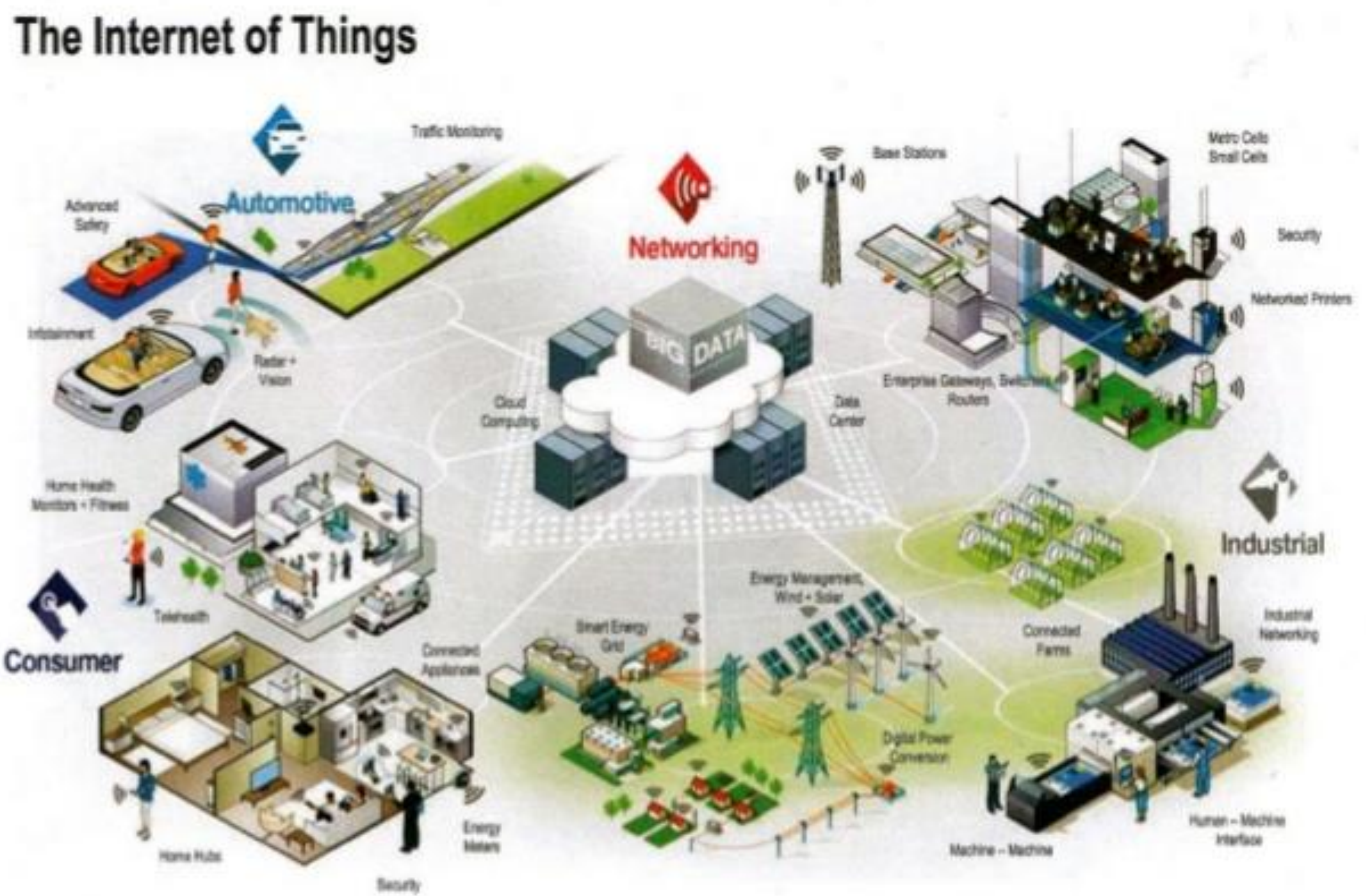

idea!
water pump
temperature sensor
led light
humidity sensor
Product design
&Cube:Thyme
Thyme Core
Application Manager
Resource Manager
Interaction Manager
Thing Manager
Device Manager
Security Manager
&CUBE-Thyme
H/W
(Open Platform)
TAL S/W
supporting S/W
Rosemary
Lavender
Thyme
Product

3 DAYS
화분모니터링 및 Twitter 연동
MOBIUS
[2015-11-16T23:57:27] Hubert's pot status is Temp: 22.6'C , Humi: 54.0%

KETI
Parrot
AR.Drone2.0
ARDrone 연결 제어
1 WEEK

❖ TAS: Thing Application Software

IoT Applications


The Internet of Things
Automotive
Traffic Monitoring
Advanced Safety
Infotainment
Radar + Vision
Networking
Base Stations
Metro Cells
Small Cells
Security
Networked Printers
BIG DATA
Cloud Computing
Data Center
Enterprise Gateways, Switches, Routers
Home Health Monitors + Fitness
Telehealth
Consumer
Connected Appliances
Home Hubs
Security
Energy Meters
Smart Energy Grid
Energy Management, Wind + Solar
Digital Power Conversion
Industrial
Connected Farms
Industrial Networking
Machine – Machine
Human – Machine Interface

Cloud(Computing)

Cloud Computing?

- **Cloud computing is an umbrella term used to refer to Internet based development and services**
- **A number of characteristics define cloud data, applications services and infrastructure:**
  - **Remotely hosted**: Services or data are hosted on remote infrastructure.
  - **Ubiquitous**: Services or data are available from anywhere.
  - **Commodified**: The result is a utility computing model similar to traditional that of traditional utilities, like gas and electricity - you pay for what you would want!

Cloud Service Model

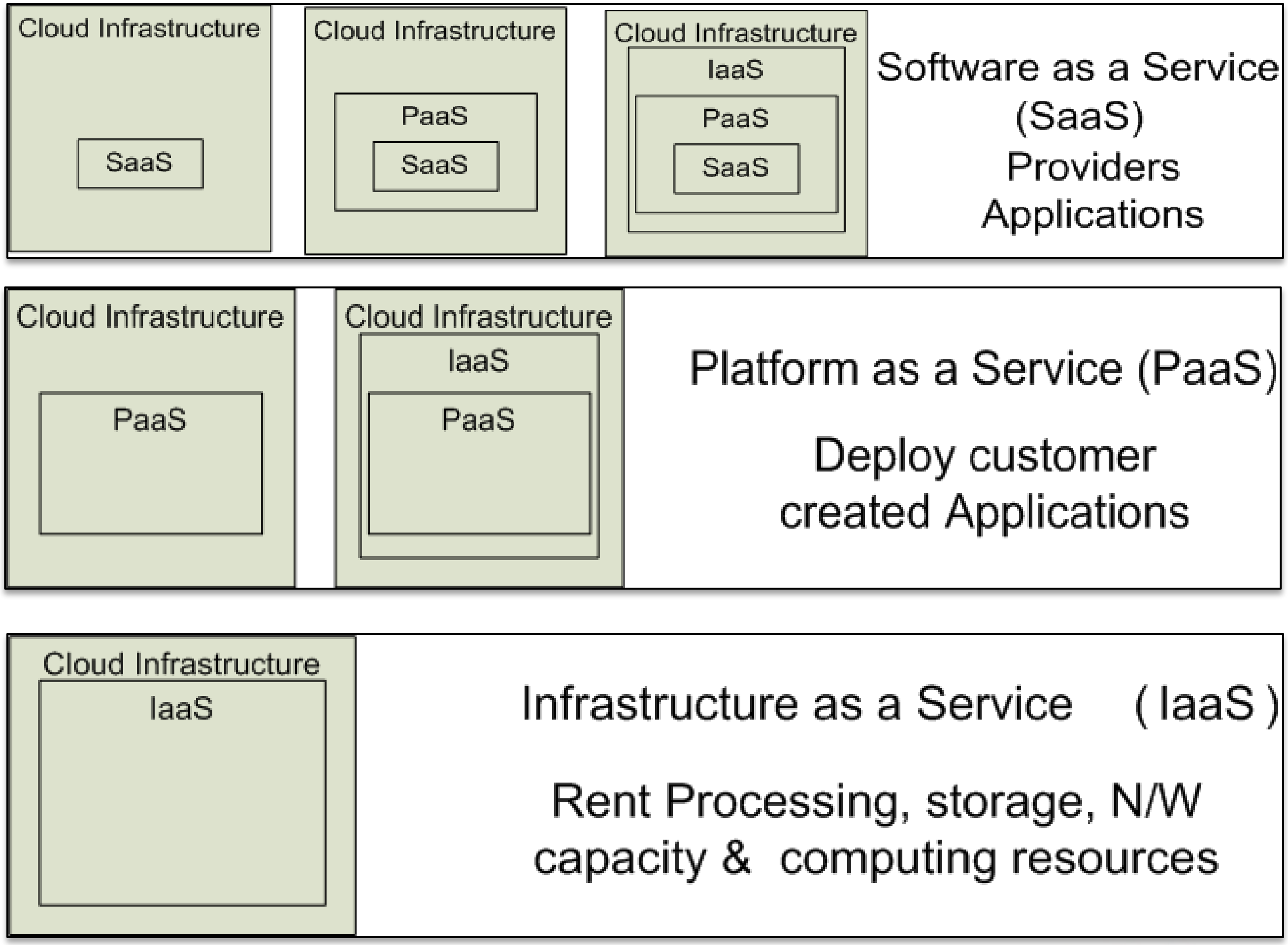
Software as a Service (SaaS)

Platform as a Service (PaaS)

Infrastructure as a Service (IaaS)

SalesForce
CRM
LotusLive

Google App


Cloud Infrastructure
SaaS
Cloud Infrastructure
PaaS
SaaS
Cloud Infrastructure
IaaS
PaaS
SaaS
Cloud Infrastructure
PaaS
Cloud Infrastructure
IaaS
PaaS
Cloud Infrastructure
IaaS

Software as a Service (SaaS)
Providers
Applications

Platform as a Service (PaaS)

Deploy customer created Applications

Infrastructure as a Service (IaaS)

Rent Processing, storage, N/W capacity & computing resources

SPI Service: SaaS

- **SaaS (Software-as-a-Service)**
  - vendor/provider controlled applications accessed over the network
  - characteristics
    - network based access
    - multi-tenancy
    - single software release for all
- **SaaS Examples**
  - Salesforce.com, Google Docs, MS Office

※ SPI: Service Provider Interface

SPI Service: PaaS

- **PaaS (Platform-as-a-Service)**
  - ➢ vendor provided development environment
    - tools & technology selected by vendor
    - control over data life-cycle
- **PaaS Examples**
  - ➢ Google app engine: Google Site + Google Docs

SPI Service: IaaS

- **IaaS (Infrastructure-as-a-Service)**
  - vendor provided and consumer provisioned computing resources
    - processing, storage, network, etc.
    - consumer is provided customized virtual machines
    - consumer has control over
      - OS, memory
      - storage
      - servers & deployment configurations
      - limited control over network resources
- **IaaS Examples**
  - Amazon Elastic Compute Cloud – EC2

SPI Service: Market Landscape

Software-as-a-Service (SaaS)	iCloud Google Drive Dropbox	salesforce SOFTWARE servicenow Google Apps Docs & Spreadsheets Calendar Talk Gmail StartPage	DEEZER YouTube Spotify
Platform-as-a-Service (PaaS)	mongoHQ fast & easy data management CLOUDANT	force.com platform as a service heroku Google App Engine	Akamai amazon cloudfront CLOUDFLARE
Infrastructure-as-a-Service (IaaS)	amazon web services S3	Windows Azure Cloudwatt amazon web services rackspace NUMERGY Google Compute Engine	orange Telefonica cogent communications Optical Internet Level(3) communications
	Storage	**Compute**	**Delivery**

Security in Cloud

- **Security**
  - Technology, provides assurance
    - confidentiality
    - integrity, authenticity
- **Privacy**
  - Right, provides control
    - anonymity
    - primary & secondary use

Advantages of Cloud Computing

- Lower computer costs
- Improved performance
- Reduced software costs
- Instant software updates
- Improved document format compatibility
- Unlimited storage capacity
- Increased data reliability
- Universal document access
- Latest version availability…

Big Data

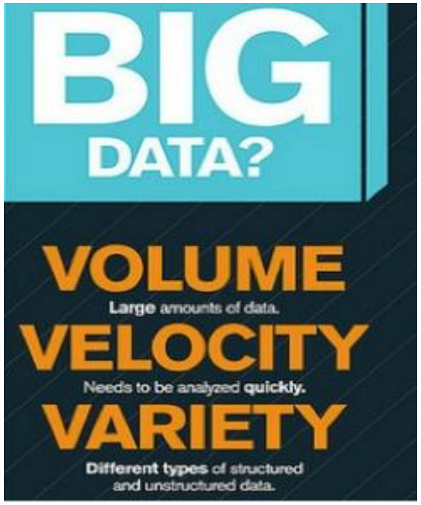
BIG
DATA
USE
ONE
SINCE
SOFTWARE
REQUIRING
UBIQUITOUS
BUSINESS
MOVING
ANALYTICS
SAN
RADIO-FREQUENCY
SOLID
COMPLEXITY
WIRELESS
TOLERABLE
PARALLEL
SIZE
NEEDED
QUALITIES
PROCESSING
BURIED
PETABYTES
LOGS
INTERNET
TECHNOLOGIES
ORGANIZATIONS
USED
DISTRIBUTED
CAPTURE
MAY
MANAGEMENT
MANAGE
GROW
SOCIAL
LARGE
DEFINING
STORE
EVERY
CASE
LARGER
STORAGE
CURRENT
THOUGHT
ELAPSED
EXAMPLES
APPLIED
DESCRIBING
AMOUNT
SETS
ABILITY
ARCHIVES
SENSOR
TARGET
DIFFICULTY
INDEXING
DATABASES
RESEARCH
MPP
COMPLEX
CITATION
COST
CONTINUES
TERABYTES
WORLD'S
PRESENTATIONS
NOW
PRACTITIONERS
FORMS
CAPACITY
TENS
FC
CURRENTLY
DESKTOP
USING
TYPES
WORKING
GARTNER
MASSIVELY
RELATED
BIOLOGICAL
PERFORMANCE
ALSO
HUNDREDS
CREATED
DISK
RELATIONAL
ZETTABYTES
GENOMICS
COMPUTING
TOOLS
SET
SHARED
TIME
WITHIN
COMBAT
SIGNIFICANT
PROCESS
INCLUDE
SYSTEMS
DEFINITION
BIOGEOCHEMICAL
NETWORKS
RECONSIDER
SEARCH
OPPORTUNITIES
INFORMATION
CONNECTOMICS
RECORDS

Big Data: Definition

- No single standard definition…

"***Big Data***" is data whose scale, diversity, and complexity require new architecture, techniques, algorithms, and analytics to manage it and ***extract value and hidden knowledge*** from it…

Big Data: 3V's

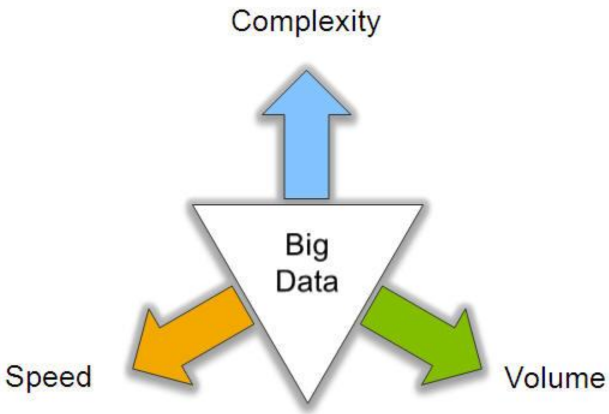


BIG DATA?

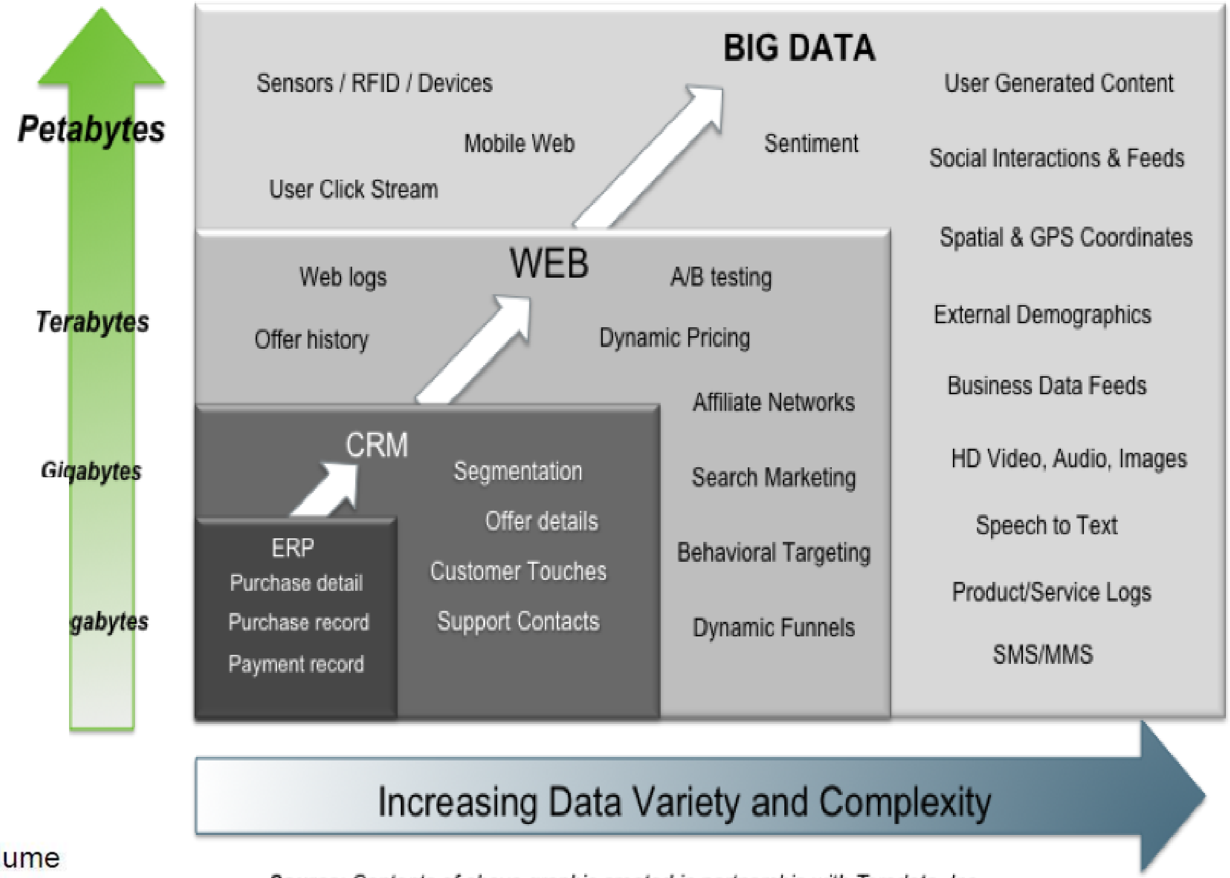
VOLUME
Large amounts of data.

VELOCITY
Needs to be analyzed quickly.

VARIETY
Different types of structured and unstructured data.


Complexity
Big Data
Speed
Volume

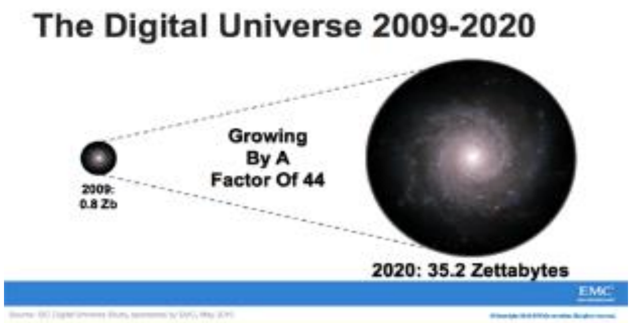
Big Data = Transactions + Interactions + Observations

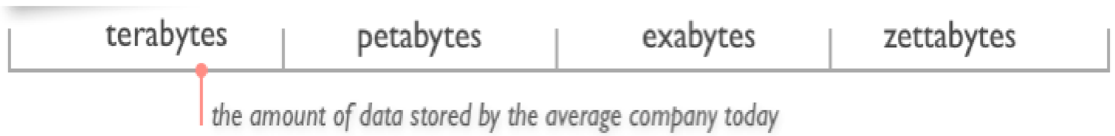

Petabytes
Terabytes
Gigabytes
gabytes
BIG DATA
Sensors / RFID / Devices
Mobile Web
User Click Stream
Sentiment
User Generated Content
Social Interactions & Feeds
Spatial & GPS Coordinates
External Demographics
Business Data Feeds
HD Video, Audio, Images
Speech to Text
Product/Service Logs
SMS/MMS
WEB
Web logs
Offer history
A/B testing
Dynamic Pricing
Affiliate Networks
Search Marketing
Behavioral Targeting
Dynamic Funnels
CRM
Segmentation
Offer details
Customer Touches
Support Contacts
ERP
Purchase detail
Purchase record
Payment record
Increasing Data Variety and Complexity

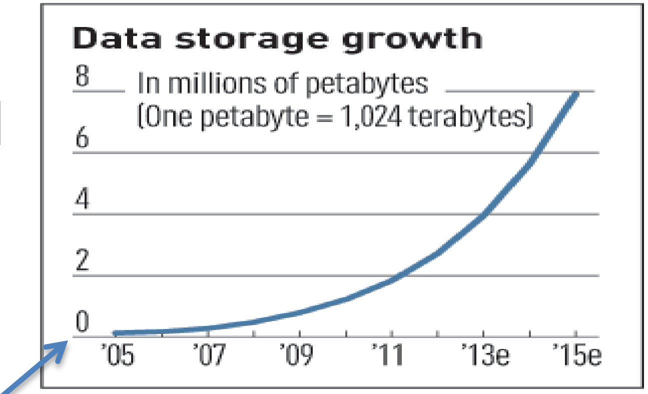
***Source**: Contents of above graphic created in partnership with Teradata, Inc.*

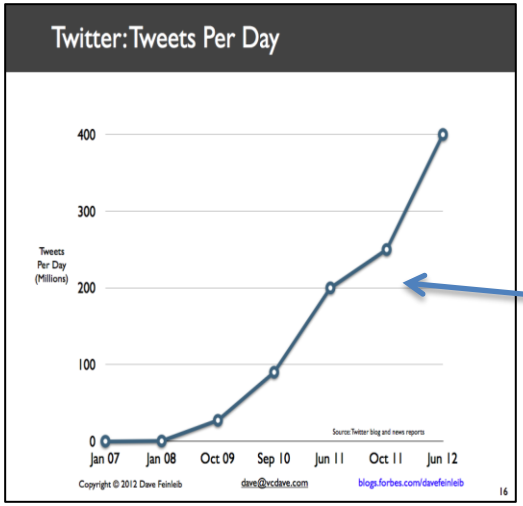
Characteristics of Big Data: Scale (Volume)

- **Data Volume**
  - 44x increase from 2009 to 2020
  - From 0.8 zettabytes to 35zb
- **Data volume is increasing exponentially**


The Digital Universe 2009-2020
Growing By A Factor Of 44
2009: 0.8 Zb
2020: 35.2 Zettabytes
EMC


terabytes
petabytes
exabytes
zettabytes
the amount of data stored by the average company today

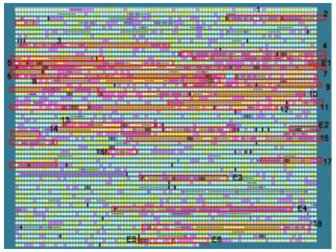


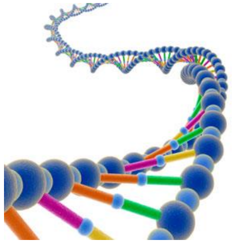


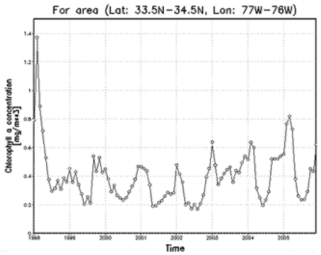
Exponential increase in collected/generated data

Characteristics of Big Data: Complexity (Varity)

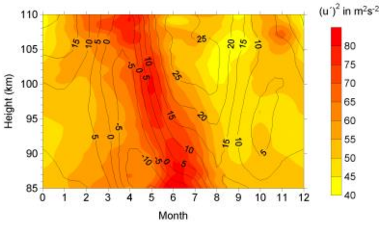
- Various formats, types, and structures
- Text, numerical, images, audio, video, sequences, time series, social media data, multi-dim arrays, etc. …
- Static data vs. streaming data
- A single application can be generating/collecting many types of data






For area (Lat: 33.5N–34.5N, Lon: 77W–78W)
Chlorophyll a concentration [mg/m**3]
Time

You Tube
flickr
digg
facebook
Social Media
Bandwagon

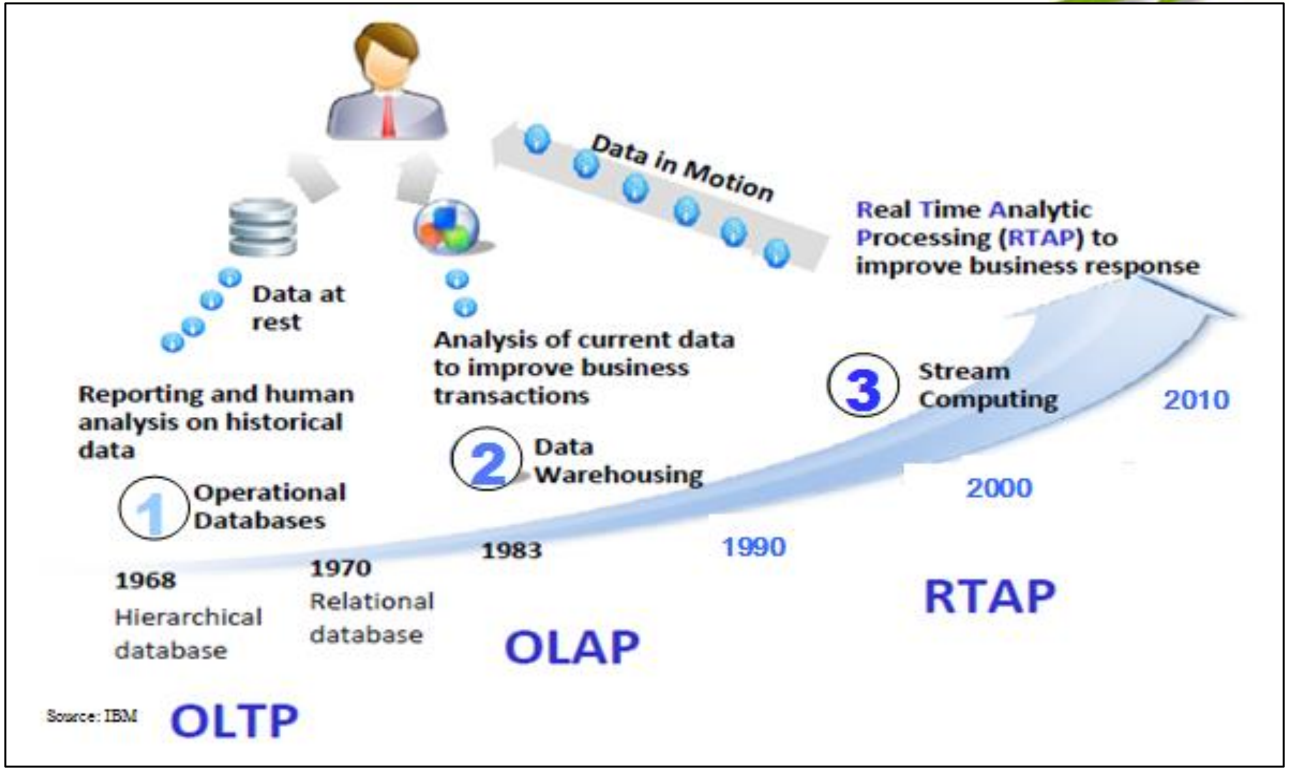


To extract knowledge➔ all these types of data need to linked together

Characteristics of Big Data: Speed (Velocity)

- Data is begin generated fast and need to be processed fast
- Online Data Analytics
- Late decisions ➔ missing opportunities
- **Examples**
  - **E-Promotions:** Based on your current location, your purchase history, what you like ➔ send promotions right now for store next to you
  - **Healthcare monitoring:** sensors monitoring your activities and body ➔ any abnormal measurements require immediate reaction

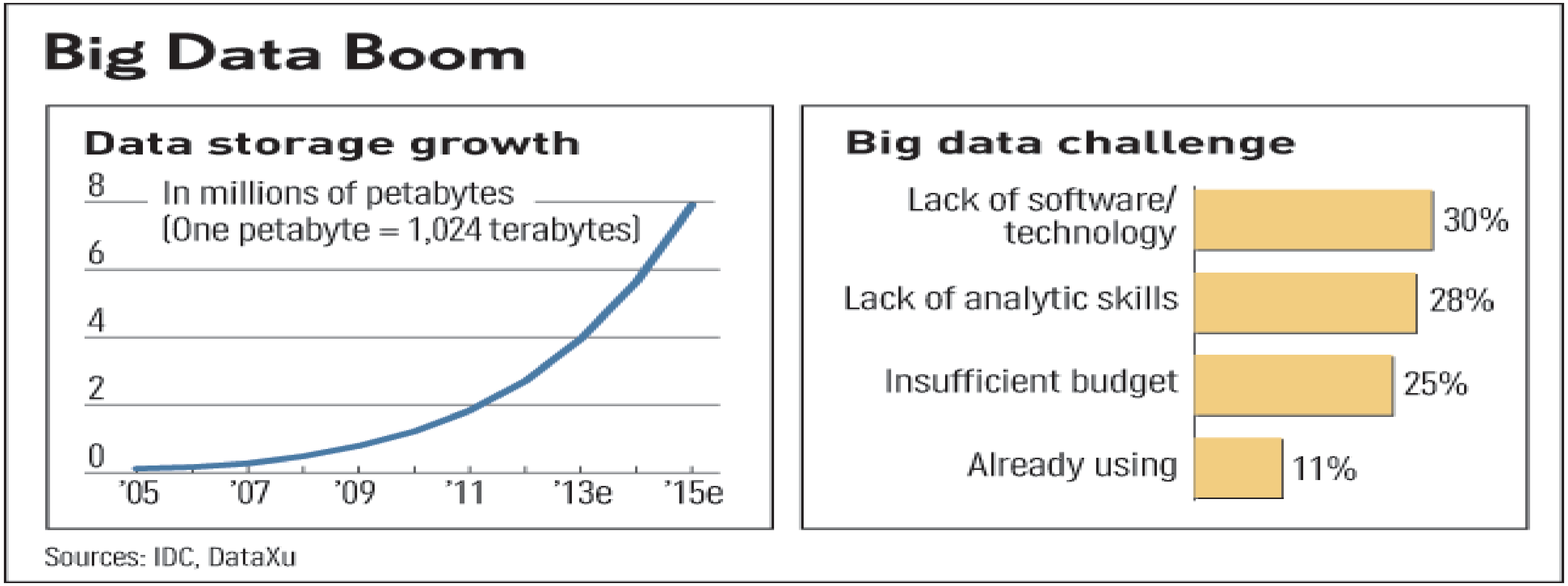
Harnessing Big Data


Data in Motion
Real Time Analytic Processing (RTAP) to improve business response
Data at rest
Analysis of current data to improve business transactions
Reporting and human analysis on historical data
3 Stream Computing
2010
2 Data Warehousing
2000
1 Operational Databases
1983
1990
1968
Hierarchical database
1970
Relational database
RTAP
OLAP
OLTP

Source: IBM

- **OLTP:** Online Transaction Processing (DBMSs)
- **OLAP:** Online Analytical Processing (Data Warehousing)
- **RTAP:** Real-Time Analytics Processing (Big Data Architecture & technology)

Challenges in Handling Big Data



Sources: IDC, DataXu

- **The Bottleneck is in technology**
  - New architecture, algorithms, techniques are needed
- **Also in technical skills**
  - Experts in using the new technology and dealing with big data

Mobile Network (5G)

Mobile Communication Trend

Smart Devices Explosion

x10 ~ x1000
5Billion
to
5Trillion

Super-fast Hyper Connection

Connecting all
devices derives new
business models

Cost Effective Systems

Need New Solution
to resolve ARPU
reduction over
CAPEX/OPEX

Giga Service Demand

Driven by display
tech. & Giga
networks
(AR, Hologram, UHD)

Welfare Infra Demand

National wide
knowledge based
service for all people
in need

Mobile Service Trend

- Multimedia Services will Require More and More Bandwidth
- Mobile Cloud Services are Growing Rapidly

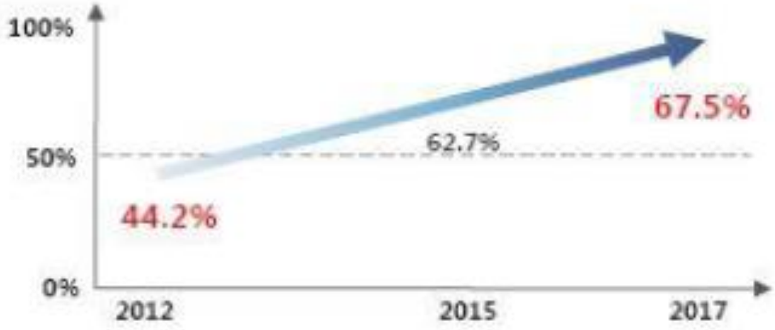
- Augmented Reality/Virtual Reality Services will Become Common
- Social Networking Services will be Expanded with Rich Contents

- M2M Devices Proliferate & High Data Rate Media-Based M2M Service will Grow
- Personalized Services will be Integrated into Daily Life (LBS, u-health)

Mobile Device Trend

Penetration of Smartphone Terminals

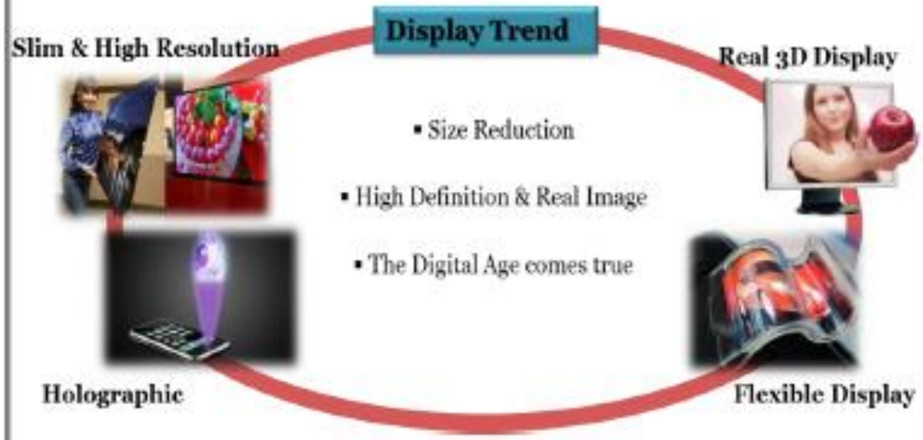
- The spread of smartphones will continue to rise worldwide
  - Traffic share : 44.2%('12) → 67.5%('17)



- Smartphones generate tremendous traffic (compared with feature phones)
  - Smartphone : 24times ↑, Tablet : 122times ↑

Device Environmental Trend

- Slim & High Resolution, Flexible Display will be introduced



Display Trend

Slim & High Resolution

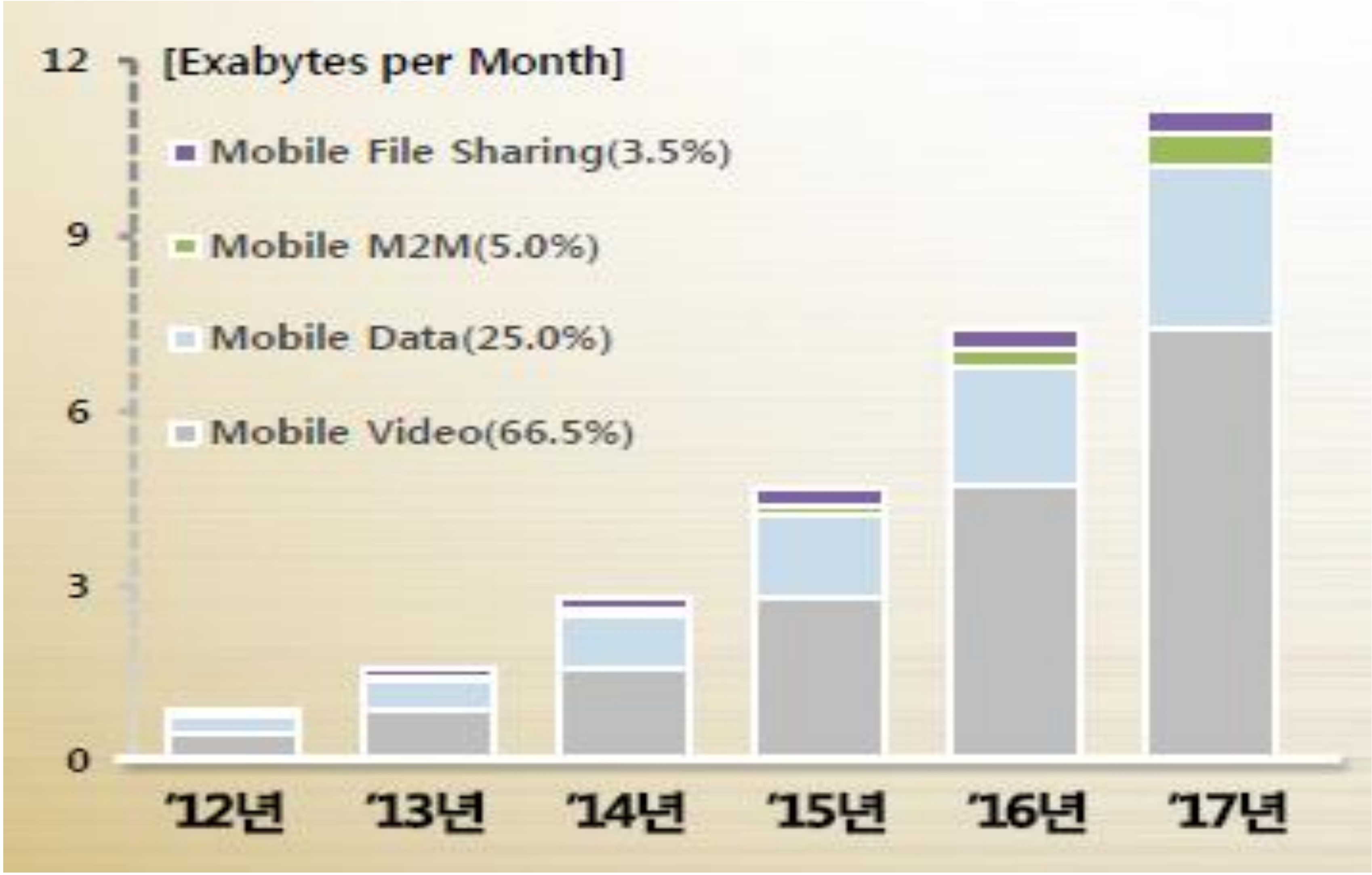
Real 3D Display

- Size Reduction
- High Definition & Real Image
- The Digital Age comes true

Holographic

Flexible Display

Mobile Traffic Explosion

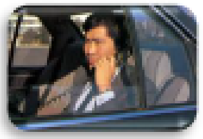


Mobile Evolution Trend

1G
Carrier operating

- Only voice call
- 1984' service start

[first cellphone]


[Car phone]

2G
Government leading

- Voice call, SMS, e-mail (data transmission)
- 1996' service start
- IS-95 (USA, Synchronous) GSM(Europe)

[2G phone]

[SMS]

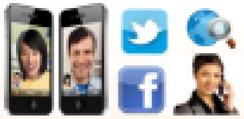
3G
Carrier leading

- Voice data, non voice data transmission
- 2003' service start
- Composite

IMT-2000

※ WCDMA, CDMA2000, TD-SCDMA

[WCDMA]

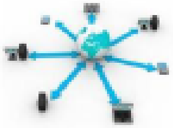

[SNS]

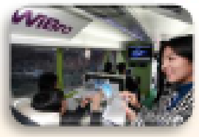
4G
Manufacturer leading

- Fast data rate, High quality HD visual phone

※ Full All-IP -> M-VoIP, VoLTE service

- 2011' service start
- LTE, LTE-A(2013')





5G Mobile Vision

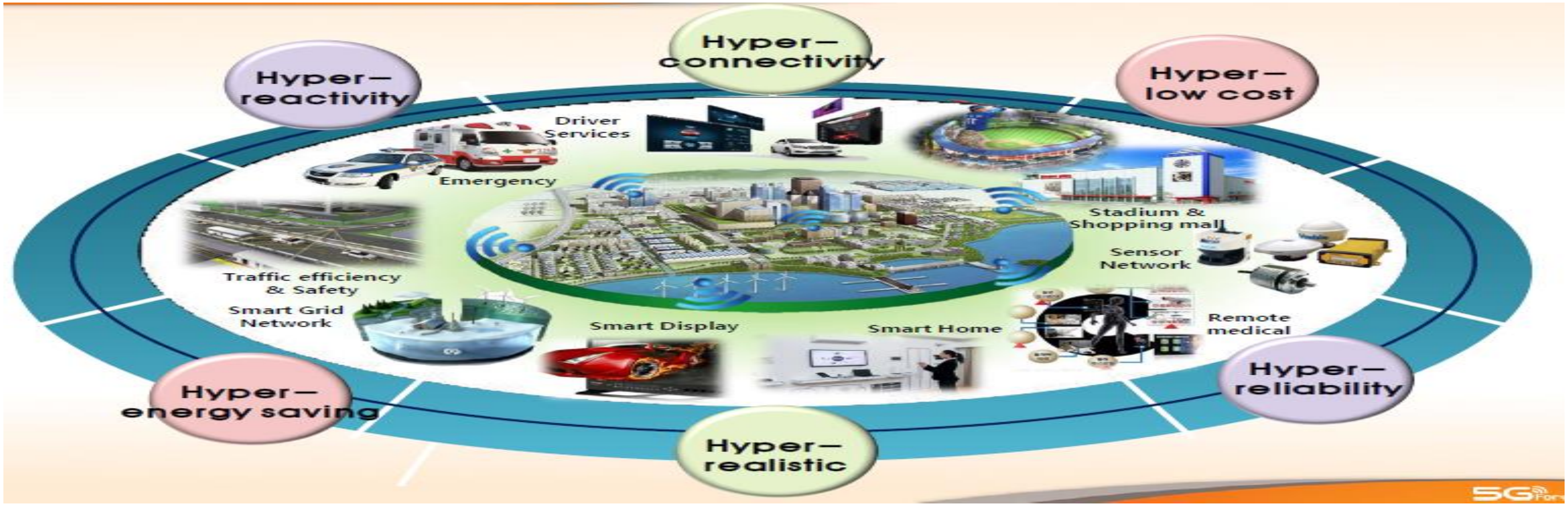
Quadruple X1000

Thousands of times **Mobile Device**

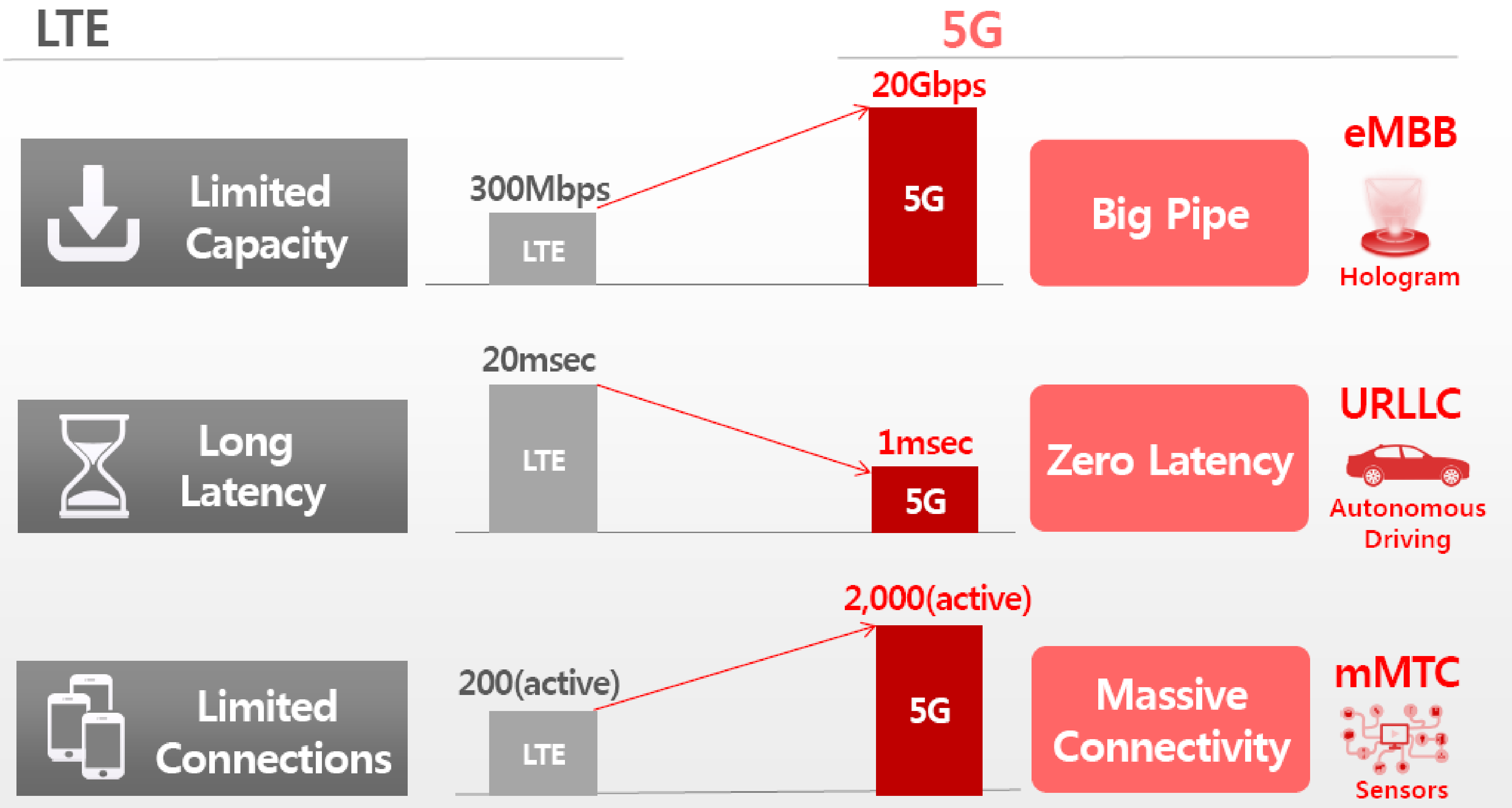
Thousands of times **Mobile Traffic**

Thousands of times **Latency**

Thousands of times **Energy savings**


Hyper-connectivity
Hyper-reactivity
Hyper-low cost
Driver Services
Emergency
Stadium & Shopping mall
Sensor Network
Traffic efficiency & Safety
Smart Grid Network
Smart Display
Smart Home
Remote medical
Hyper-reliability
Hyper-energy saving
Hyper-realistic
5G

5G Mobile Requirement



LTE

5G

Limited Capacity

300Mbps → 20Gbps

Big Pipe — eMBB

Long Latency

20msec → 1msec

Zero Latency — URLLC

Limited Connections

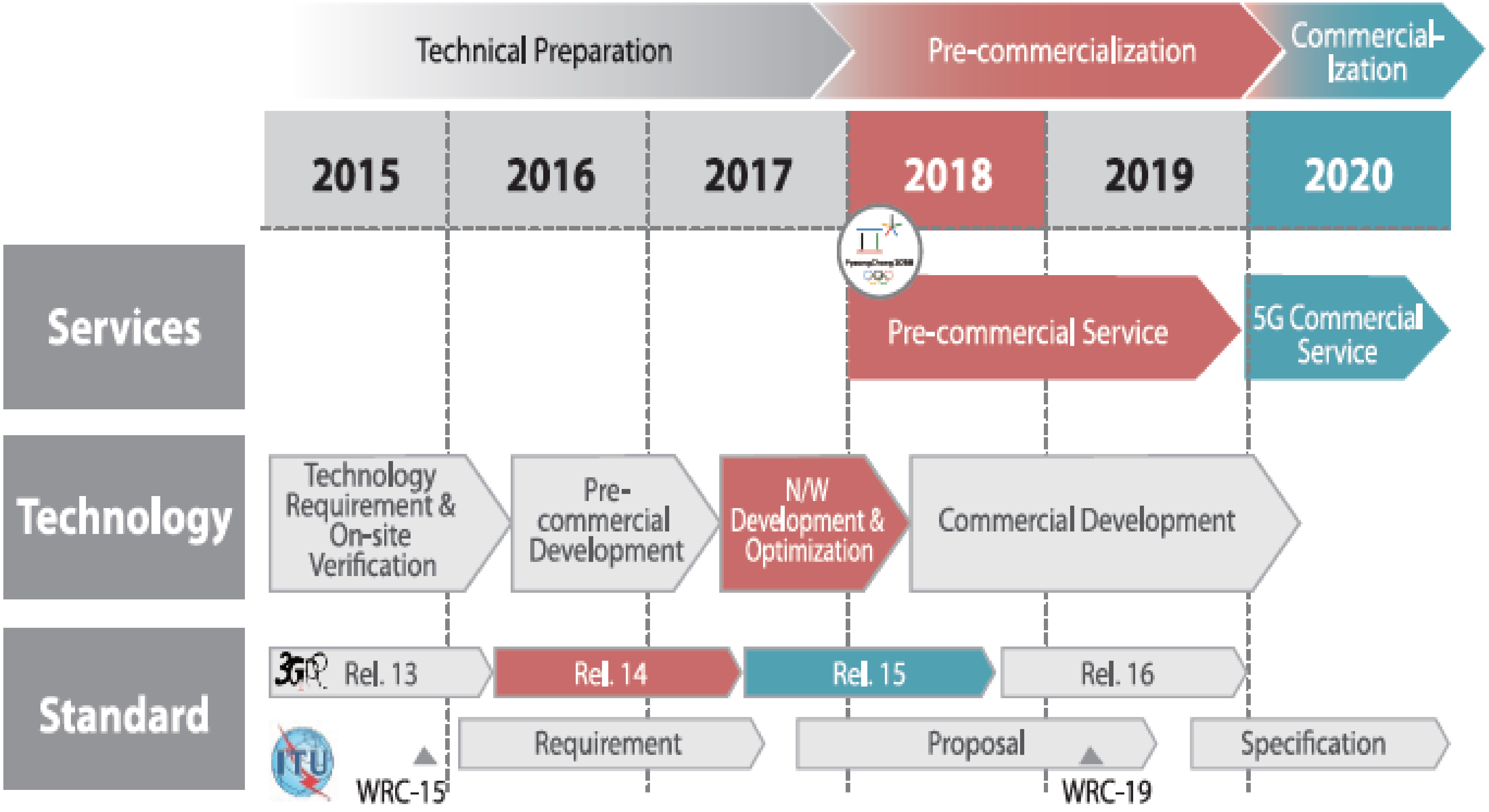
200(active) → 2,000(active)

Massive Connectivity — mMTC

LTE
5G
LTE
5G
LTE
5G
Hologram
Autonomous Driving
Sensors

- eMBB: Enhanced mobile broadband
- URLLC: Ultra-reliable & low-latency communications
- mMTC: Massive machine type communications

KT 5G Roadmap



Technical Preparation → Pre-commercialization → Commercial-lization

2015 | 2016 | 2017 | 2018 | 2019 | 2020

Services

Pre-commercial Service

5G Commercial Service

Technology

Technology Requirement & On-site Verification

Pre-commercial Development

N/W Development & Optimization

Commercial Development

Standard

Rel. 13

Rel. 14

Rel. 15

Rel. 16

Requirement

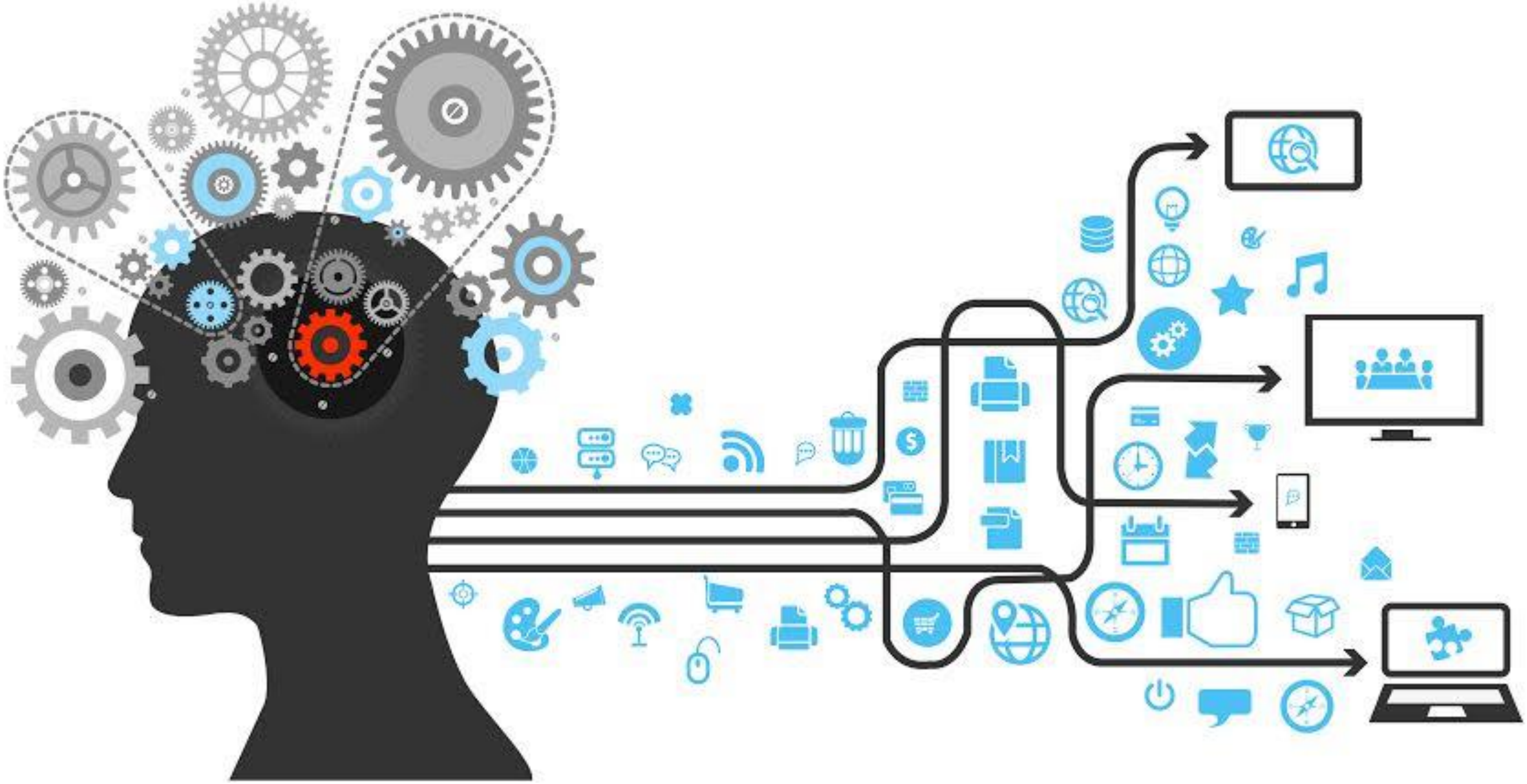
Proposal

Specification

WRC-15

WRC-19

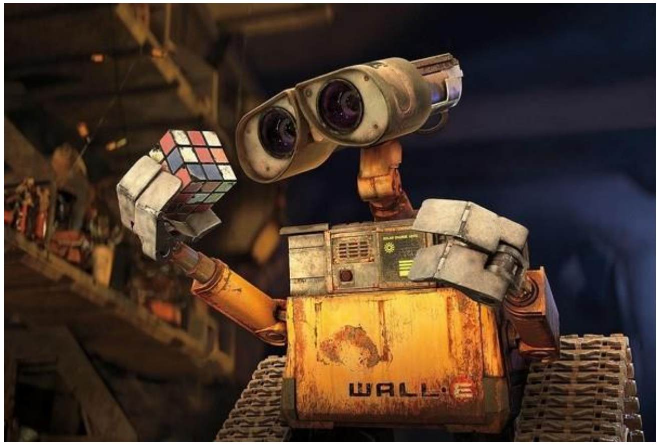
AI(Artificial Intelligence)



AI in Movies

In movies, robots are able to talk, think, have emotions, and make decisions just like humans.

The Terminator
AI



HALEY JOEL OSMENT
JUDE LAW
A.I.
ARTIFICIAL INTELLIGENCE

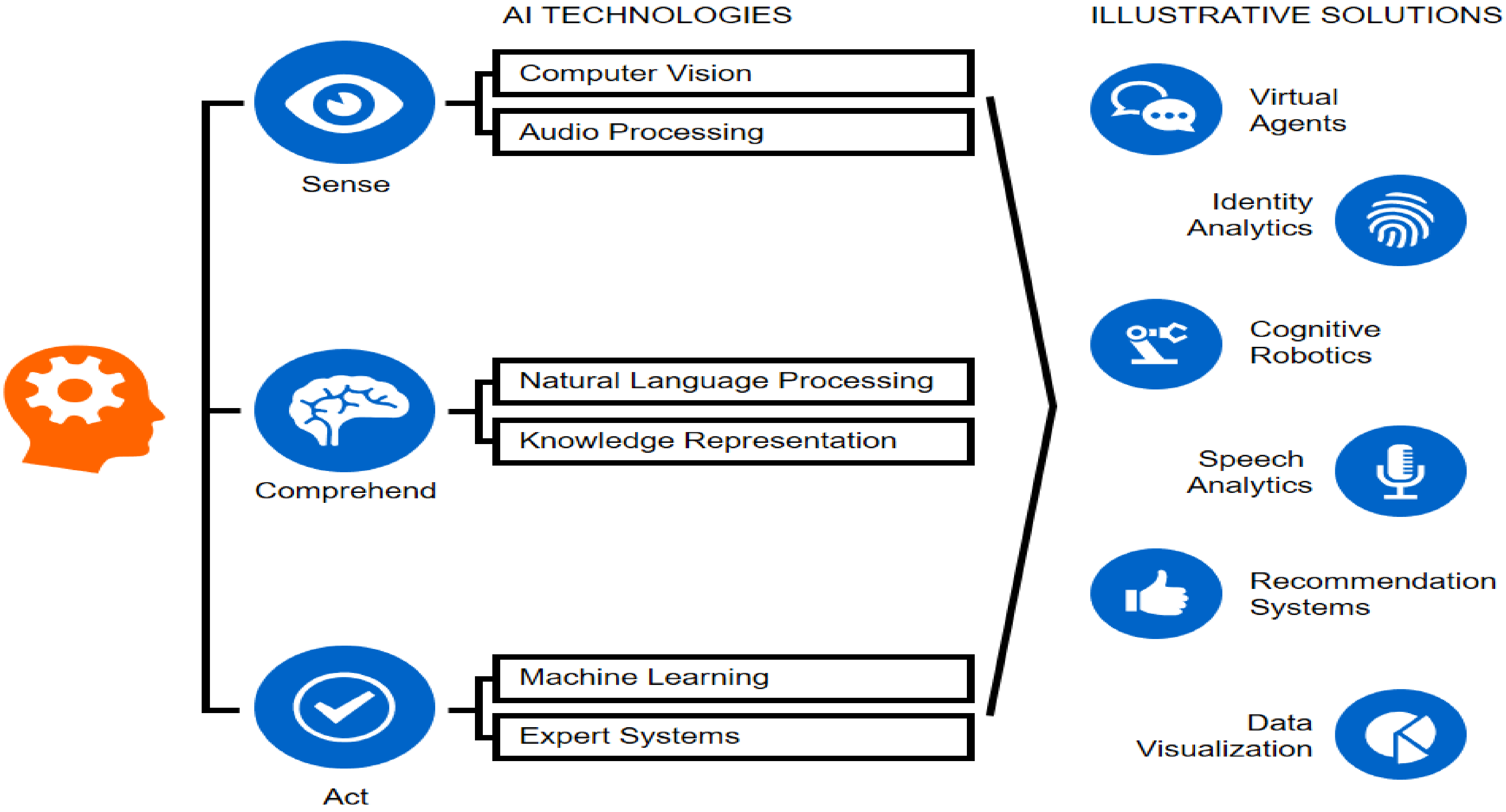
What is Artificial Intelligence?

- Artificial Intelligence is the development of computer systems that are able to perform tasks that would require human intelligence.

- Examples of these tasks are visual perception, speech recognition, decision-making, and translation between languages.

What is Artificial Intelligence?

Emerging AI technologies



AI TECHNOLOGIES

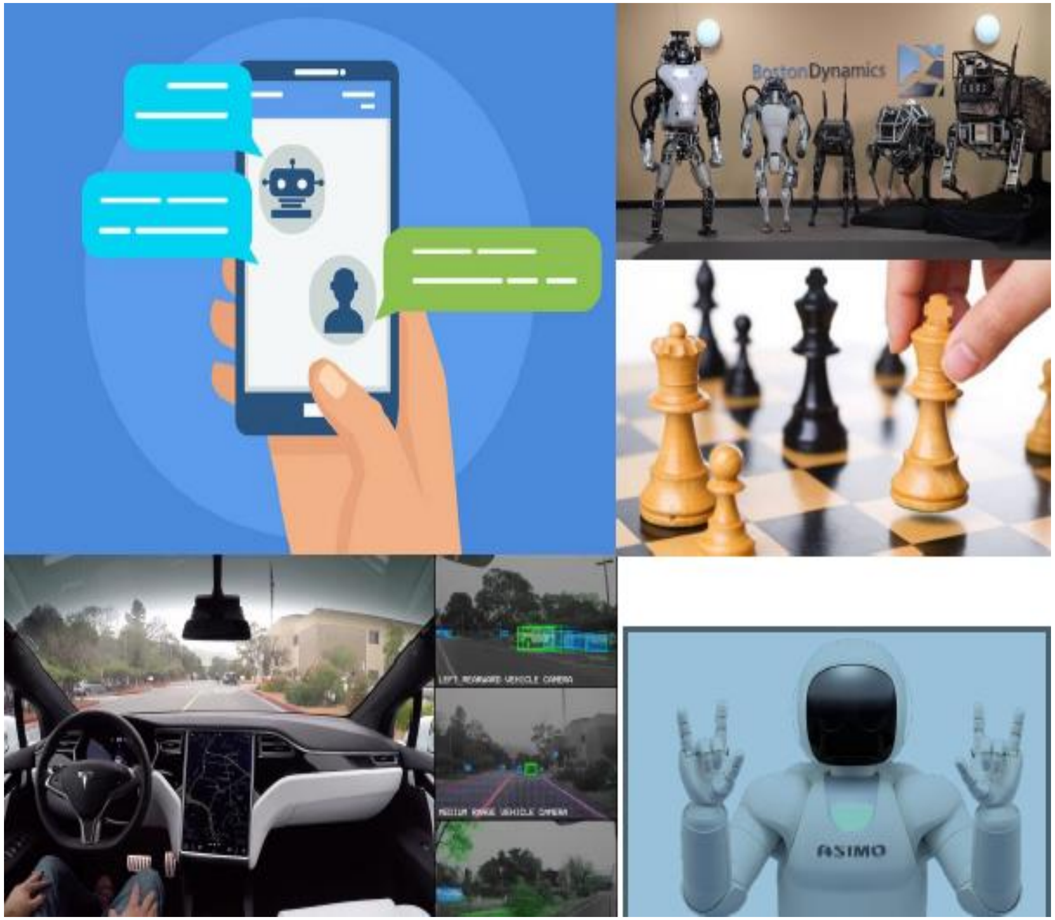
- **Sense**
  - Computer Vision
  - Audio Processing
- **Comprehend**
  - Natural Language Processing
  - Knowledge Representation
- **Act**
  - Machine Learning
  - Expert Systems

ILLUSTRATIVE SOLUTIONS

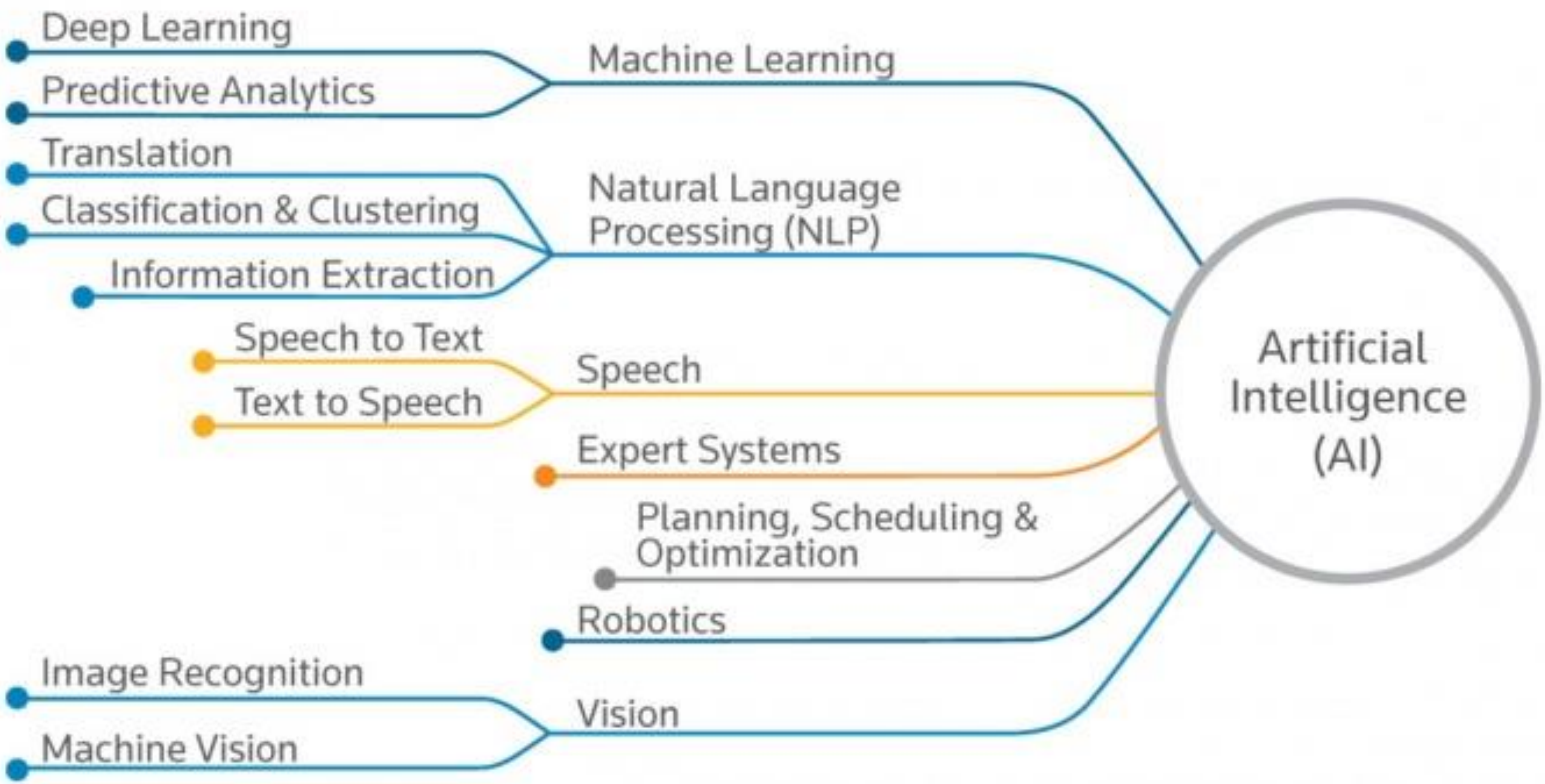
- Virtual Agents
- Identity Analytics
- Cognitive Robotics
- Speech Analytics
- Recommendation Systems
- Data Visualization

Real Life A.I. Examples

- Self Driving Cars
- Boston Dynamics
- Navigation Systems
- ASIMO
- Chatbots
- Human vs Computer Games
- Many More!


BostonDynamics
LEFT REARWARD VEHICLE CAMERA
MEDIUM RANGE VEHICLE CAMERA
ASIMO

AI Technology Tree


Deep Learning
Predictive Analytics
Machine Learning
Translation
Classification & Clustering
Natural Language Processing (NLP)
Information Extraction
Speech to Text
Text to Speech
Speech
Expert Systems
Artificial Intelligence (AI)
Planning, Scheduling & Optimization
Robotics
Image Recognition
Machine Vision
Vision

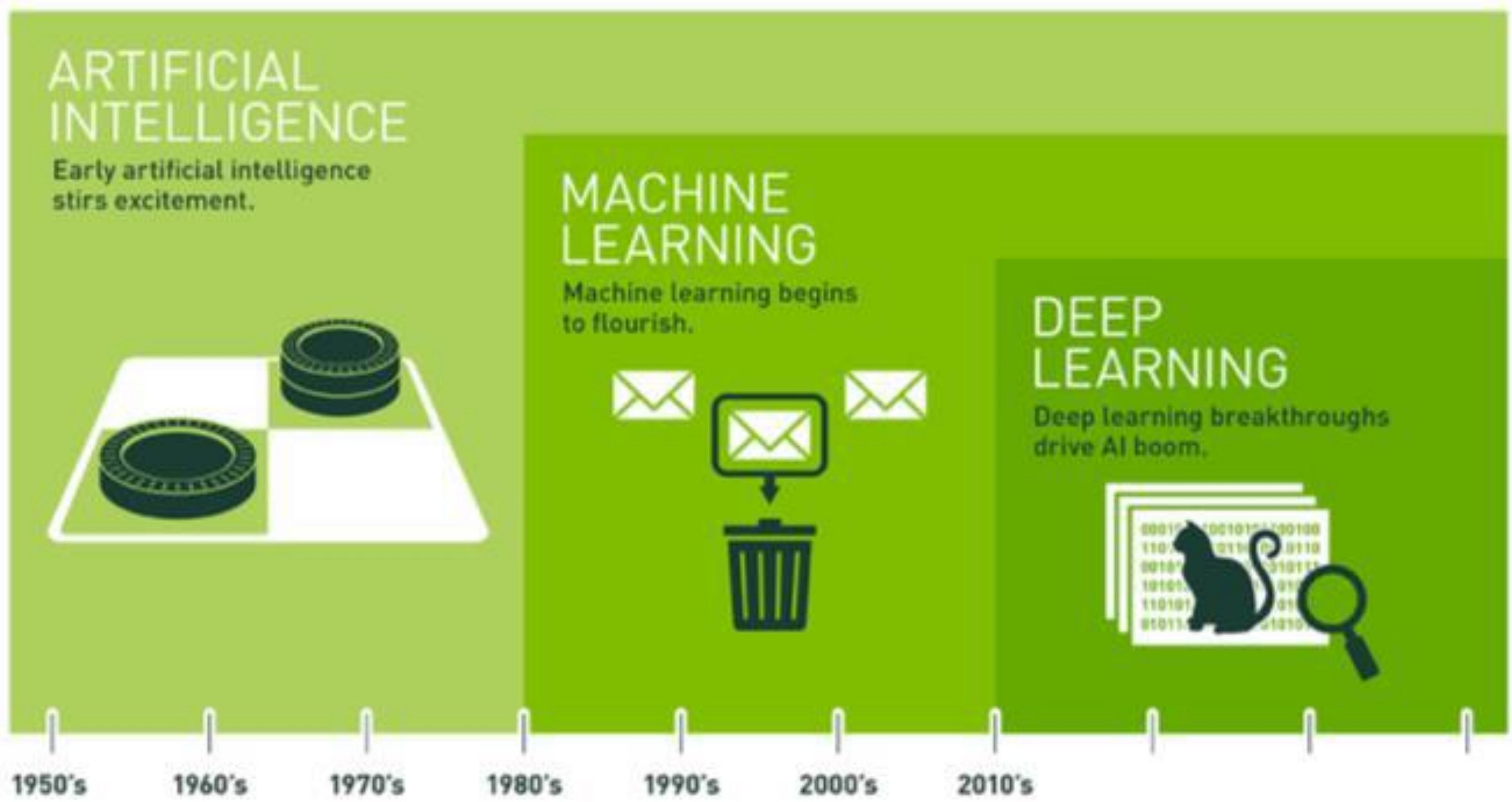
Strong AI vs. Weak AI

- **Strong AI**
  - Study or technology to *implement* human intelligence
  - Technology to make machine think like human: Create / Thought / Emotion

- **Week AI**
  - Study or technology to *solve* a particular problem by imitating human intelligence
  - Technology to solve a specific problem like human: Large-scale data processing tirelessly and unbiasedly

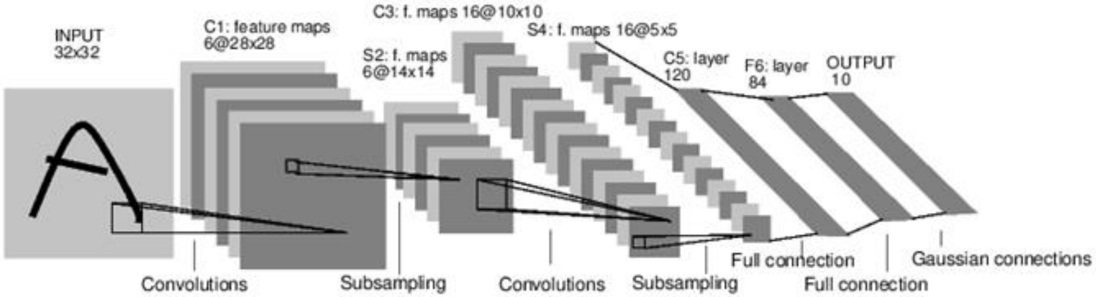
Machine Learning

- An application of Artificial Intelligence that gives machines the ability to learn and improve without the help of humans or new programming.


ARTIFICIAL INTELLIGENCE
Early artificial intelligence stirs excitement.
MACHINE LEARNING
Machine learning begins to flourish.
DEEP LEARNING
Deep learning breakthroughs drive AI boom.
1950's
1960's
1970's
1980's
1990's
2000's
2010's

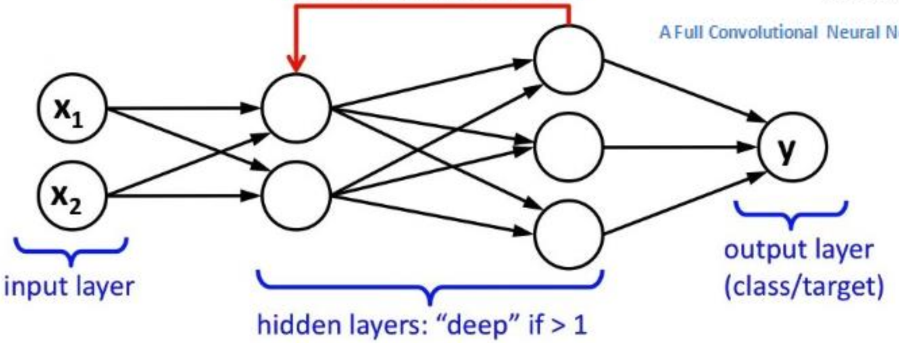
Deep Learning

- Deep learning is a type of machine learning that can process a wider range of data resources, requires less data preprocessing by humans, and can often produce more accurate results than traditional machine learning approaches.
- In deep learning, interconnected layers of software-based calculators known as “neurons” form a neural network.



INPUT 32x32
C1: feature maps 6@28x28
S2: f. maps 6@14x14
C3: f. maps 16@10x10
S4: f. maps 16@5x5
C5: layer 120
F6: layer 84
OUTPUT 10
Convolutions
Subsampling
Convolutions
Subsampling
Full connection
Full connection
Gaussian connections

A Full Convolutional Neural Network (LeNet)



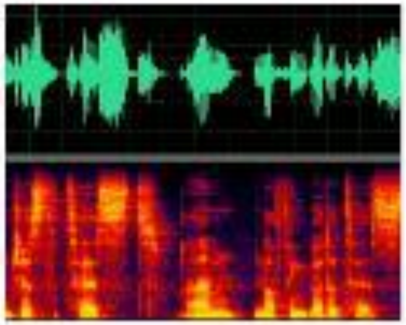
Recurrent network
x_1
x_2
y
input layer
hidden layers: “deep” if > 1
output layer (class/target)

Deep Learning Use Cases

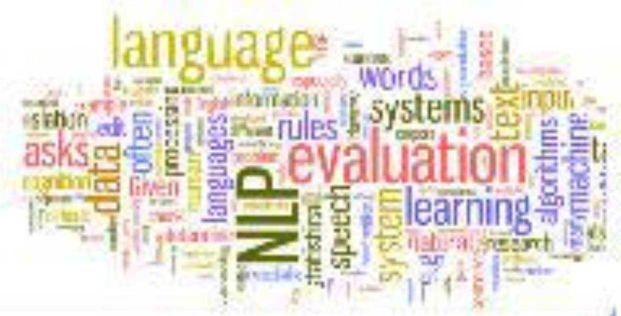
Significantly improve many applications and multiple domains

image understanding

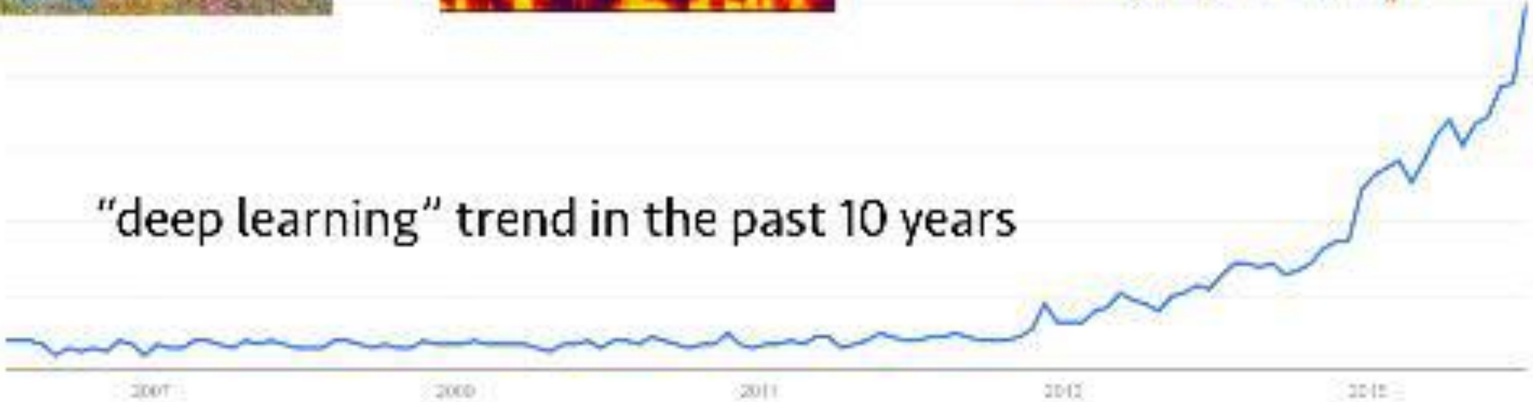
speech recognition



natural language processing

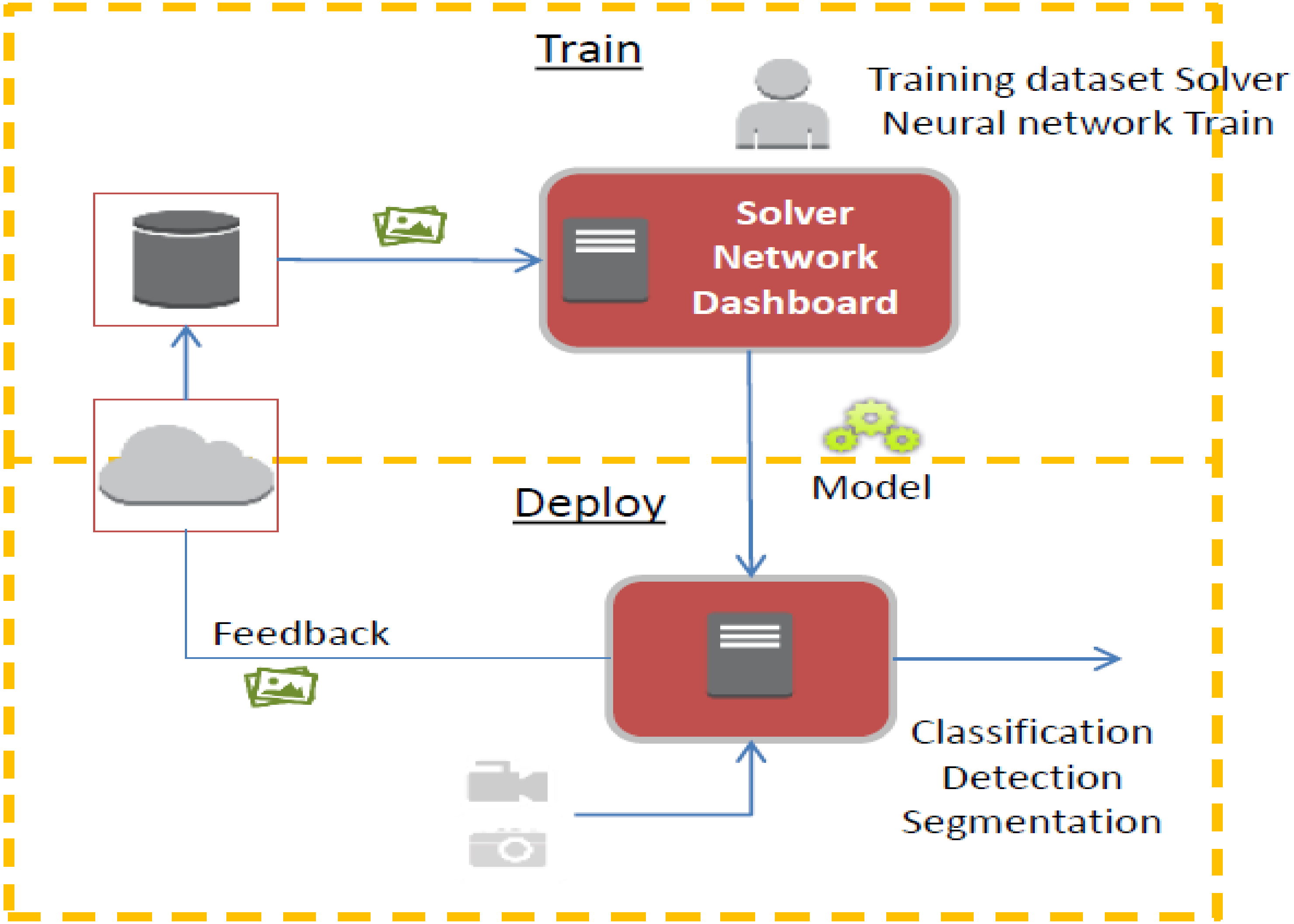

language
words
systems
text
input
rules
evaluation
asks
data
often
languages
NLP
learning
algorithms
machine
speech
system
natural
research

…



“deep learning” trend in the past 10 years

Deep Learning –Flow

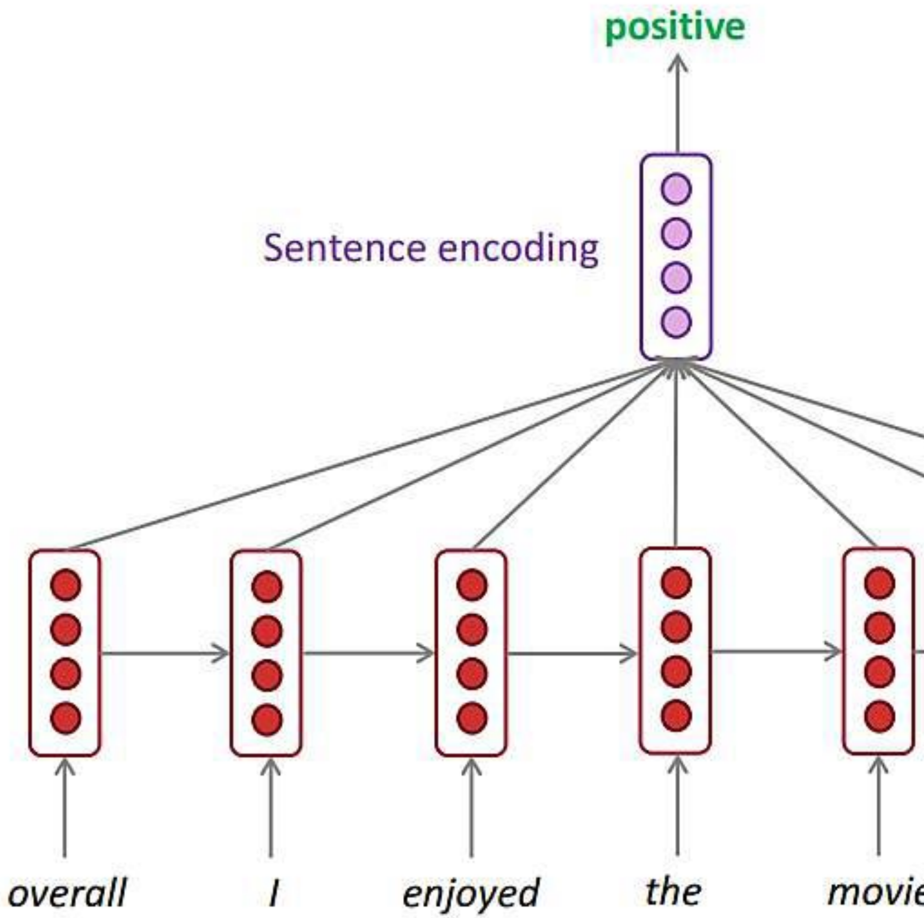

Train
Training dataset Solver
Neural network Train
Solver
Network
Dashboard
Model
Deploy
Feedback
Classification
Detection
Segmentation

AI application Area

A lot of number crunching	Computer vision	Language Processing
Business Intelligence	Auto tech and drone Collision avoidance	Chatbots
IoT Predictive Maintenance	E-Commerce Search	News & Media Content Creation
Search Recommendation	Pick and Place robots	Smart home voice interfaces
Forecasting Models	Healthcare Diagnostics	Text Analytics

Deep Learning Application

- **Discriminant model**

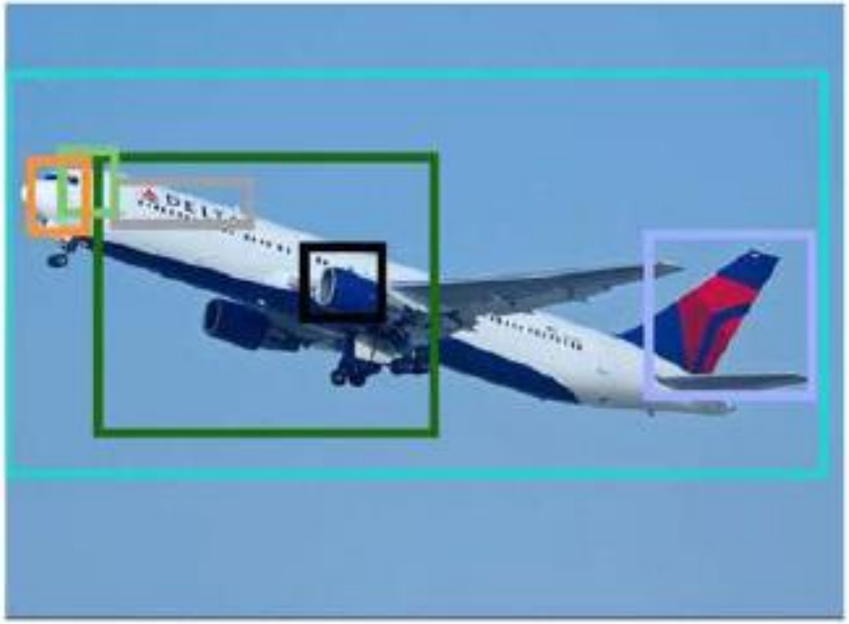

positive
Sentence encoding
overall
I
enjoyed
the
movie
a
lot

How to compute sentence encoding?

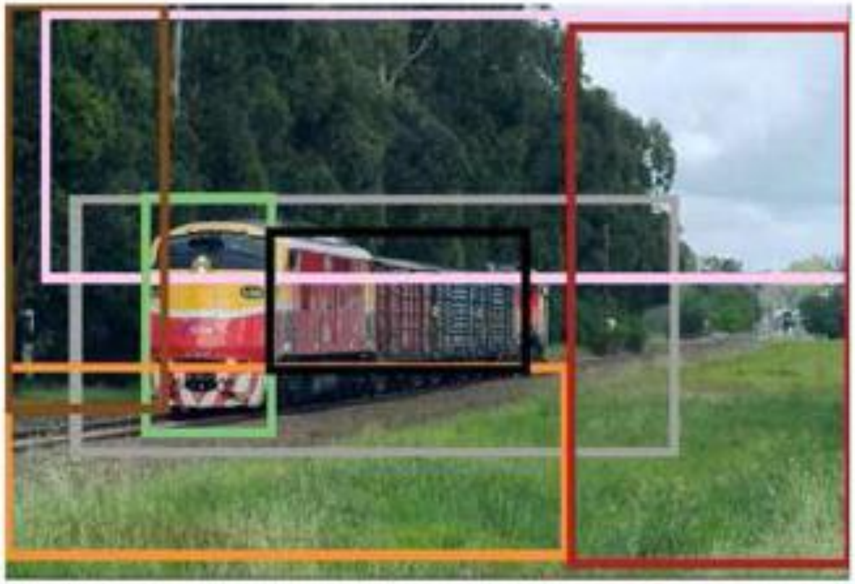
Usually better:
Take element-wise max or mean of all hidden states

Images processing in AI

Picture analysis result by DenseCap: Vision Lab. In U of Standford



plane is flying. tail of the plane. red and white plane. plane is white. engine on the plane. windows on the plane. nose of the plane.



train on the tracks. trees are green. front of the train is yellow. grass is green. green trees in the background. photo taken during the day. red train car.

※ Justin Johnson et al, “DenseCap: Fully Convolutional Localization Networks for Dense Captioning” , CVPR, 2016

Deep Learning Application

AI Agent: Home AI

아마존 'Echo(Alexa)'

amazon echo
Always ready, connected, and fast. Just ask.

kt 'GiGA-Genie'

음식을 주문 하실 건가요?
치킨학교
주문하기

SKT '누구'

SK telecom
음성인식기반
인공지능서비스
NUGU

Self-Driving Vehicles

Ford

Puck™
VLP-32
AUTOMOTIVE APPLICATIONS
Velodyne LiDAR

GM

Jaguar

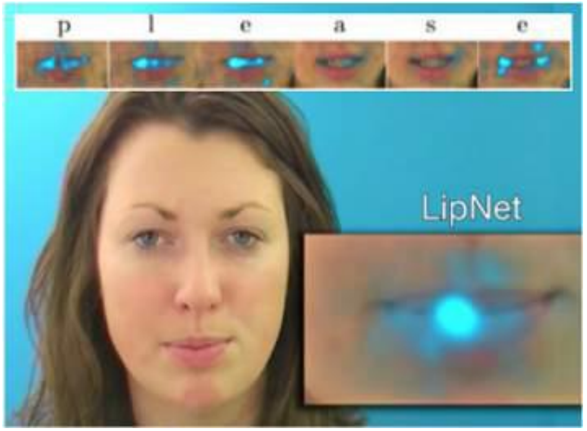
CAR 02
CAR 03 has stopped

Deep Learning Application

Emotient(Apple)

감정 해석
성별 해석
Joy
Sadness
Male
Contempt
Disgust
Female

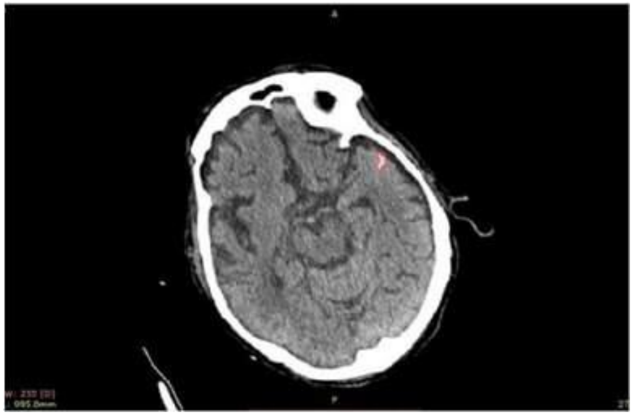
LipNet(Oxford University)


p
l
e
a
s
e
LipNet

Cogito(Start-up Co.)

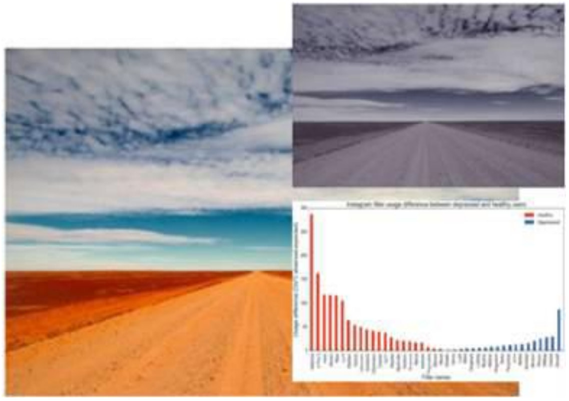
Real-time conversational intelligence
INTERRUPTION
TONE
CX SCORE
9

MedyMatch



Stanford Uni. R&D

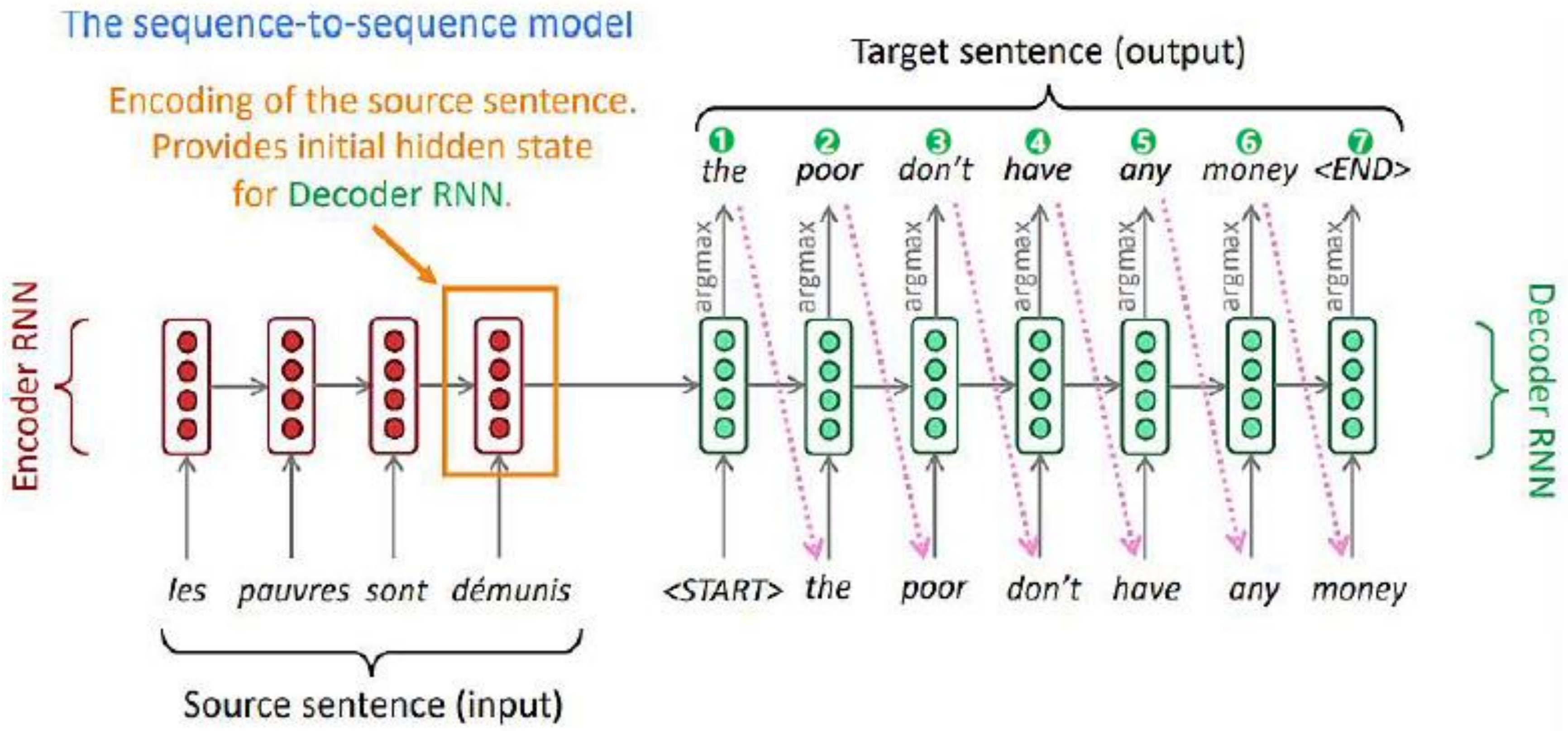
Harvard Uni. R&D



Deep Learning Application

- **Generative model**

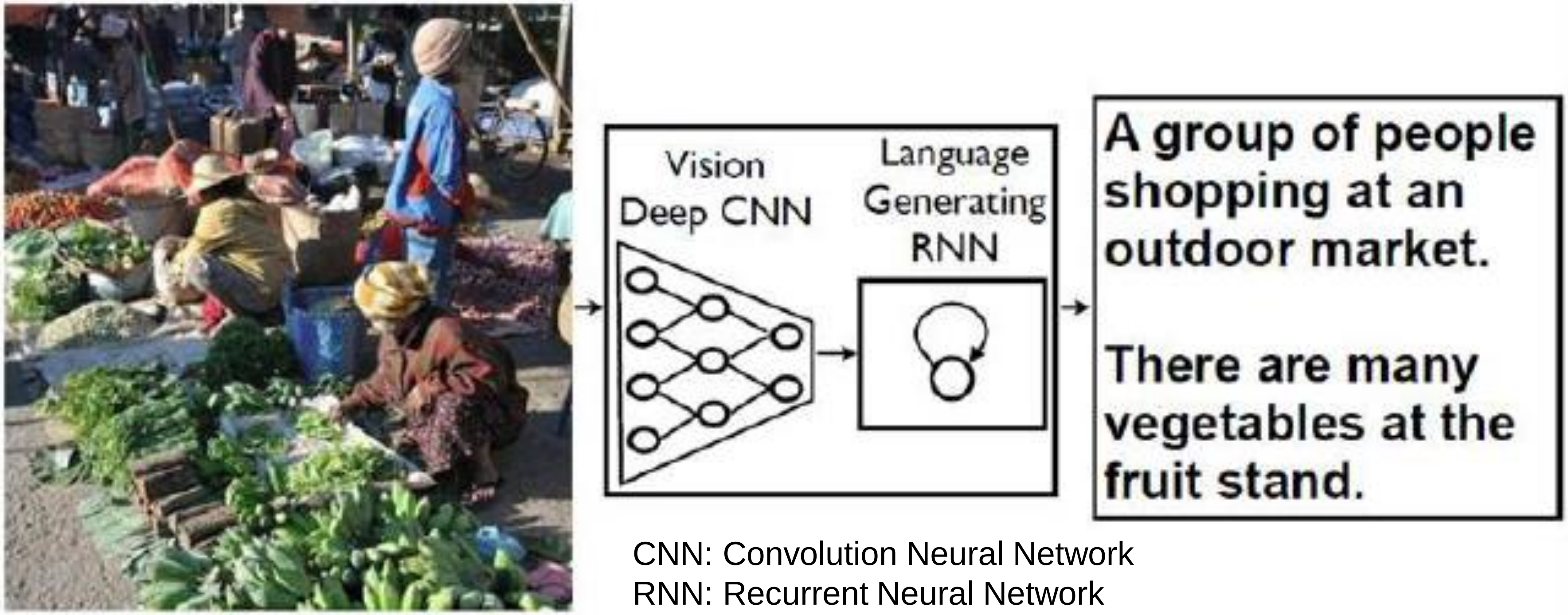
Neural Machine Translation (NMT)


The sequence-to-sequence model
Encoding of the source sentence. Provides initial hidden state for Decoder RNN.
Target sentence (output)
① the ② poor ③ don't ④ have ⑤ any ⑥ money ⑦ <END>
argmax
Encoder RNN
Decoder RNN
les pauvres sont démunis
<START> the poor don't have any money
Source sentence (input)

Deep Learning Application

- **Automatically describing the content of an image**

Neural Machine Translation (NMT)


Vision
Deep CNN
Language
Generating
RNN
A group of people shopping at an outdoor market.
There are many vegetables at the fruit stand.

CNN: Convolution Neural Network
RNN: Recurrent Neural Network

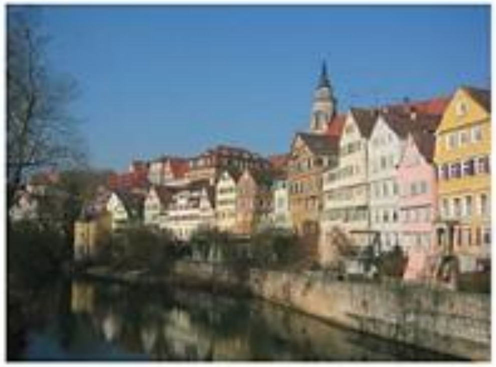
※ Oriol Vinyals et al.(Google), ”Show and Tell: A Neural Image Caption Generator” CVPR, 2015

Creative Activity in AI

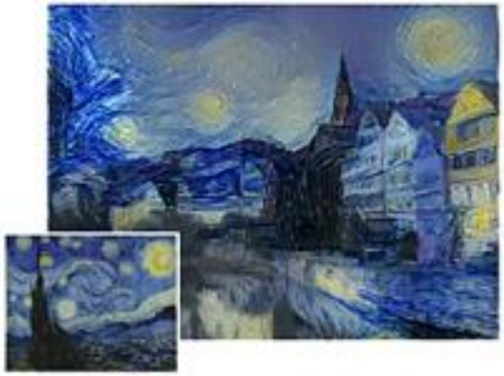
A Neural Algorithm of Artistic Style: can separate and recombine the image content and style of natural images

※ Leon A. Gatys et al., “Image Style Transfer Using Convolutional Neural Networks”, CPVR, 2016

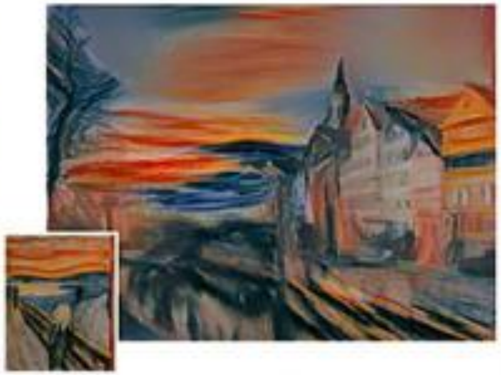
Image Style Transfer Using **Convolutional Neural Networks**



Original photograph

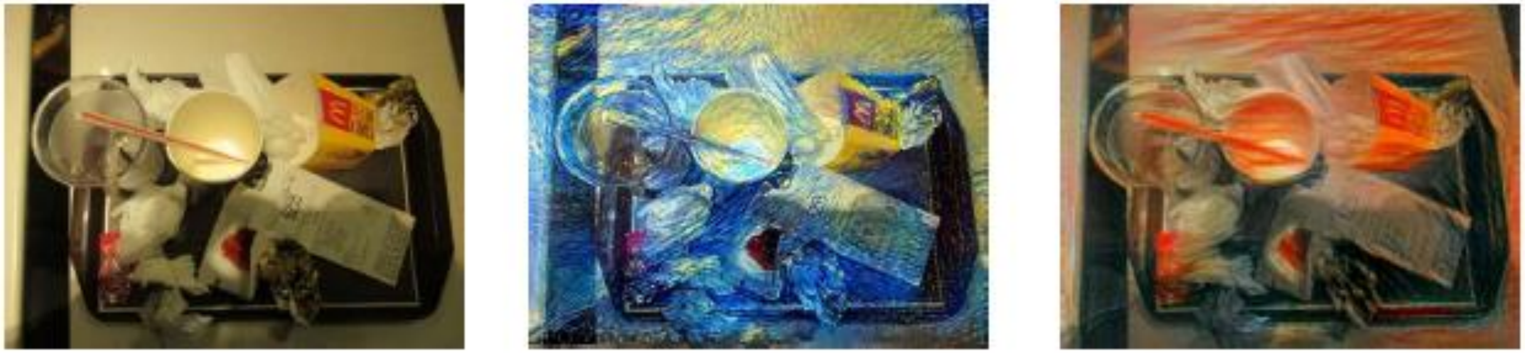


The Starry Night by Vincent van Gogh



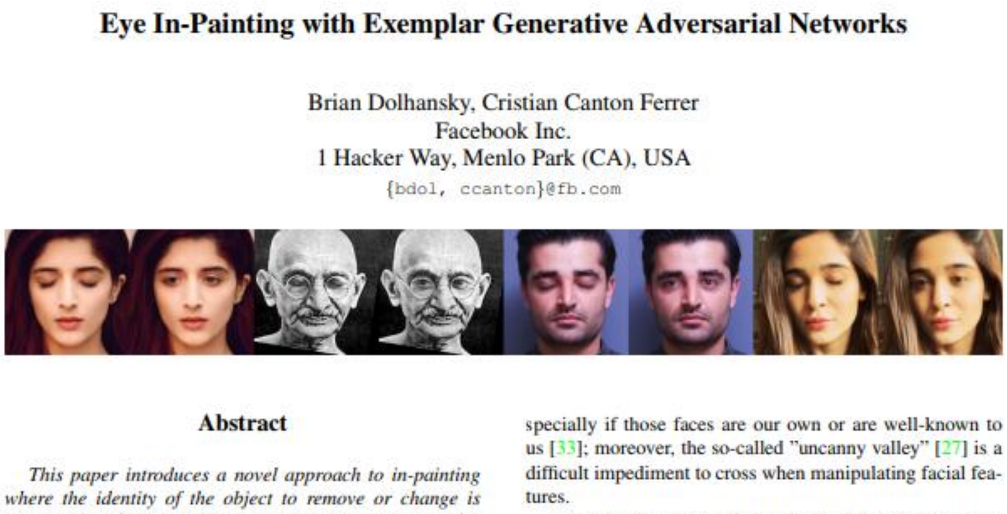
Der Schrei by Edvard Munch

Using Google **Deep Dream**



Deep Learning Application

Closed-eye-opening results generated with a reference-based Exemplar GAN(Generative Adversarial networks)



Eye In-Painting with Exemplar Generative Adversarial Networks

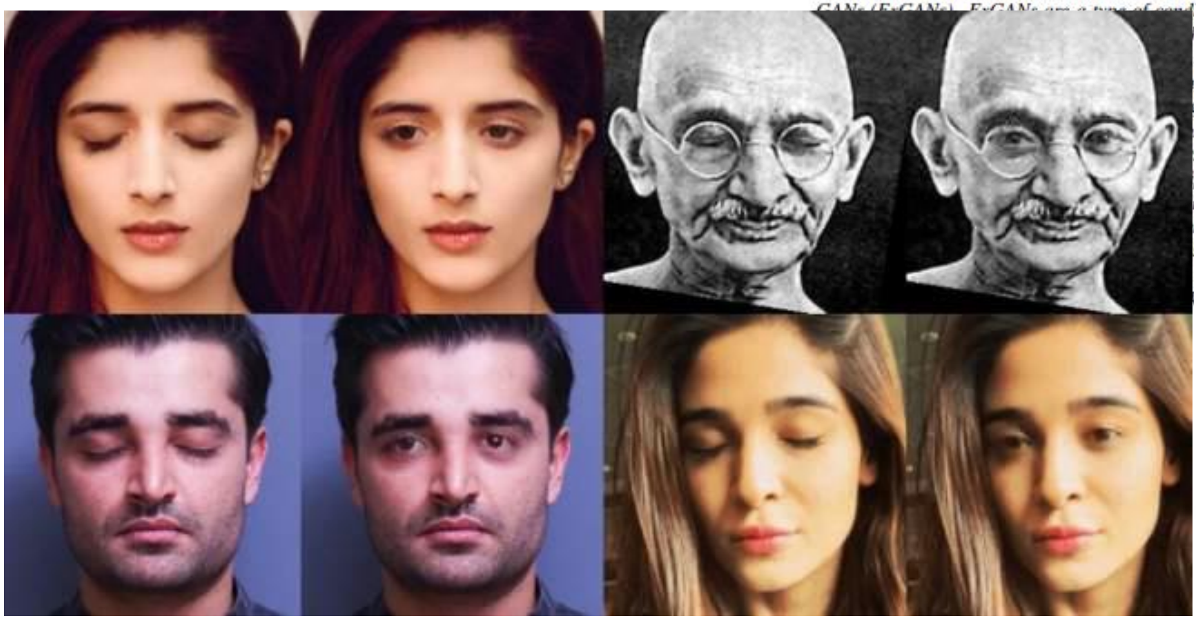
Brian Dolhansky, Cristian Canton Ferrer
Facebook Inc.
1 Hacker Way, Menlo Park (CA), USA
{bdol, ccanton}@fb.com

Abstract

This paper introduces a novel approach to in-painting where the identity of the object to remove or change is preserved and accounted for at inference time: Exemplar

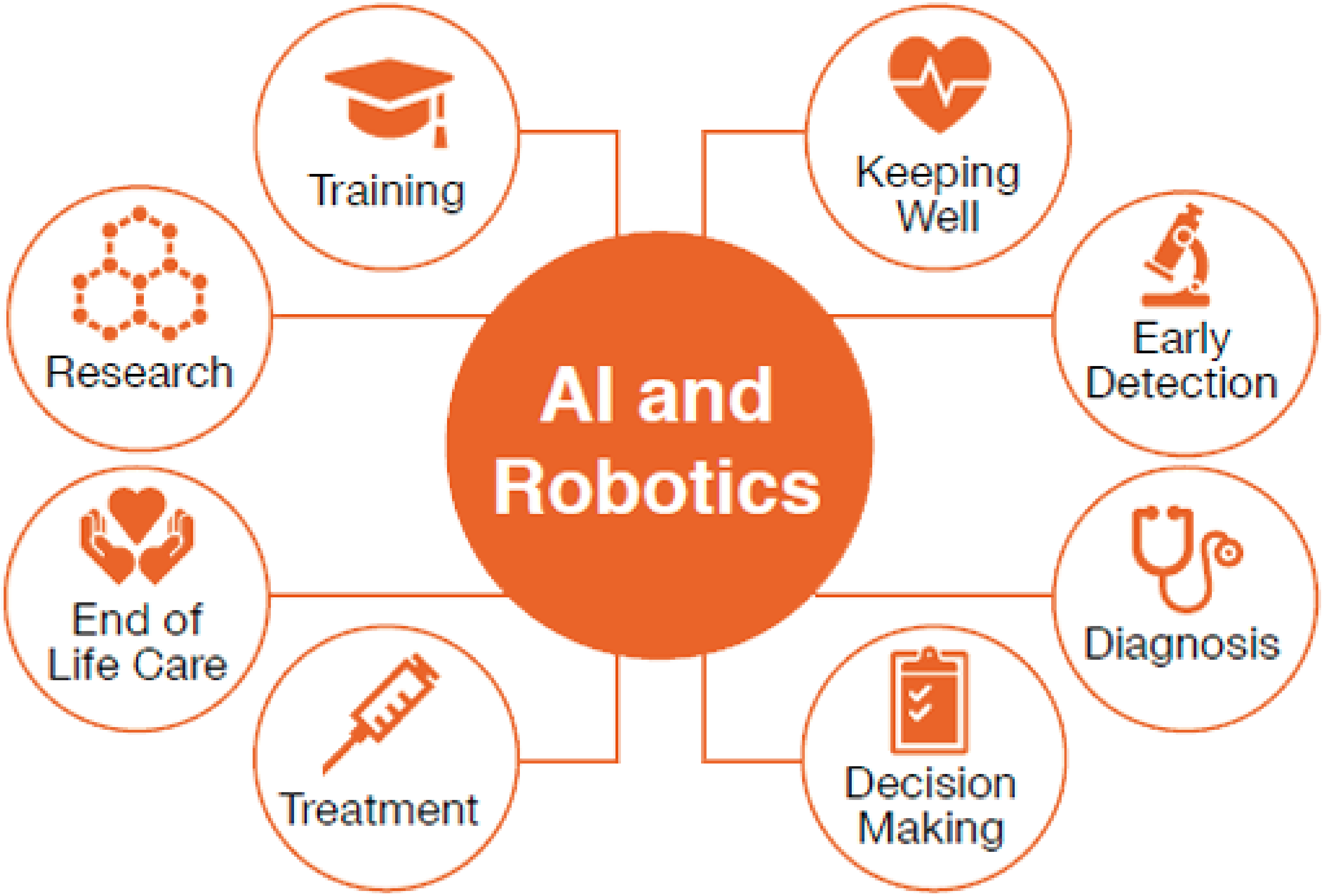
specially if those faces are our own or are well-known to us [33]; moreover, the so-called "uncanny valley" [27] is a difficult impediment to cross when manipulating facial features.

Recently, deep convolutional networks (DNNs) have



(a) (b) (c)

AI Applications in Healthcare



AI and Robotics

Training

Keeping Well

Research

Early Detection

End of Life Care

Diagnosis

Treatment

Decision Making

Reference

- https://www.itu.int/en/ITU-T/publications/
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- http://www.real-iot.com/lora-techology/
- Leon A. Gatys et al., “Image Style Transfer Using Convolutional Neural Networks”, CPVR, 2016
- Oriol Vinyals et al.(Google), ”Show and Tell: A Neural Image Caption Generator” CVPR, 2015
- Justin Johnson et al, “DenseCap: Fully Convolutional Localization Networks for Dense Captioning” , CVPR, 2016
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- Cloud computing Technology stack, consortium of cloud computing research, 2015.12.
- KT 5G master plan,2015.9.

Q & A

THANK YOU!

Contact me

Korea ICT Convergence Research Association

M: (+82) 010-9777-5670
E-mail: yhbang82@hanmail.net