KAIT 한국정보통신진흥협회
Korea Association for ICT Promotion

KAIT
ICT 기업의 성장 플랫폼

BM 과정 AI Architecture & Business Model

2019

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I Big Data Architecture와 AI 시스템의 Position

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1. Big Data 기반 Analytics Concept Making

- 분석 패러다임의 변화

1) Analysis to Analytics

	직관/경험 중심	Analytics 중심
문제 해결 범위	특정 상황의 단위별 과제 해결	복합 과제 해결을 통해 일반화
Input	작업자 선정한 소수의 Parameter	모든 Parameter와 파생 변수
Output	Rule(If-Then)	▪ Label = Features(X1, X2, ……..Xn) ▪ Rule(If-Then)
지식 유형	유효기간이 있는 암묵지	연속된 자기 학습으로 개선하는 형식지
개선의 양상	연속적 점진적 개선	불연속 급진적 개선

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1. Big Data 기반 Analytics Concept Making

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1) Analysis to Analytics

true friend 한국투자증권

실적 Review

2018. 7. 27

실리콘웍스(108320)

하반기 OLED 사업비중 더 높아진다

2분기 영업이익률 5.9%, 영업이익 105억원으로 컨센서스 상회
하반기에는 OLED매출 비중 상승으로 영업이익률 9.7%까지 높아져
목표주가 62,000원으로 11% 상향

Facts : 2분기 영업이익률 5.9%로 전분기대비 3.9%p 개선

2분기 매출액은 1,797억원으로 추리 예상과 일치했지만 영업이익률은 5.9%로 추리 예상대비 1.1%p, 전분기대비 3.9%p 높았다. 수익성 높은 모바일 제품비중이 1분기 16%에서 2분기 20%로 높아지고 연구개발비용 부담이 낮아진 것이 수익성 개선의 가장 큰 이유이다. 하반기에도 모바일 OLED용 제품 공급이 증가하고 OLED TV용 Driver-IC와 T-con 매출액이 증가하면서 수익성 개선은 지속될 것이다. 또한 2015년 이후 지속적으로 높아졌던 연구개발비 증가추세가 인력보강이 마무리되면서 비용증가 추세가 둔화될 것이다. 하반기 영업이익률은 9.7%까지 높아질 전망이다.

Pros & cons : 3분기부터 아이폰용 OLED패널 D-IC 공급 시작

LG디스플레이가 4분기부터 아이폰용 OLED패널을 공급하기로 결정했다. 4분기 공급 계획물량은 4백만대 수준으로 많지 않지만 삼성디스플레이가 독점 공급하던 시장에 2nd vendor로 공급하게 된다. LG디스플레이가 공급하는 아이폰용 패널에 실리콘웍스가 Driver-IC를 독점 공급하게 된다. 패널생산이 10월부터 시작되기 때문에 Driver-IC 공급은 3분기 말부터 시작될 전망이다. 보통 Driver-IC 공급물량이 패널생산량보다는 많고 초기 패널의 낮은 생산수율을 감안하면 Driver-IC 공급물량은 패널 공급물량보다 더 많을 것이다. 2019년 패널 공급물량 증가에 따른 매출액 및 이익증가가 예상된다.

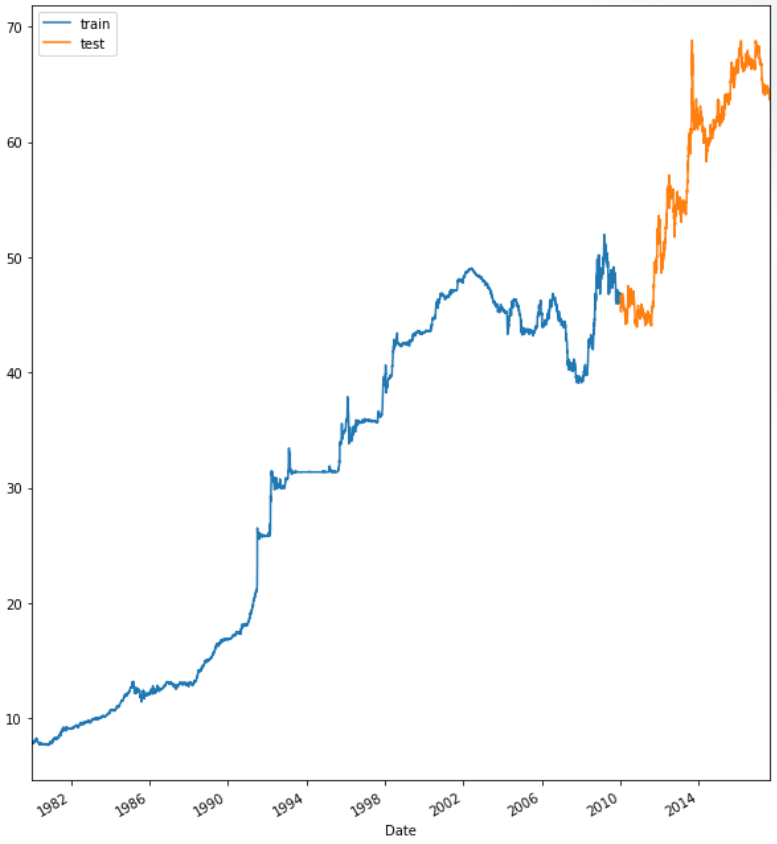
Action : 목표주가 62,000원으로 11% 상향

OLED 제품 매출비중 상승으로 매출액과 이익증가가 예상되는 실리콘웍스의 목표주가를 62,000원으로 기존대비 11% 상향한다. 목표주가는 향후 12개월 추정 EPS에 목표PER 16배를 적용했다. LG디스플레이 사업의 OLED로의 전환은 앞으로 더 빠르게 이루어지고 실리콘웍스의 수혜도 커질 것이다. 4분기부터 시작되는 아이폰용 패널의 Driver-IC 매출액 증가로 2019년 매출액은 1,035원으로 다시 30% 증가할 것이다. 모바일사업과 OLED매출군 증가로 성장성을 더하고 있는 실리콘웍스에 대한 '매수' 투자의견을 유지한다.

매수(유지)

목표주가: 62,000원(상향)

유종우
jongwoo.yoo@truefriend.com



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1. Big Data 기반 Analytics Concept Making

- 분석 패러다임의 변화

2) Technology Shift : Data Warehouse to Data Lake

	전통적인 Data Warehouse	Data Lake
Technology	▪ DBMS	▪ Big Data Ecosystem
Data Type	▪ Structured Data ▪ Semi-Structured의 제한적 수용	▪ Structured ▪ Semi-Structured ▪ Unstructured / Free Format
Data Capability	▪ 상업용 고가의 Software & Repository ▪ 확장 제약(inflexibility)	▪ Open Source Software & 저비용 Repository ▪ Scale-Out
Data Access	▪ DBMS 접근은 숙련자 Only ▪ 일반 사용자는 제공하는 Report 내에서 한정된 정보 접근 ▪ 분석가는 개인PC난 Mart를 통해 사전에 정의된 한정된 데이터 접근	▪ 비숙련자의 정보 접근 확대 수용 ▪ 일반 사용자는 다양한 시각화 도구로 확대된 정보 접근 ▪ 분석가를 위한 개인화 대용량 공간 제공

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1. Big Data 기반 Analytics Concept Making

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2) Technology Shift : Data Warehouse to Data Lake

Unstructured data

The university has 5600 students.
John's ID is number 1, he is 18 years old and already holds a B.Sc. degree.
David's ID is number 2, he is 31 years old and holds a Ph.D. degree. Robert's ID is number 3, he is 51 years old and also holds the same degree as David, a Ph.D. degree.

Semi-structured data

```
<University>
 <Student ID="1">
  <Name>John</Name>
  <Age>18</Age>
  <Degree>B.Sc.</Degree>
 </Student>
 <Student ID="2">
  <Name>David</Name>
  <Age>31</Age>
  <Degree>Ph.D. </Degree>
 </Student>
 ....
</University>
```

Structured data

ID	Name	Age	Degree
1	John	18	B.Sc.
2	David	31	Ph.D.
3	Robert	51	Ph.D.
4	Rick	26	M.Sc.
5	Michael	19	B.Sc.

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1. Big Data 기반 Analytics Concept Making

- 분석 패러다임의 변화

3) Small Data to Big Data

	Small Data	Big Data
Capability	개인 PC, Workstation, Single Server	**Big Data Infrastructure**
Tools	Excel, R, Python	Python, Scala, R, Scala, Java
Data	▪ Software dependent File • excel ▪ Flat File • txt, csv ▪ DBMS • oracle, mysql, etc • sql, stored procedure, api for dbma	▪ Software Independent ▪ Any File • txt, csv • json, parquet • hdfs on Hadoop ▪ Any DBMS • sql, orc • hive, impala • real time ▪ NoSQL • hbase, mongodb, kasandra

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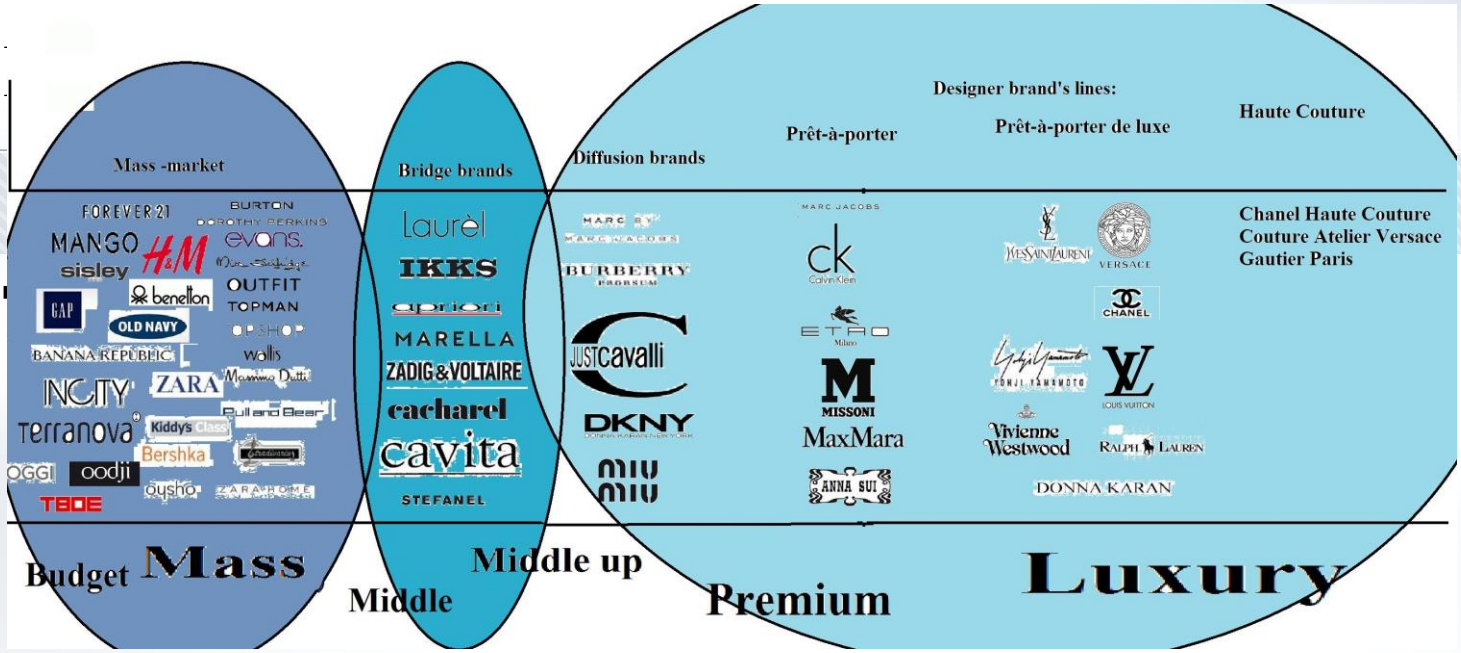

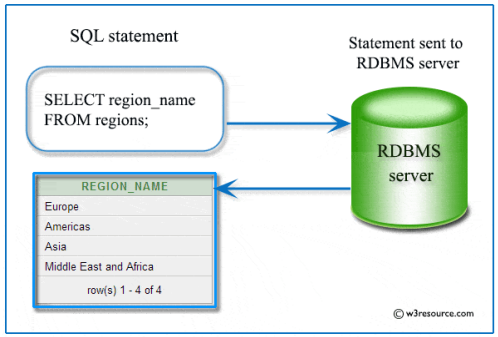

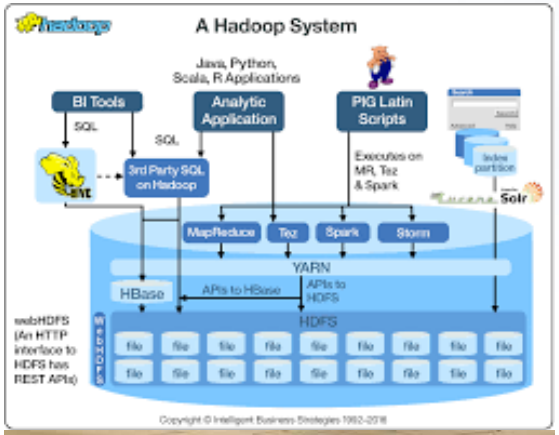

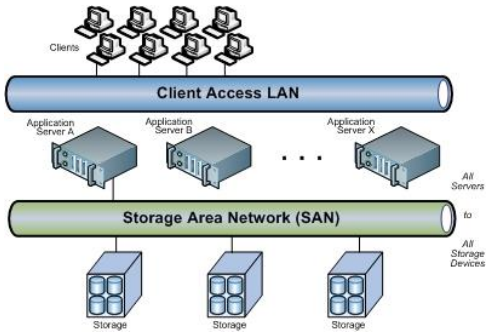

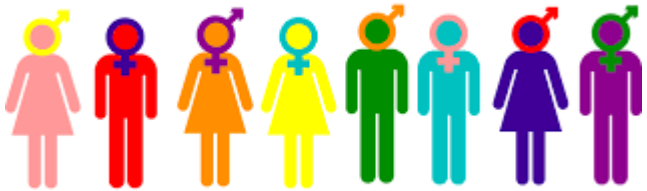

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1. Big Data 기반 Analytics Concept Making

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4) Sampling Methodology to Big Data Methodology

	Sampling Methodology	Big Data Methodology
일반화 접근	▪ Parametric Approach ▪ Small Sample의 반복 적용 ▪ Normal Distribution ▪ Linearity(선형성) 충족	▪ Non-Parametric의 수용 ▪ Big Data의 반복 적용 ▪ Combination between Linearity and Non-Linearity
Main Stream	▪ Statistics ▪ Simple Gaussian • Central Tendency • Linear Transformation • Correlation • Regression(Logistic 포함) • PCA ▪ Data Mining • Knowledge Data Discovery • Decision Tree, Clustering	▪ Machine Learning & Deep Learning ▪ Multiple Gaussian Fitting • (looping) Linear Transformation + Non-Linear Transformation ▪ Perceptron • Label & Features • Multi-Layers • Activations

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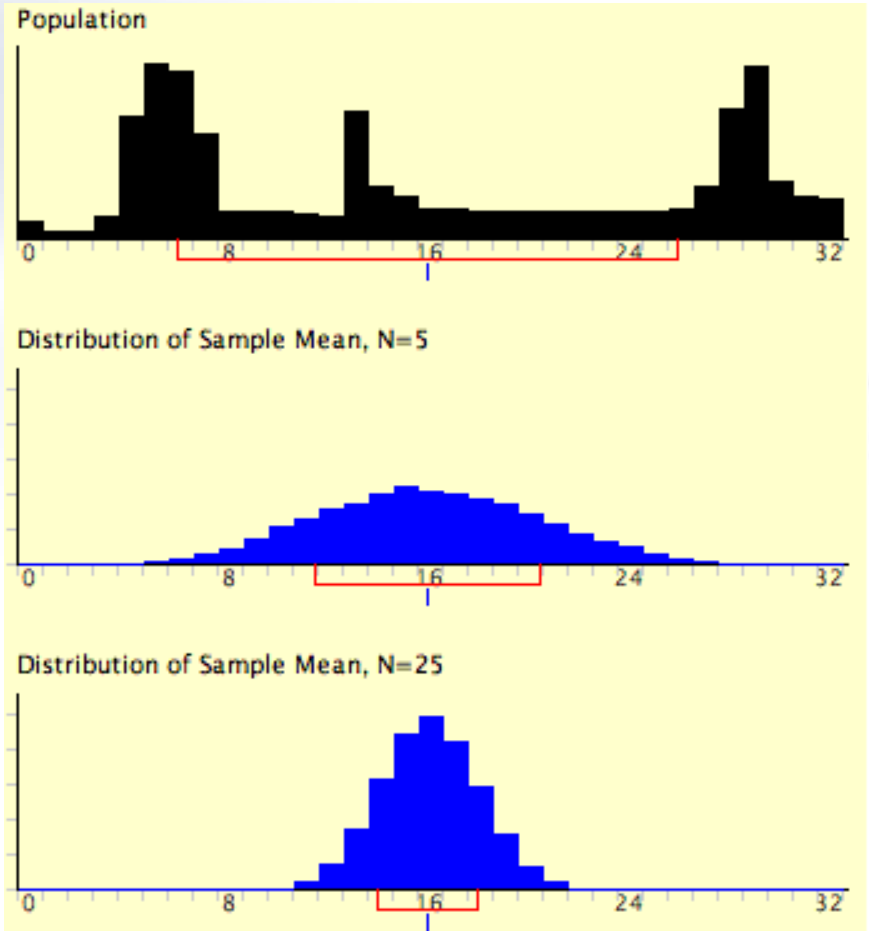

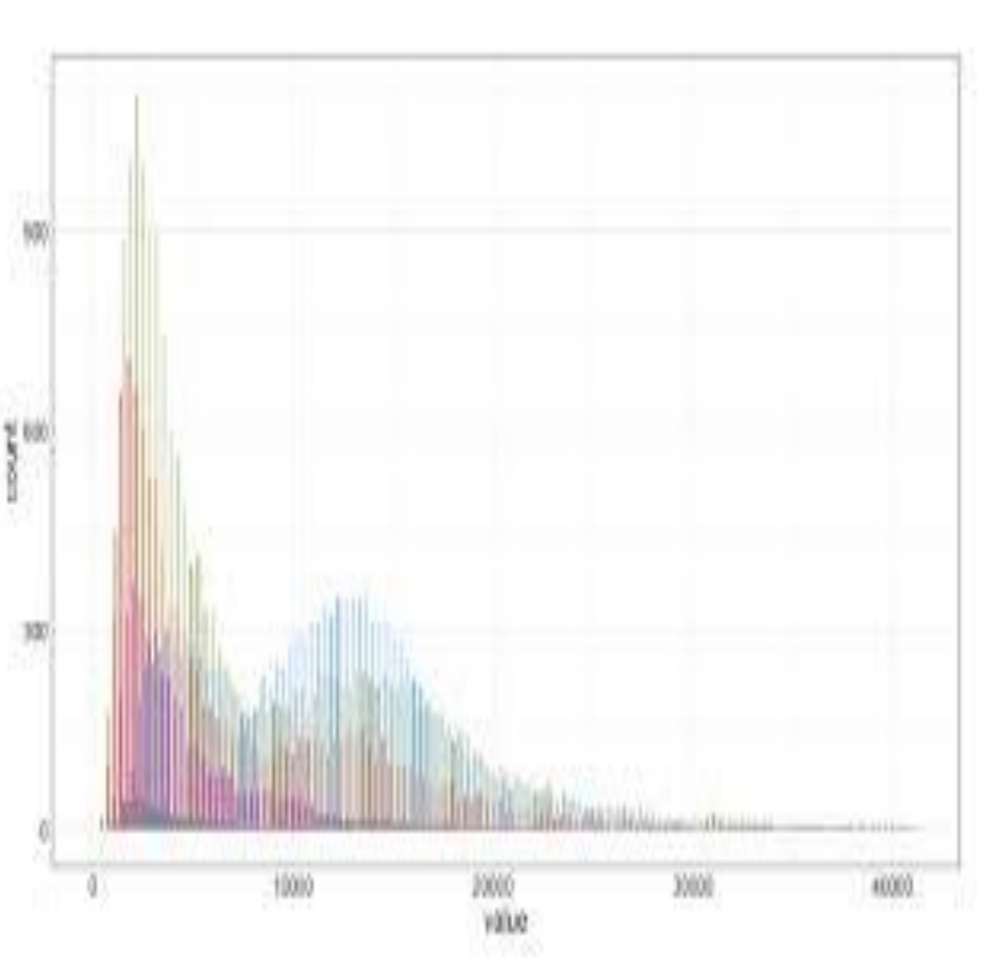

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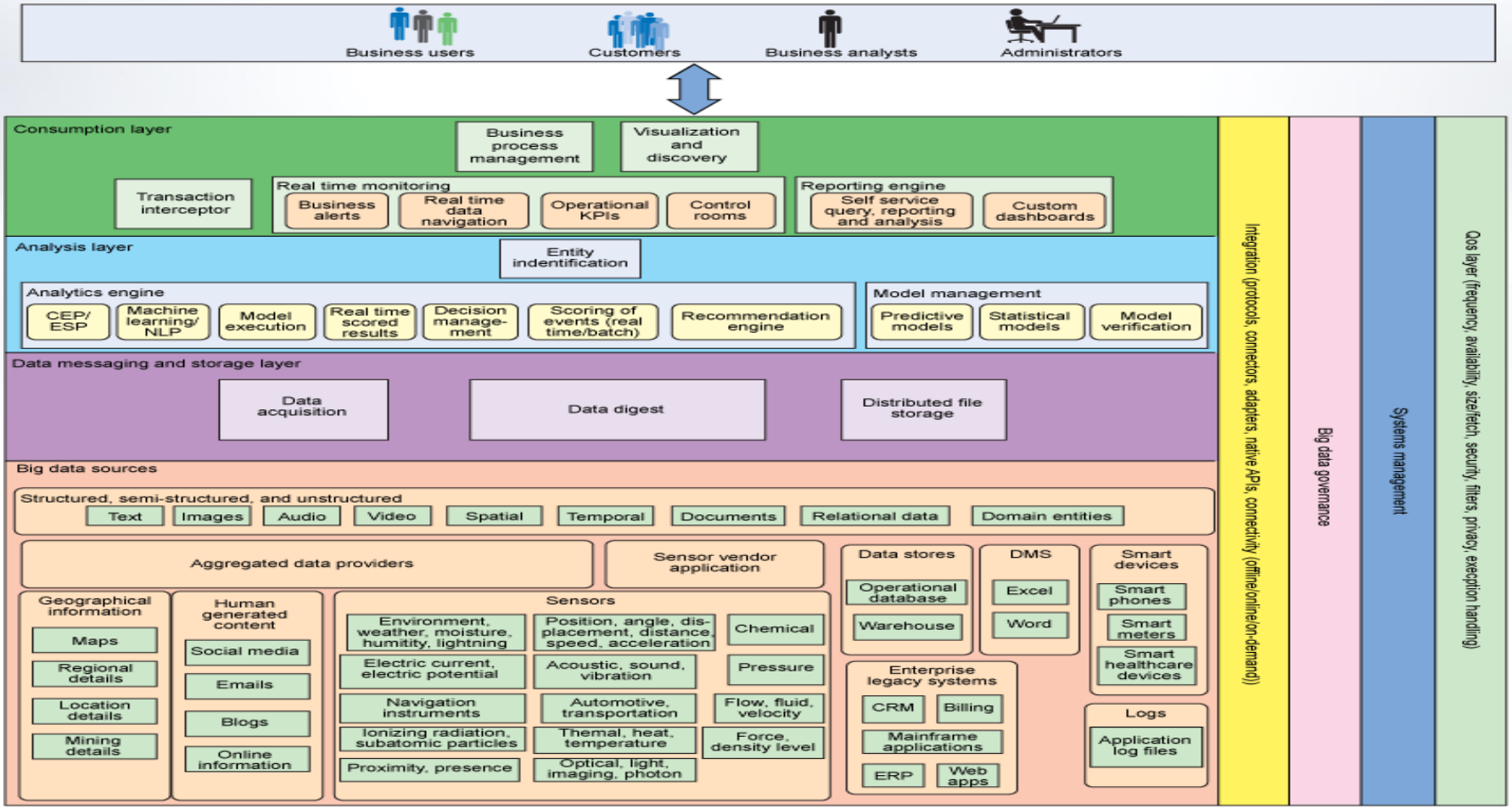
1. Big Data 기반 Analytics Concept Making

- Logical Layers of Big Data Solution
  - Big Data Sources, Data Management and Store Layer, Analysis Layers, Consumption Layer
  - [Point] 아래의 표를 이용하여 가치 창출을 요하는 Big Data 기반 Business Model의 Layer 정의

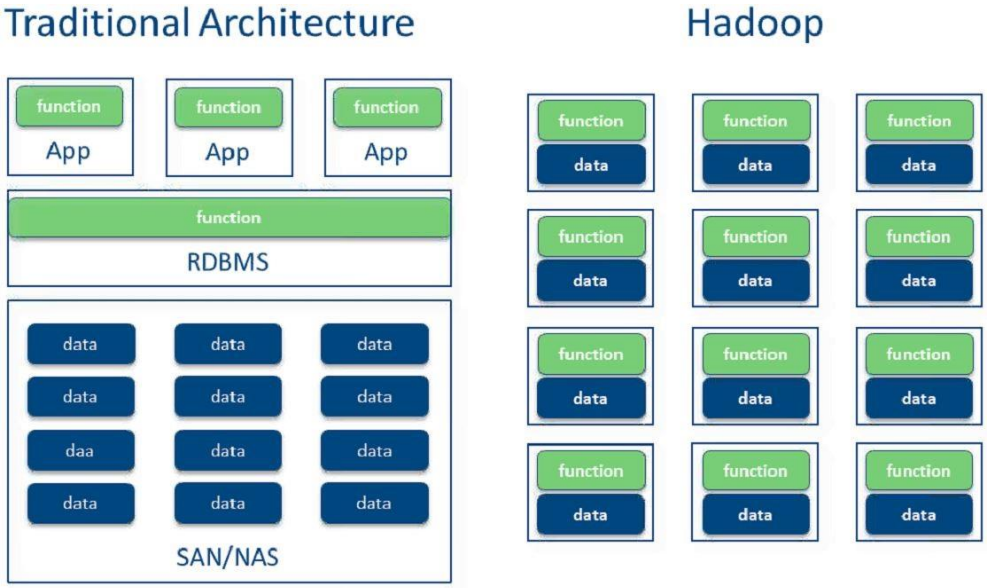


[source] https://www.xenonstack.com/blog/ingestion-processing-big-data-iot-stream/

2. Big Data Architecture

- Hadoop System의 특징
  - Data Node의 유연한 확장 – Tera, Peta
  - Map Reduce : Key-Value Pair

- Scale-Up
- Row/Column
- SQL
  - Conditional Record Selection
- OLTP
- Structured Data



[source] https://mapr.com/why-hadoop/why-mapr/architecture-matters/

- Scale-Out
  - Tera → Peta
- Key-Value Pair
- Map Reduce
  - Mapper, Reducer, Driver
- Batch
- Any Types
  - Structured
  - Semi-Structured
  - Unstructured

AI 관점

- 분석하고자 하는 대상 데이터의 집합소 → 전수 데이터 기반 분석 접근
- CSV, Text, Image, Voice, Video 등 모든 유형의 데이터 접근

☞ Real World Data의 제한없는 획득으로 실질적 분석 작업 인프라 실현

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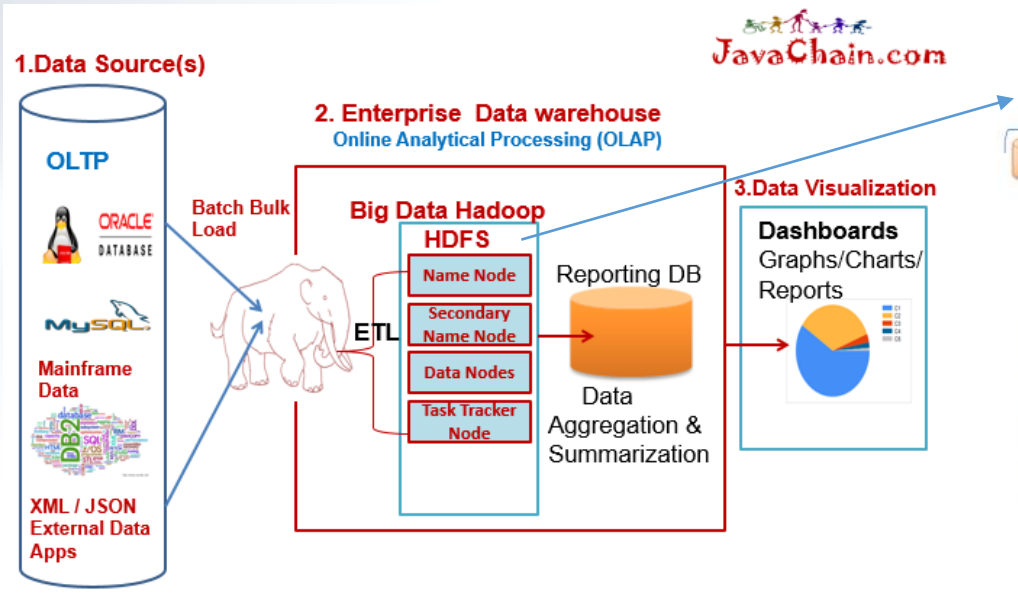
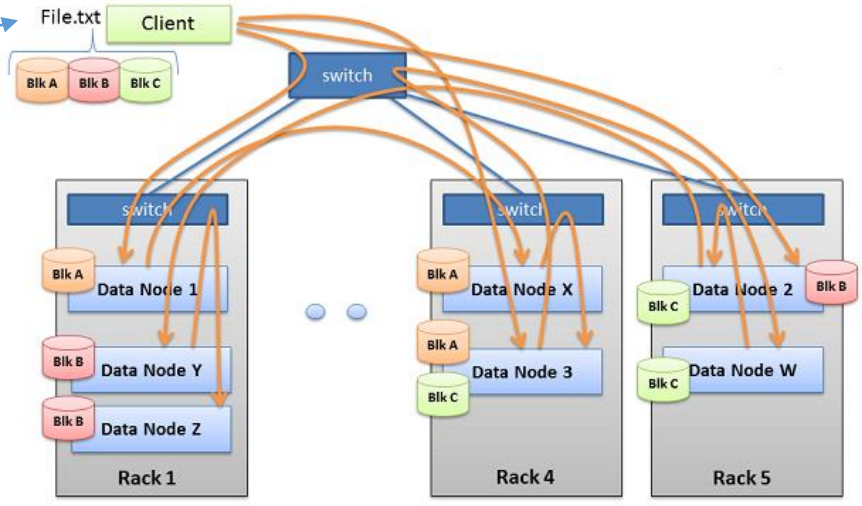
2. Big Data Architecture

- HDFS : Hadoop Distributed File System
  - CSV, TXT외의 다양한 Flat File Format(XML, JSON, Parquet 등)의 Hadoop에 저장
  - 아무리 큰 데이터라도 단위블록으로 분할하여 Data Node에 분산 저장
  - 데이터의 완전성 보증 : 하나의 단위 블럭을 3개의 Data Node에 저장



[source] http://www.javachain.com/big-data-hadoop-in-data-warehouse/



[source] https://hadoopabcd.files.wordpress.com/2015/03/multi-block-replication-pipeline1.png/

AI관점

- Analytic Input Data의 누락없음의 보증
- CSV중심으로 Input Data를 구성하더라도 XML, JSON, Parquet Format의 추가 가능

☞ XML, JSON, Parquet 등의 데이터 접근이 가능한 Library 설치 및 Script 작성

2. Big Data Architecture

- Hadoop Ecosystem
  - Open Source 로 제공하는 Enterprise Data Components 집합 생태계

2 → 1 ▪ Hadoop 자원 관리

1 → 3 ▪ Hadoop 파일시스템에서의 데이터 프로세싱 방식

4 → 1 ▪ 외부데이터(SNS포함)의 HDFS로 Import

5 ↔ 1 ▪ DBMS/CSV to HDFS

1 → 9 ▪ SQL on Hadoop

5 → 9 ▪ Any DBMS table to Hive Table

15 → 1 ▪ Hadoop Scheduling
▪ Workflow 제공

14 ▪ HDFS 기반 NoSQL database

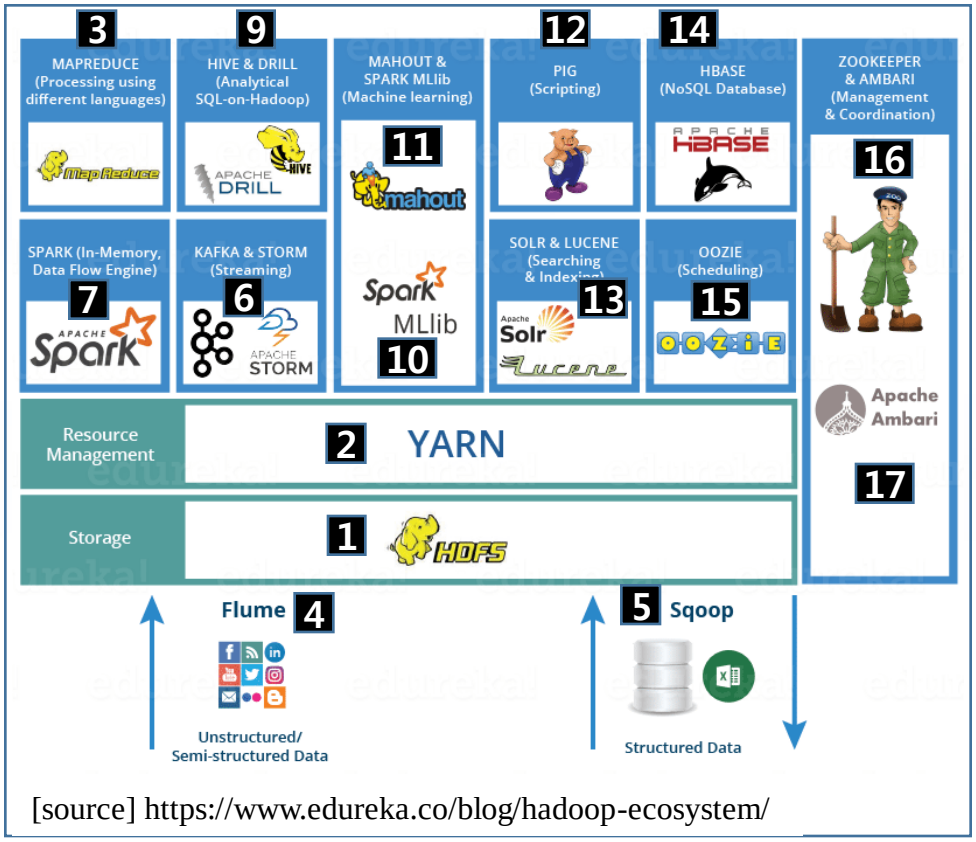
6 ▪ 실시간 스트리밍 연산 처리

12 ▪ HDFS processing 전용 Scripter

13 ▪ 검색 엔진

16 ▪ Hadoop Storage확장, 분산처리 관리 코디네이터

17 ▪ Hadoop 모니터링 Browser



[source] https://www.edureka.co/blog/hadoop-ecosystem/

7 ▪ Local file, hdfs, dbms 등 대부분의 데이터의 inmemory 기반 프로세싱(streaming 포함)
▪ org.apache.spark.sql

7 → 1 ▪ hdfs data를 memory로 load 하여 101배 빠른 데이터 프로세싱

7 → 9 ▪ Hive on Spark

10 ▪ Spark Machine Learning Library
▪ org.apache.spark.ml
▪ org.apache.spark.mllib

11 ▪ Spark Machine Learning Library

12 ▪ Map Reduce 기반의 Machine Learning Package
▪ org.apache.mahout

AI관점

- Python + Tensorflow의 근시안에서 벗어나기
- 분산시스템 프레임의 데이터 Flow의 기술적 이해는 Artificial Intelligence 전문가로 가는 길의 매우 충실한 촉진제 역할

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2. Big Data Architecture

- Hadoop Ecosystem
  - Language를 이용한 Big Data 접근 → AI 구현의 첫단계

1 Analytics Language

Compiler	Interpreter

Java	Scala	Python	R

Stats Library	ML Library	DL Library

Vector	Matrix	Tensor	Math

Data Processing Library

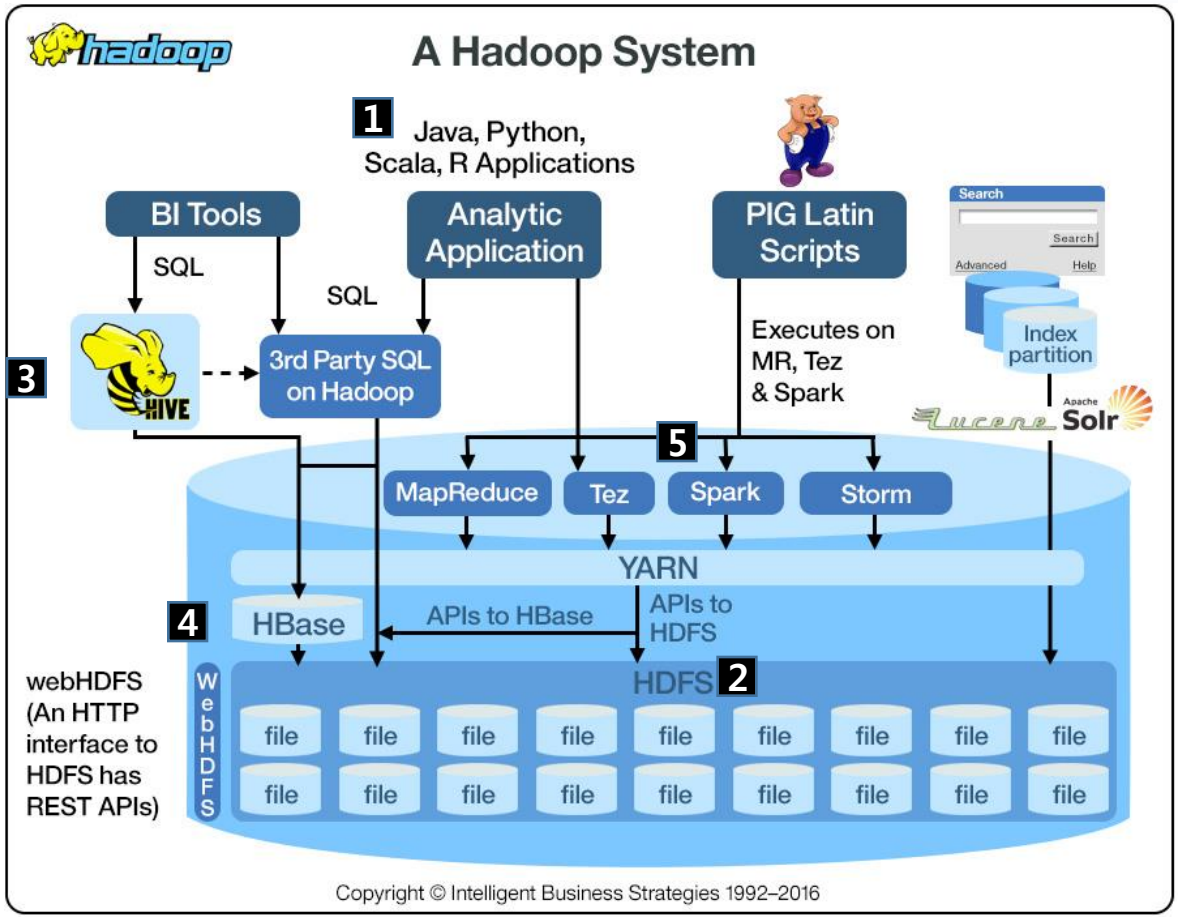
2 hdfs://<host:port>/<filepath>

- Flat File : csv, json, parquet, …
- Image : jpg, png, gif, svg, …
- Audio : mp3, wav, odg, …
- Video : mp4, avi,wmv, mpeg, …

3
```
import org.apache.hadoop.hive
select * from table_a …
```

4
```
import org.apache.hadoop.habse
select * from table_a …
```

5
```
import org.apache.spark
select * from table_a …
```



[source] http://www.ibmbigdatahub.com/blog/what-hadoop/

2. Big Data Architecture

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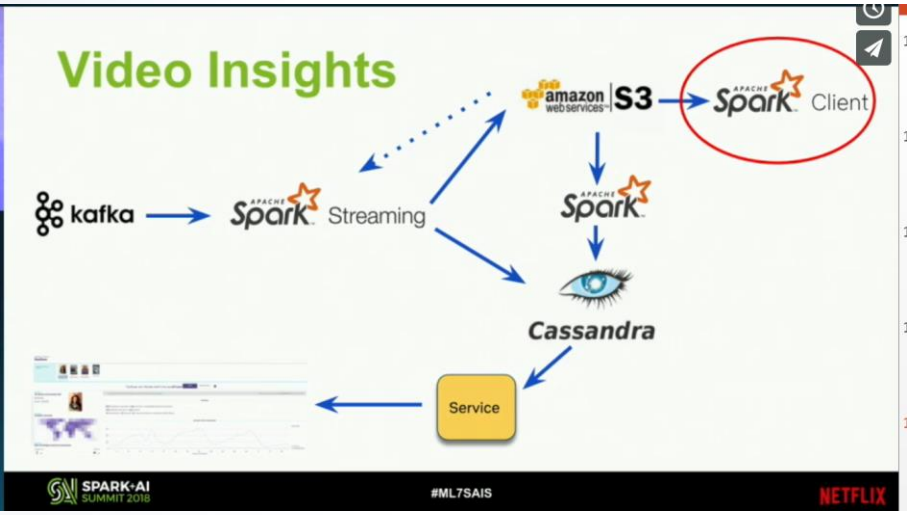
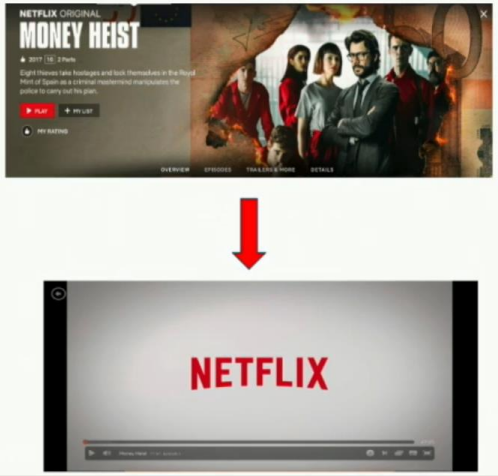
2. Big Data Architecture



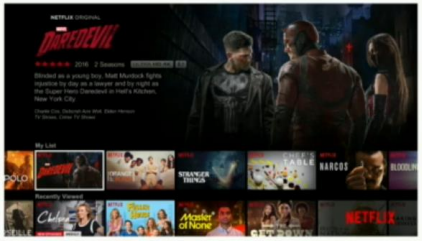
Required Data

- Impressions, Plays, etc.
- Attribution
- Explore/Exploit Metadata



Billboard Recommendations

- Recommend a relevant title to each member
- Right time
- Respond quickly to member feedback



Artwork Personalization

- Personalized Image
- Visual Evidence
- Quickly adapting - Title launches, member tastes
- Rapid learning - Cold start

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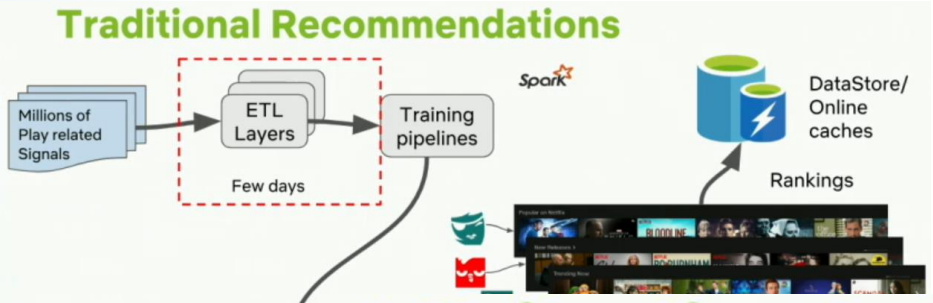
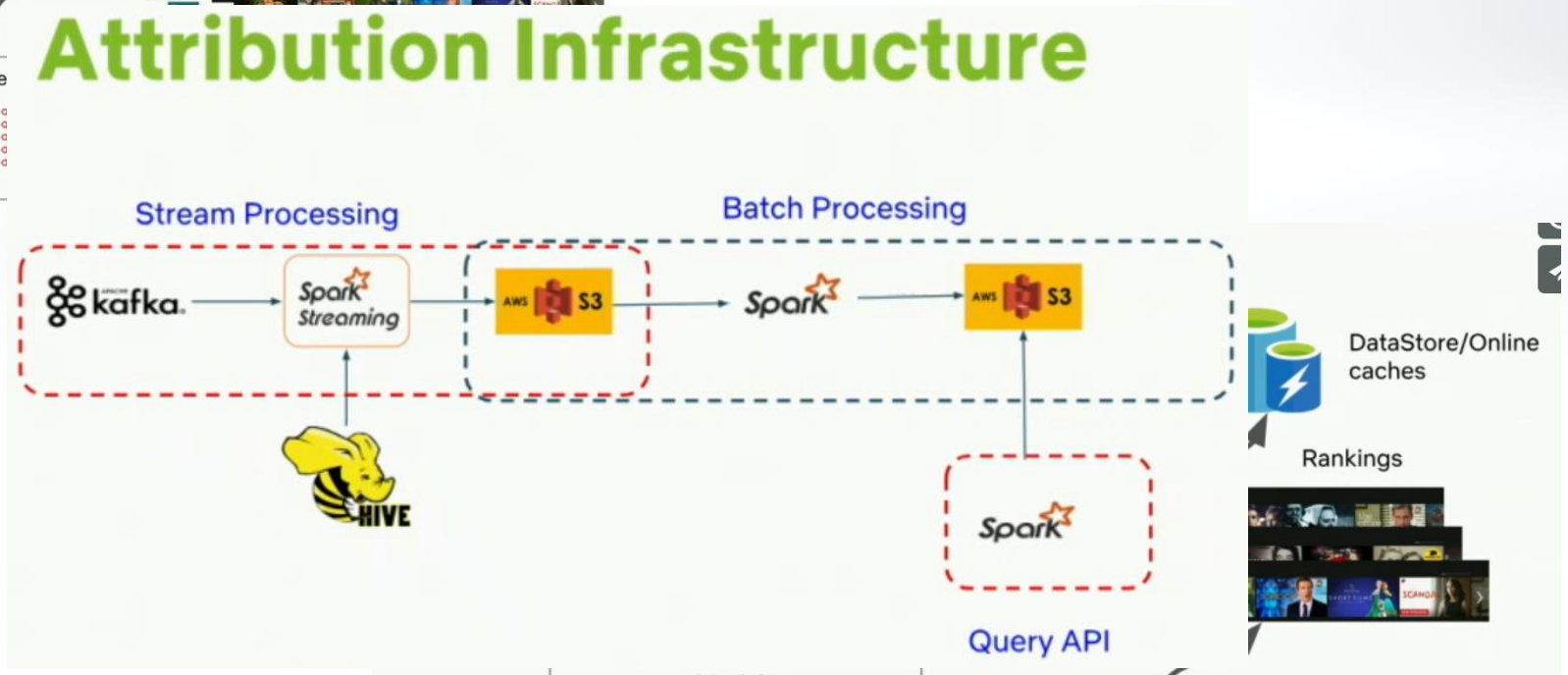
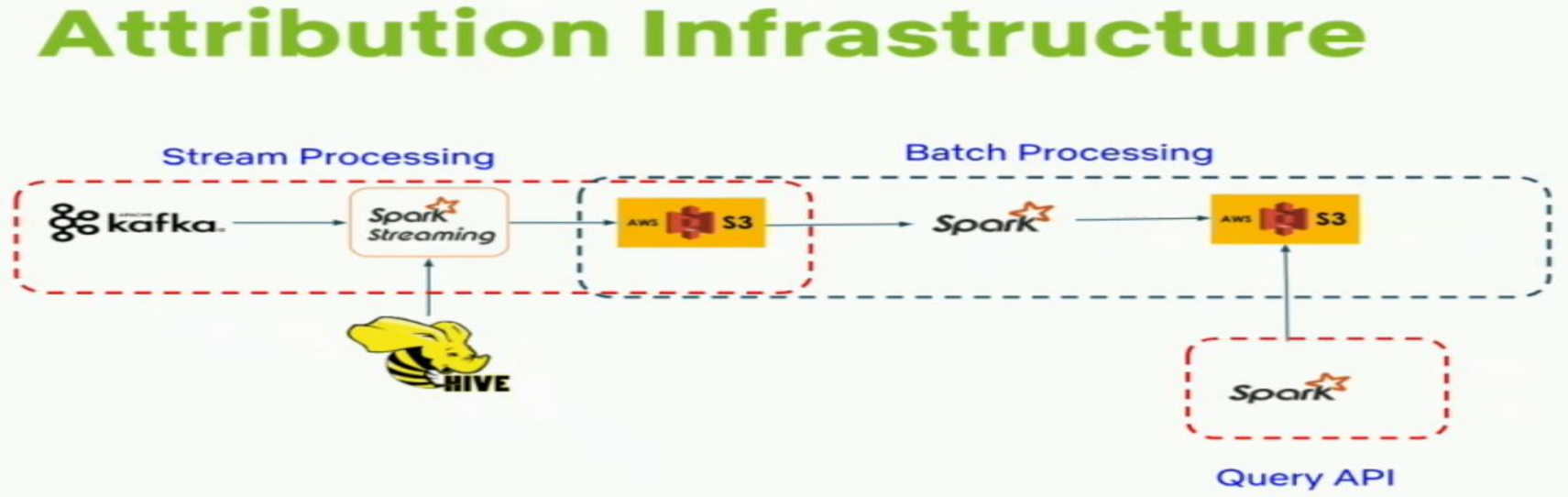
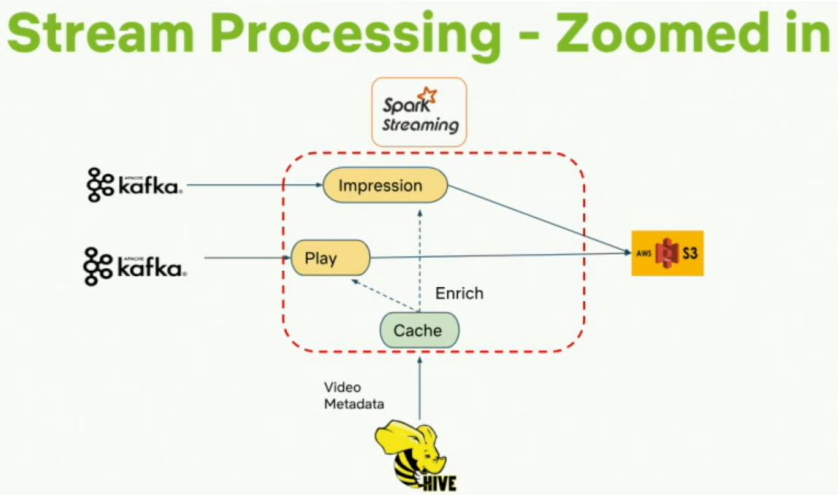
2. Big Data Architecture

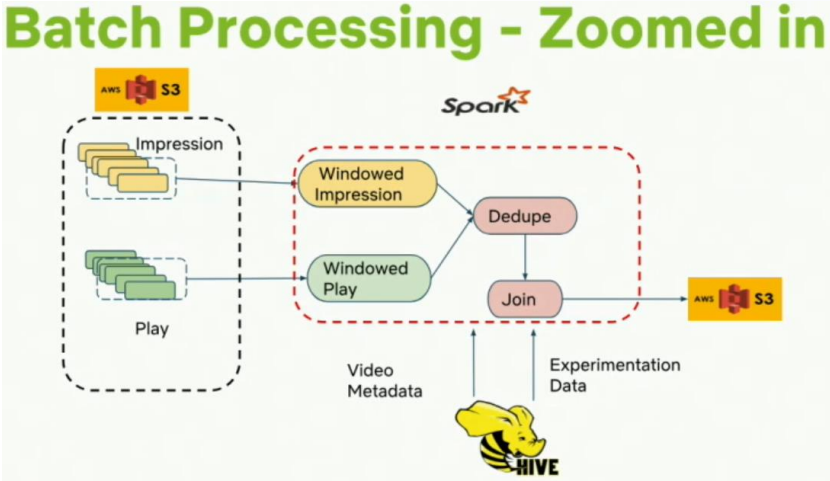




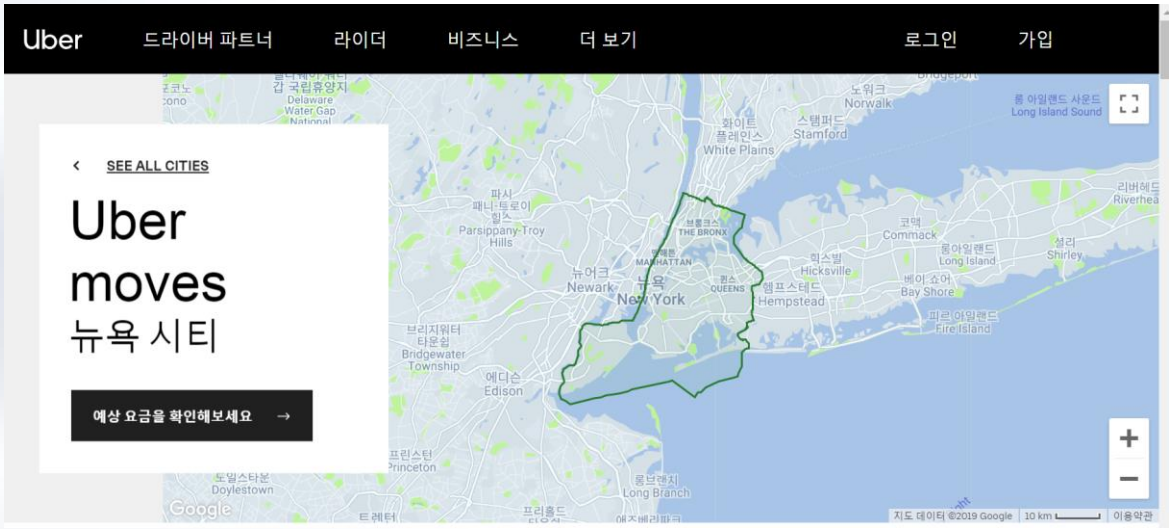
2. Big Data Architecture

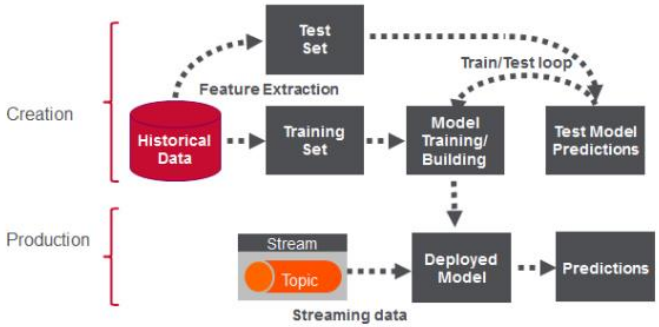






2. Big Data Architecture






```
import org.apache.spark._
import org.apache.spark.sql.SQLContext
import org.apache.spark.sql.types._
import org.apache.spark.sql.functions._
import org.apache.spark.sql._
import org.apache.spark.ml.feature.VectorAssembler
import org.apache.spark.ml.clustering.KMeans
```

```
val sqlContext = new SQLContext(sc)
import sqlContext.implicits._
import sqlContext._

val schema = StructType(Array(
  StructField("dt", TimestampType, true),
  StructField("lat", DoubleType, true),
  StructField("lon", DoubleType, true),
  StructField("base", StringType, true)
))
```

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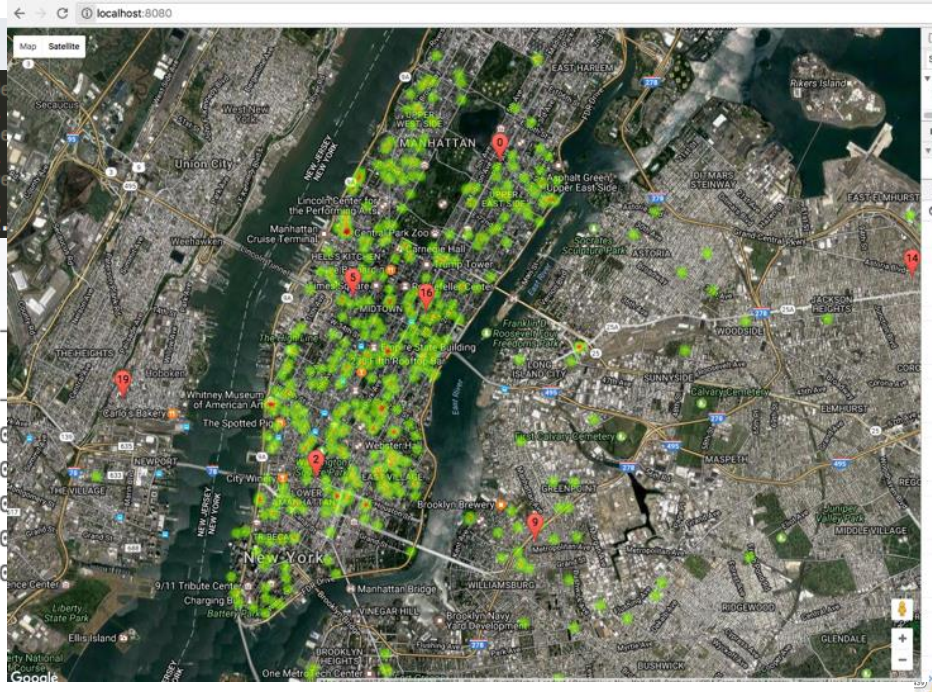
2. Big Data Architecture

Load data → Data Frame → transform → Features

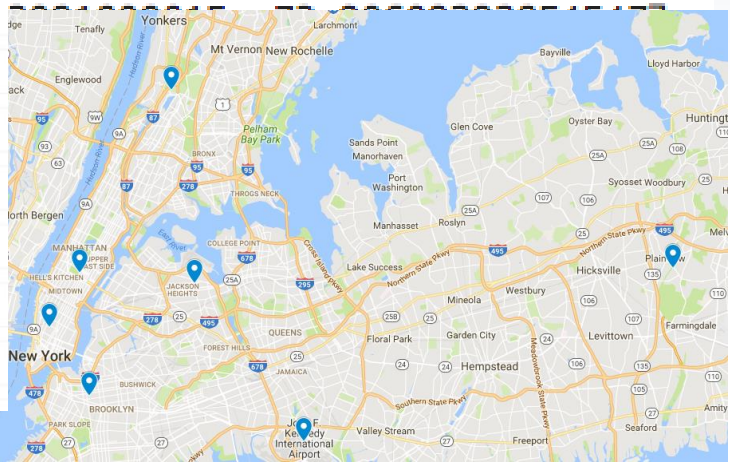
dt	lon	lat	base	features
2014-08-01 00:00:00	40.729	-73.9422	B02598	[40.729,-73.9422]

Load data → Data Frame → transform → Features → fit → model

dt	lon	lat	base	features
2014-08-01 00:00:00	40.729	-73.9422	B02598	[40.729,-73.9422]



```
ters:
885211822,-73.9734999829014]
065064515,-73.77831638518956]
711652399,-73.45962448979598]
284538119,-73.87295292246709]
```



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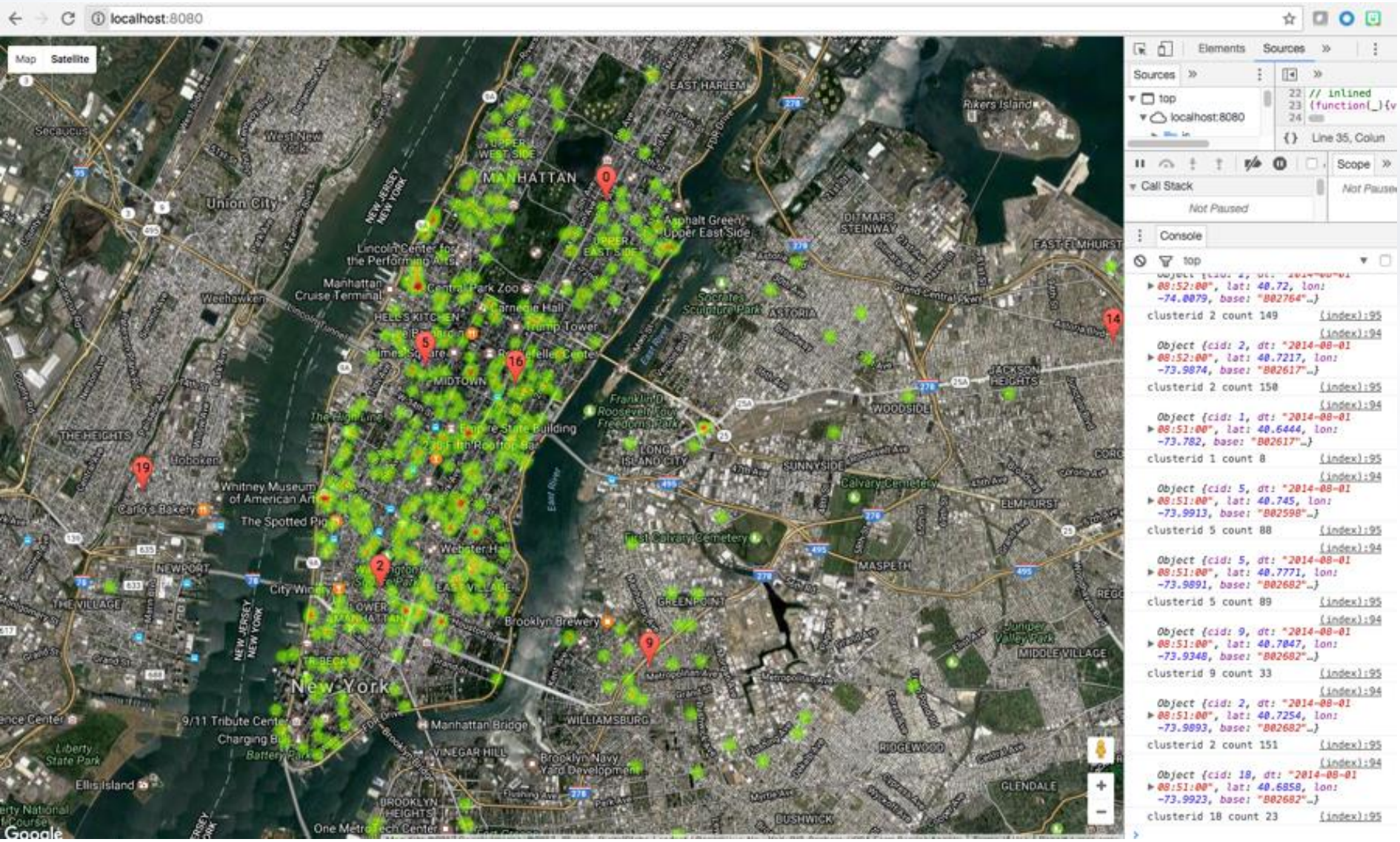
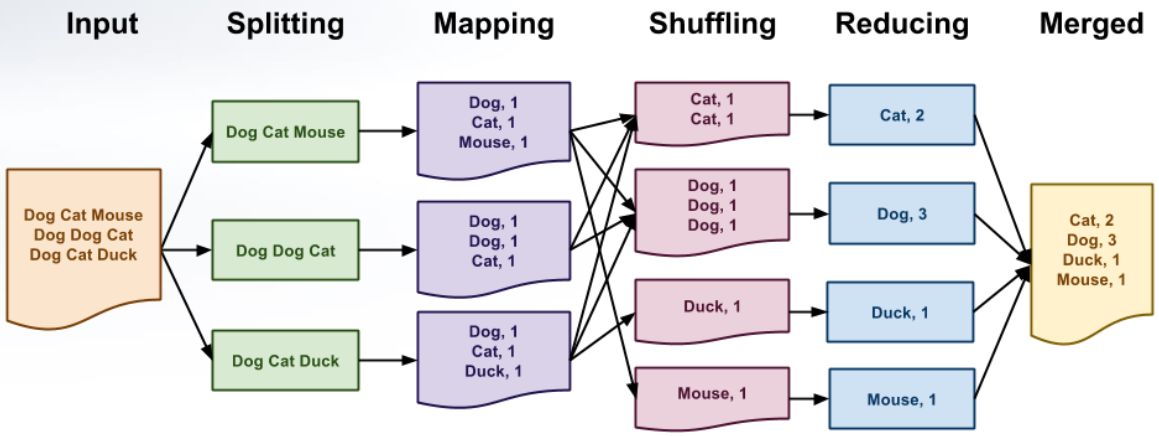
2. Big Data Architecture



2. Big Data Architecture

- Hadoop Map Reduce Technology
  - Mapper
  - Reducer
  - Shuffling



[source] https://www3.nd.edu/~pbui/teaching/cse.30331.fa16/challenge11.html/

```
package co.edureka.mapreduce;
import java.io.IOException;
import java.util.StringTokenizer;
import org.apache.hadoop.io.IntWritable;
import org.apache.hadoop.io.LongWritable;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapreduce.Mapper;
import org.apache.hadoop.mapreduce.Reducer;
import org.apache.hadoop.conf.Configuration;
import org.apache.hadoop.mapreduce.Job;
import org.apache.hadoop.mapreduce.lib.input.TextInputFormat;
import org.apache.hadoop.mapreduce.lib.output.TextOutputFormat;
import org.apache.hadoop.mapreduce.lib.input.FileInputFormat;
import org.apache.hadoop.mapreduce.lib.output.FileOutputFormat;
import org.apache.hadoop.fs.Path;

public class WordCount
{
public static class Map extends Mapper<LongWritable,Text,Text,IntWritable> {
public void map(LongWritable key, Text value,Context context) throws IOExcepti
String line = value.toString();
StringTokenizer tokenizer = new StringTokenizer(line);
while (tokenizer.hasMoreTokens()) {
value.set(tokenizer.nextToken());
context.write(value, new IntWritable(1));
}
}
}

public static class Reduce extends Reducer<Text,IntWritable,Text,IntWritable>
public void reduce(Text key, Iterable<IntWritable> values,Context context) thr
int sum=0;
for(IntWritable x: values)
{
sum+=x.get();
}
context.write(key, new IntWritable(sum));
}
}

public static void main(String[] args) throws Exception {

Configuration conf= new Configuration();
Job job = new Job(conf,"My Word Count Program");
job.setJarByClass(WordCount.class);
job.setMapperClass(Map.class);
job.setReducerClass(Reduce.class);
job.setOutputKeyClass(Text.class);
job.setOutputValueClass(IntWritable.class);
job.setInputFormatClass(TextInputFormat.class);
job.setOutputFormatClass(TextOutputFormat.class);
Path outputPath = new Path(args[1]);
//Configuring the input/output path from the filesystem into the job
FileInputFormat.addInputPath(job, new Path(args[0]));
FileOutputFormat.setOutputPath(job, new Path(args[1]));
//deleting the output path automatically from hdfs so that we don't have to de
outputPath.getFileSystem(conf).delete(outputPath);
//exiting the job only if the flag value becomes false
System.exit(job.waitForCompletion(true) ? 0 : 1);
}
}
```

AI 관점

- 대부분의 분석용 data는 이미 MapReduce 연산 처리가 되어있으므로, 특별한 경우를 제외하고는 분석가가 MapReduce native Coding 작업을 할 필요가 없음.
- 하지만 Data Scientist는 저수준의 MapReduce Operation 구조를 이해하고 있어야, IT 조직과 원활한 소통이 가능

2. Big Data Architecture

- Hadoop Map Reduce 가상 체험 실습
  - 분산시스템에서의 병렬 처리로 수행되는 Data 연산 과정의 Look & Feel
  - AI Service Server 구축을 위해 수없이 반복해야할 Software 설치/재설치 및 환경 Setting에 익숙해지기
  - Windows에 비해 다소 불편(?)할 수 있는 Linux 중심의 Open Source에 감사하는 Data Scientist 지향적 Mind-Set 전환

설치할 S/W	Link
Virtual Box 6.0.6	▪ https://download.virtualbox.org/virtualbox/6.0.6/VirtualBox-6.0.6-130049-Win.exe
Centos 7	▪ http://isoredirect.centos.org/centos/7/isos/x86_64/CentOS-7-x86_64-Minimal-1810.iso
Hadoop 3.2.0	▪ https://www.apache.org/dyn/closer.cgi/hadoop/common/hadoop-3.2.0/hadoop-3.2.0.tar.gz

AI 관점

- Huge Data 접근의 Entry Point – Data Scientist의 Road Map
  - Peta Data Processing
  - 30억 Rows + 1000개의 Columns에서의 Fact Finding
  - 전세계 Web 정보 전체에서의 New Trend Discovery
  - 1일 0.1초당 측정되는 10000개 Sensor에 나타난 Pattern

Rethink Business

Scale-out !!!

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2. Big Data Architecture

Hadoop: Setting up a Single Node Cluster.

- Purpose
- Prerequisites
  - Supported Platforms
  - Required Software
  - Installing Software
- Download
- Prepare to Start the Hadoop Cluster
- Standalone Operation
- Pseudo-Distributed Operation
  - Configuration
  - Setup passphraseless ssh
  - Execution
  - YARN on a Single Node
- Fully-Distributed Operation


```
export JAVA_HOME=/usr/java/latest
```

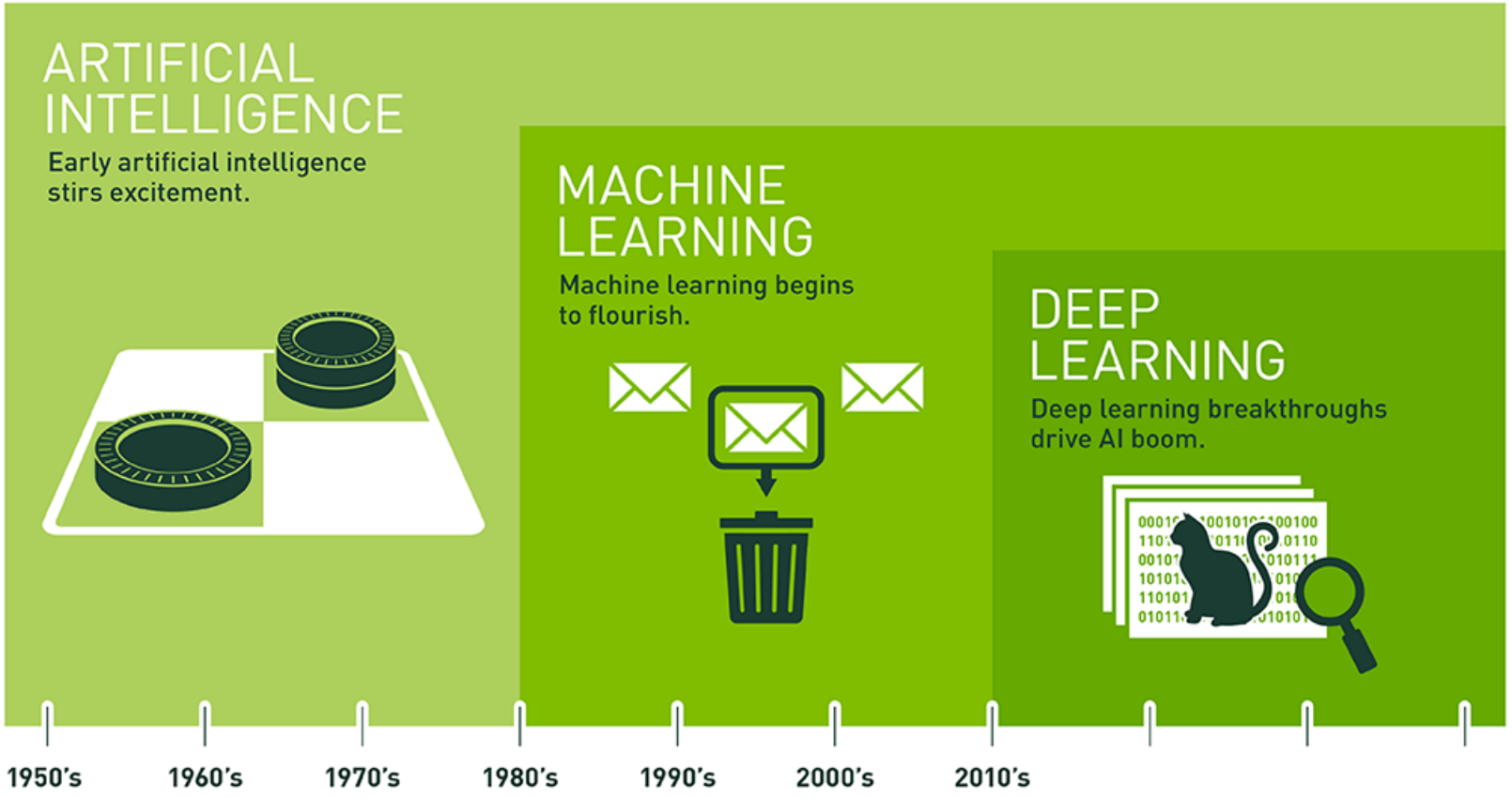
```
$ bin/hadoop
```

```
$ mkdir input
$ cp etc/hadoop/*.xml input
$ bin/hadoop jar share/hadoop/mapreduce/
  hadoop-mapreduce-examples-3.2.0.jar g
  rep input output 'dfs[a-z.]+'
$ cat output/*
```

[source] https://hadoop.apache.org/docs/r3.2.0/hadoop-project-dist/hadoop-common/SingleCluster.html/

3. AI, Machine Learning and Deep Learning

- AI, ML, DL



Since an early flush of optimism in the 1950s, smaller subsets of artificial intelligence – first machine learning, then deep learning, a subset of machine learning – have created ever larger disruptions.

[source] https://blogs.nvidia.com/blog/2016/07/29/whats-difference-artificial-intelligence-machine-learning-deep-learning-ai/

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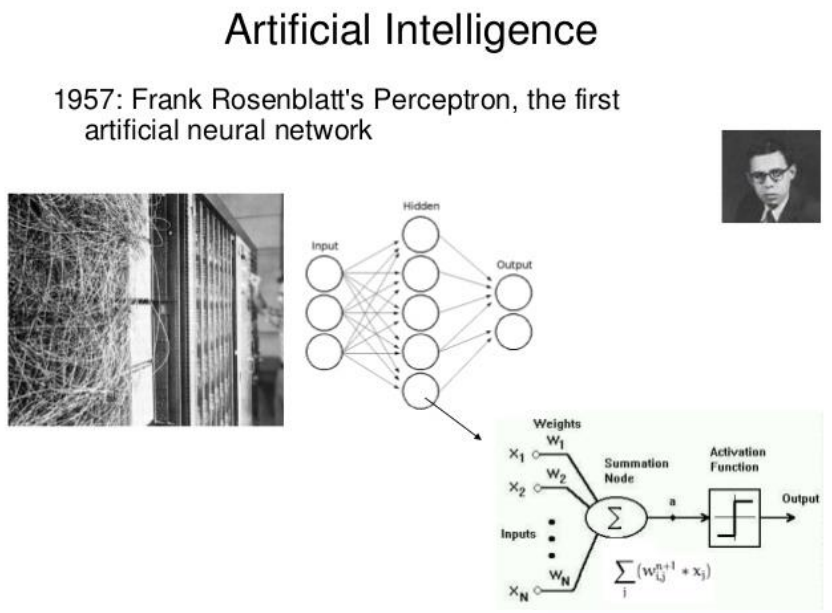
3. AI, Machine Learning and Deep Learning

Artificial Intelligence 정의

- Machine Intelligence
- Intelligent Agent
- Learning & Problem Solving



Wikipedia

1) In computer science, artificial intelligence (AI), sometimes called **machine intelligence**, is intelligence demonstrated by machines, in contrast to the natural intelligence displayed by humans and animals.

2) Computer science defines AI research as the study of **"intelligent agents": any device that perceives its environment and takes actions that maximize its chance of successfully achieving its goals**.

3) Colloquially, the term "artificial intelligence" is used to describe machines that mimic "cognitive" functions that humans associate with other human minds, such as **"learning" and "problem solving"**.

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3. AI, Machine Learning and Deep Learning

Machine Learning 정의

- Machine : Computer
- Learning : the ability to learn without being explicitly programmed

[source] IBM 1959

"[Machine Learning is the] field of study that gives computers the ability to learn without being explicitly programmed." – **Arthur Samuel (1959)**

Wikipedia

1) Evolved from the study of **pattern recognition** and **computational learning theory** in **artificial intelligence** (http://www.britannica.com/EBchecked/topic/1116194/machine-learning)
2) Machine learning is closely related to (and often overlaps with) computational **statistics**, which also focuses on **prediction-making** through the use of computers.
3) It has strong ties to **mathematical optimization**, which delivers methods, theory and application domains to the field.
4) Machine learning is sometimes conflated with **data mining**
5) Machine learning can also be **unsupervised** and be used to learn and establish baseline behavioral profiles for various entities and then used to find meaningful anomalies.

3. AI, Machine Learning and Deep Learning

Deep Learning 정의

- Broader Family of Neural Network Methods
- Learning : Supervised
- Deep vs Shallow

Wikipedia

1) Deep learning (also known as deep structured learning or hierarchical learning) is part of a broader family of neural network methods based on convolutional neural networks (CNN)s. Learning can be supervised, semi-supervised or unsupervised.
2) Deep learning architectures such as deep neural networks, deep belief networks recurrent neural networks and convolutional neural networks have been applied to fields including computer vision, speech recognition, natural language processing, audio recognition, social network filtering, machine translation, bioinformatics, drug design, medical image analysis, material inspection and board game programs, where they have produced results comparable to and in some cases superior to human experts.

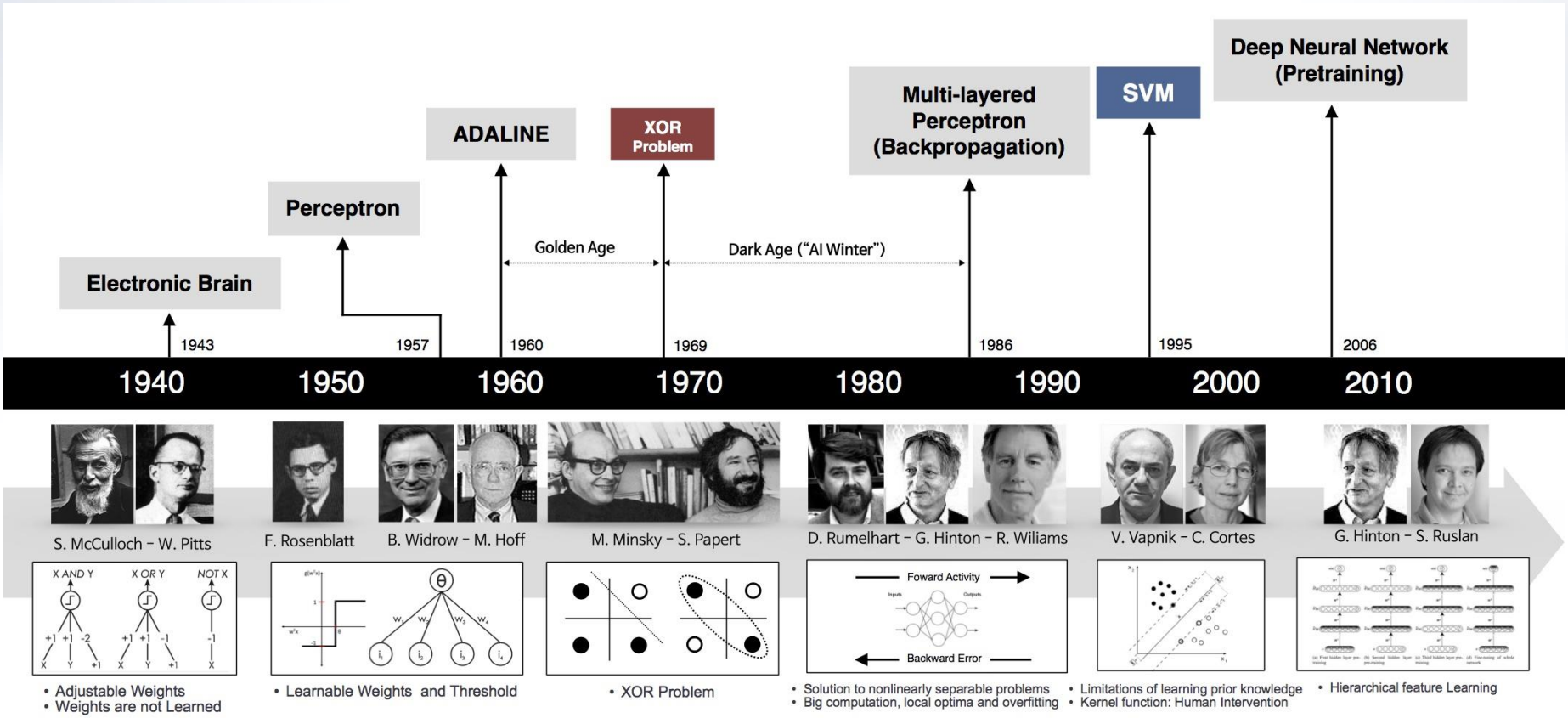
3. AI, Machine Learning and Deep Learning

- AI, ML, DL

AI	ML	DL
1950s	1960s	1970s
실세계 시뮬레이션	의사결정	복잡한 문제 해결
▪ 인간처럼 사고하고 행동하는 Device	▪ 의사결정에 필요한 데이터의 학습(Learning)	▪ 인간의 오감으로 발견하기 어려운 특징의 탐색
AI > ML > AI	ML > AI	ML

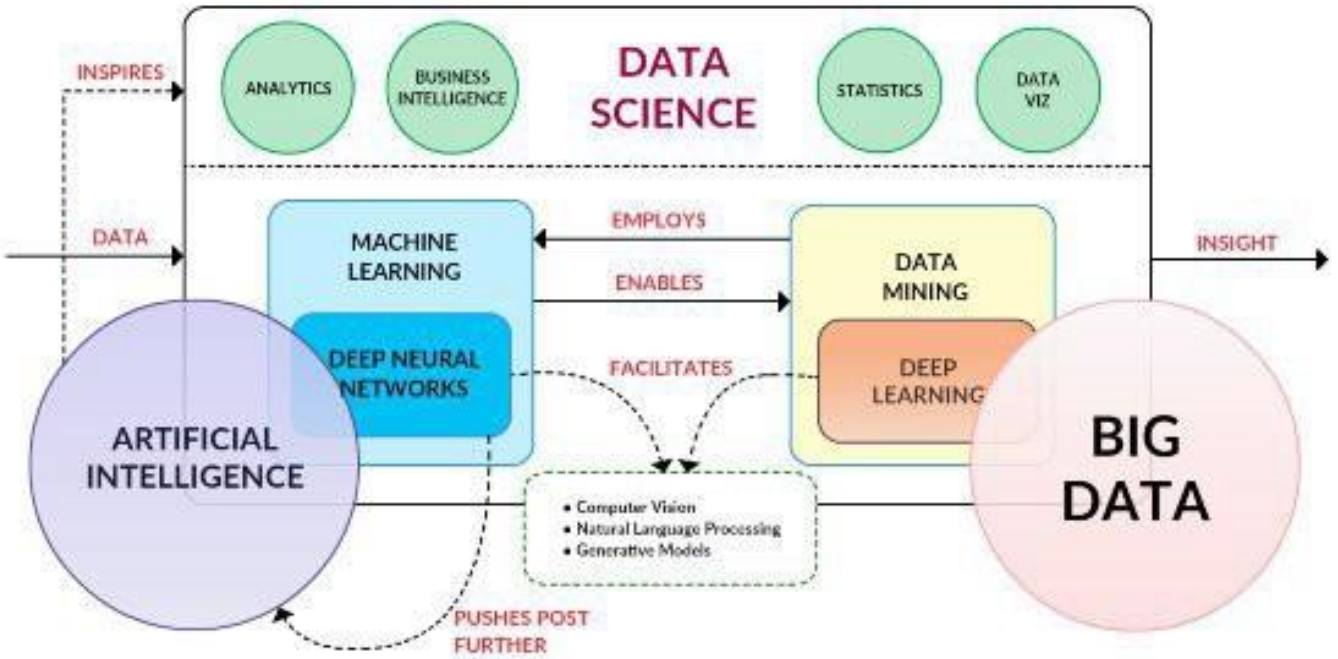
3. AI, Machine Learning and Deep Learning

- Brief History
  - 1970s – AI winter
  - SVM의 등장 – Deep Learning 능가
  - 고성능 컴퓨터 + Backpropagation의 실현으로 DL이 Main Stream으로 포지셔닝



[source] https://medium.com/ibm-data-science-experience/deep-learning-with-data-science-experience-8478cc0f81ac

4. Big Data 시스템에서의 AI의 위치와 역할



[source] https://hackernoon.com/how-big-data-is-empowering-ai-and-machine-learning-4e93a1004c8f

- AI의 R & R
  - Heuristic으로 접근해서 발견할 수 없는 기회에의 Challenge
  - 접근하지 못했던 실시간 Streaming Data(실시간 시장의 흐름, 공정의 상태 변화 등)의 모니터링 실현으로 상시 업무로의 전환
  - 경쟁우위(Competitive Advantage)를 점할 수 있는 최초의 제품/Service/Application 창출
  - 상시업무에서의 중요도가 극히 낮은 Big Data의정체성 확인과 빅데이터 유용성의 전사 확산

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4. Big Data 시스템에서의 AI의 위치와 역할

A사 사례

B사 사례

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