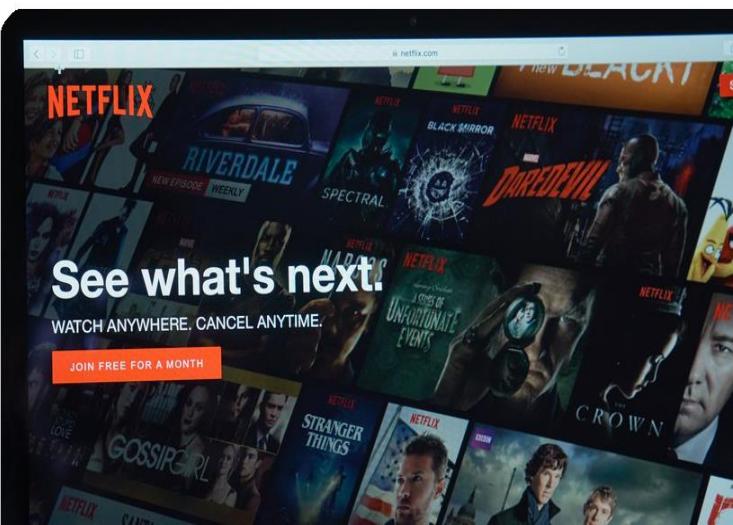




Introduction to Artificial Intelligence and Data Science



Walmart 
Save money. Live better.



Why Artificial Intelligence?

Two explosions killed 3 people and injured many at the April 15 Boston Marathon. Within 24 hours the FBI had correctly identified the suspects. To do this, they analysed about 10 TB of data from cell phone tower call logs, text messages, social media, photographs and videos from surveillance cameras and cell phones.

How did they identify the correct suspects from the enormous amount of data in less than 24 hours?

Boston Marathon Blasts Kill 3, Injure More Than 150

Marsh Plaza vigil Tuesday night

04.15.2013

By BU Today staff

95



In the slideshow above, view photographs from the Boston Marathon tragedy by BU photojournalism students. Photos by BU Photojournalism

Two explosions rocked the finish line of the Marathon about 3 p.m. on Monday, killing 3 people and injuring more than 150 others. At least 20 victims are being treated at Boston Medical Center. Boston University Police have been working with Boston Police on an investigation of the blasts, which has been taken over by the FBI.

In a note sent to the BU community Monday evening, President Robert A. Brown said the University will work with other officials to understand the media coverage

Can a machine beat humans in medical expertise?

Doctors at the University of Tokyo tried for many months to diagnose the disease a lady had. They were unsuccessful.



A machine successfully diagnosed it as a rare form of leukemia in minutes. It spent just 10 minutes cross-referencing the patient's genetic changes with 20 million cancer research papers. The finding was a life saver.

American Express handles over 25% of credit card activity in the USA. In 2014, they handled over \$1 trillion in transactions. Fraudulent transactions are a big risk to the credit card business. They identified and prevented about \$2 billion of potential fraud in a single year.

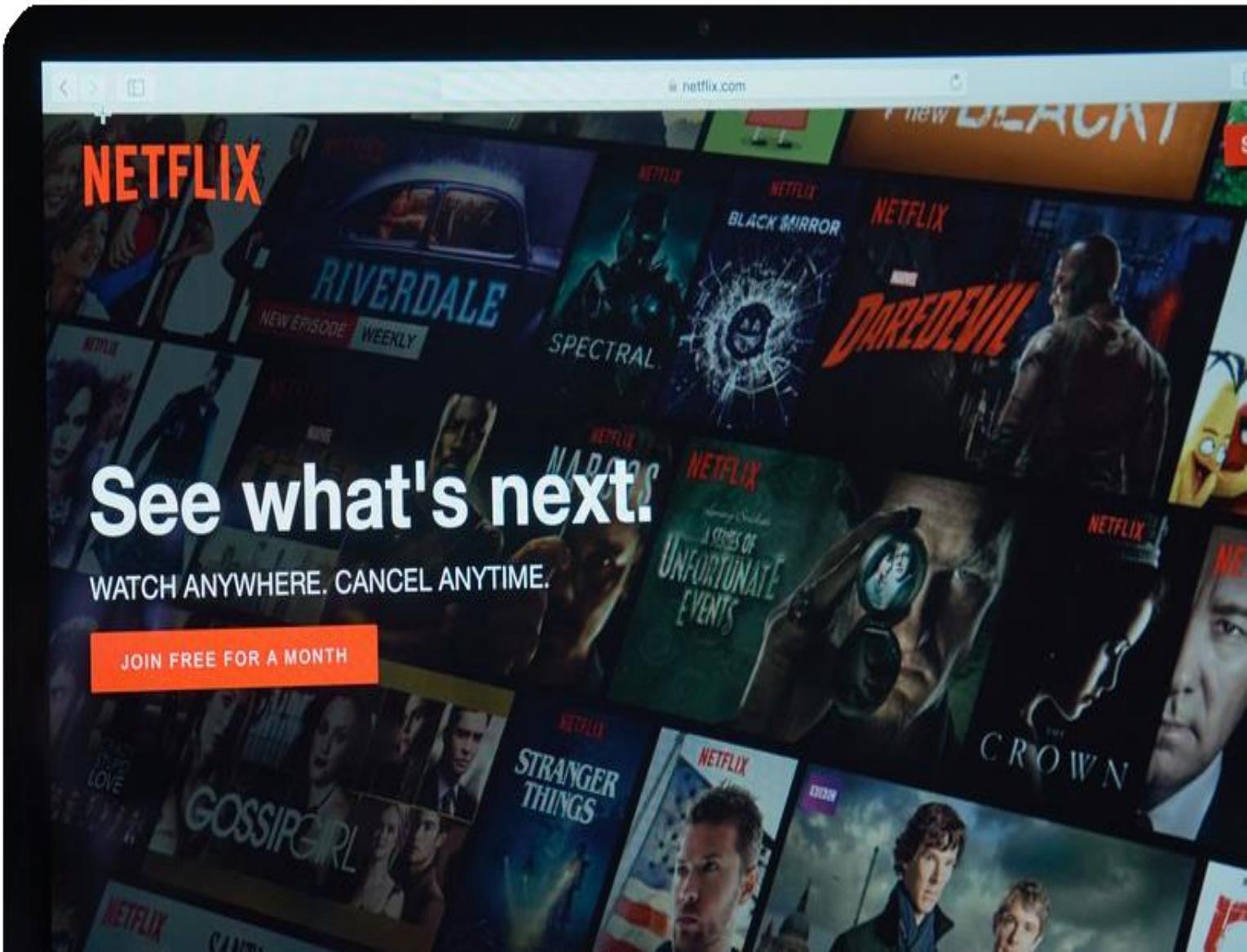


How did they do it?

It's critical for Netflix to help customers find desirable content quickly.

Customers tend to give up if it takes longer than 90 seconds to find a show they want. Through better search results, Netflix estimates that it saves \$1 billion annually by preventing subscription cancellations.

How do they personalize recommendations for 200+ million subscribers worldwide



Rolls-Royce manufactures enormous engines used by over 500 airlines and 150 armed forces.

They use AI processes in their product life cycle. They employ IoT, Cloud and Analytics in design, manufacturing and after sales support.



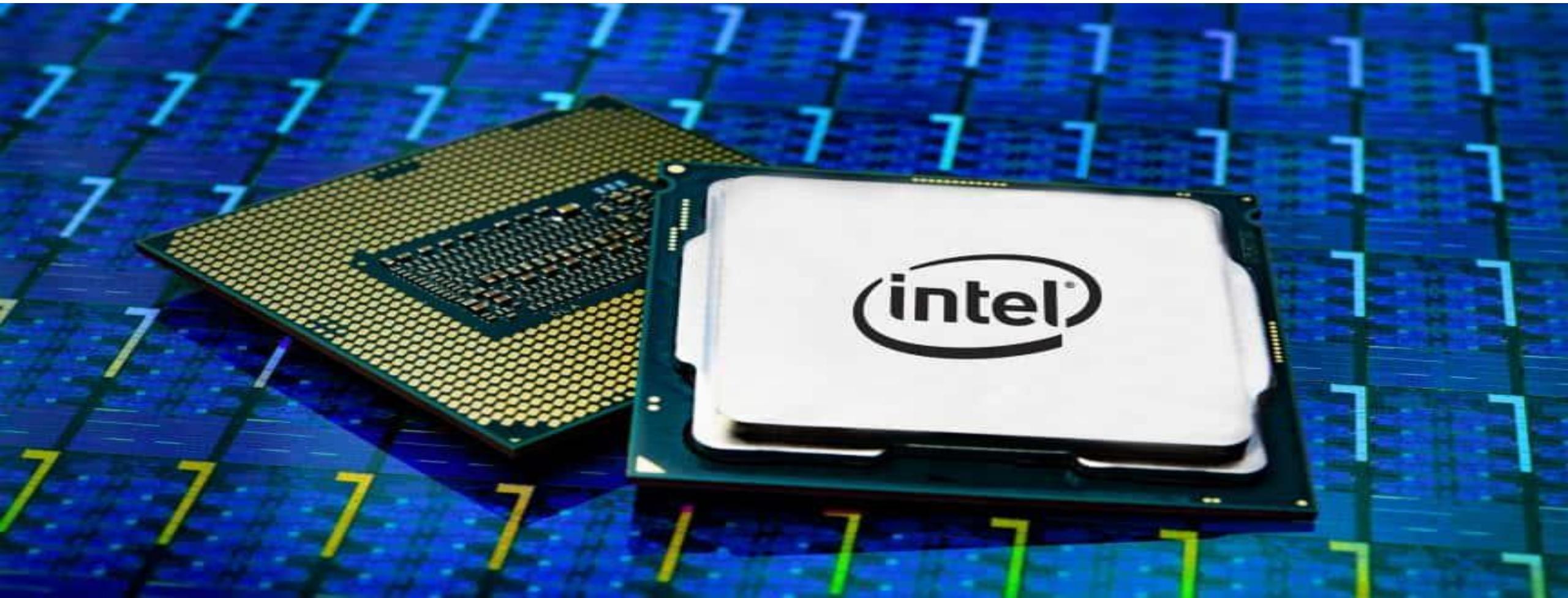
They use computer-based simulation and visualization to enhance their designs. Their manufacturing systems communicate with each other in an IoT industrial environment.

Rolls-Royce engines and propulsion systems record operational details in hundreds of sensors. Real time changes in data are reported to service center engineers.



With these insights, Rolls-Royce offered a new service model to clients called Total Care - customers are charged per hour for engine use with all servicing costs underwritten by Rolls-Royce. This pioneering business model has become a perennial source of income for the company

Intel does 19000 tests on every chip it makes. Using ML, Intel was able to significantly reduce the number of QA tests. They analyzed data from the manufacturing process to reduce test time and focus on specific tests. Intel saved \$3 MUSD in manufacturing costs for a single line of Intel Core processors and expect to save an additional \$30 million.





**2 million+ employees.
20,000+ stores in 24 countries.**

At Walmart, analytics have **reduced the problem finding to solution finding period** from 2-3 weeks to 20 minutes.

- Analytics is used for personalization, targeted marketing and optimized scheduling for quicker delivery
- While forecasting demand for emergency supplies for Hurricane Sandy, an increase in sales of strawberry pop tarts in several locations was predicted. The items were sent to these locations and sold well.
- Continuously monitor performance against the target and suggest corrective actions
- A grocery team couldn't understand why sales of a particular produce were declining. Analysis established that this was due to a pricing error. Sales recovered once the error was fixed.
- One Halloween, sales figures of novelty cookies were being monitored. Analysts saw that several locations weren't selling them at all –the products hadn't even been put on the shelves.



Automated convenience Stores – Amazon Go, Amazon Fresh

Conclusion: Adoption of AI is leading to ...

- Creation of new business lines
- Competitive advantage
- Cost reduction, increased productivity, process improvements
- Personalized communication at scale
- AI centered innovations of products and processes.

AI trends in business and market potential

Healthcare



Finance & Insurance



Construction

Govt. & City Planning



Retail & Warehousing



Legal



Mining



Food & Agriculture



Media & Entertainment



Education



Manufacturing



Energy



CROSS-INDUSTRY TECH

AI Processors



AI Model Development



DevOps & Model Monitoring



Growth in the market is driven by increasing adoption in expanding range of applications in varied industries.

Global Artificial Intelligence market predicted to touch \$228.3 billion in next five years

- The Global Industry Analysts Inc

NLP, NLG, & Computer Vision



Cybersecurity



BI & Ops Intel



Sales & CRM



Other R&D



Created by You. Powered by



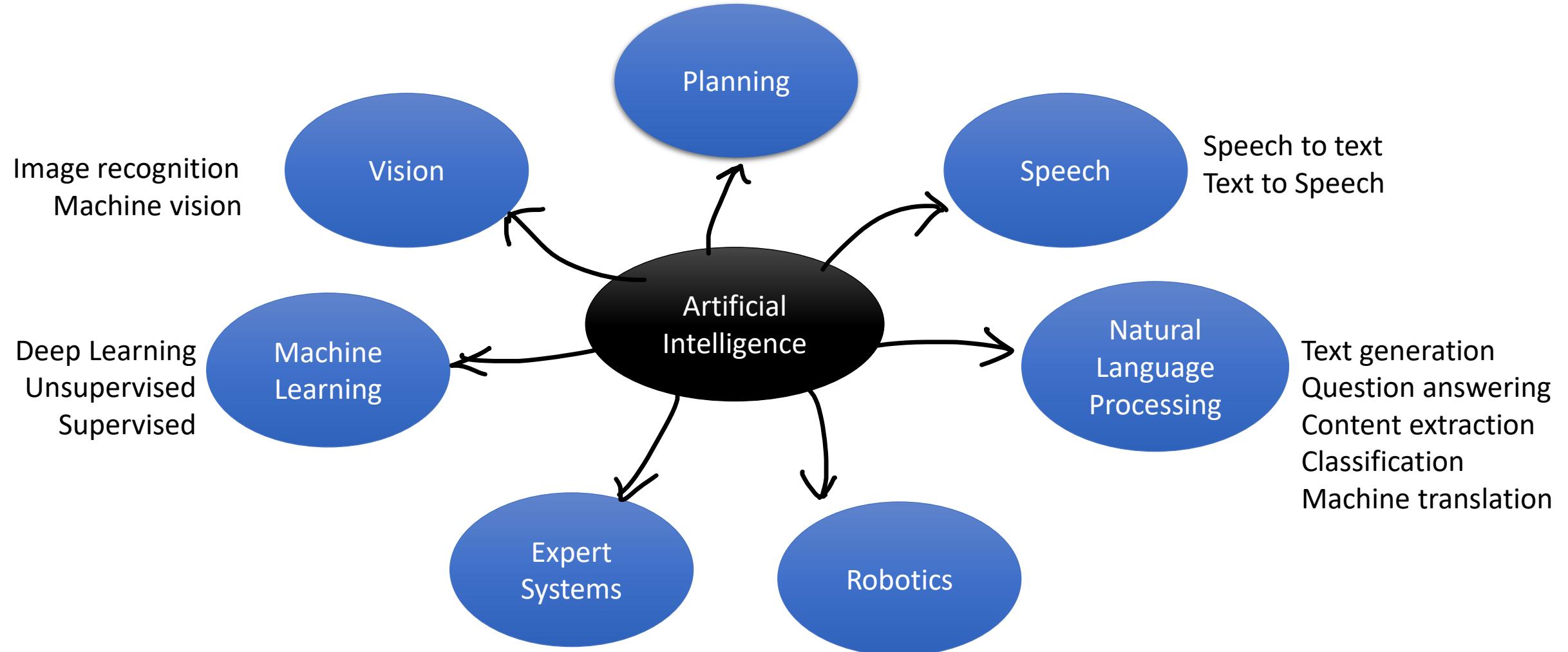
What is Artificial Intelligence?

AI defined

AI is the science of making machines do things that would require intelligence if done by men.

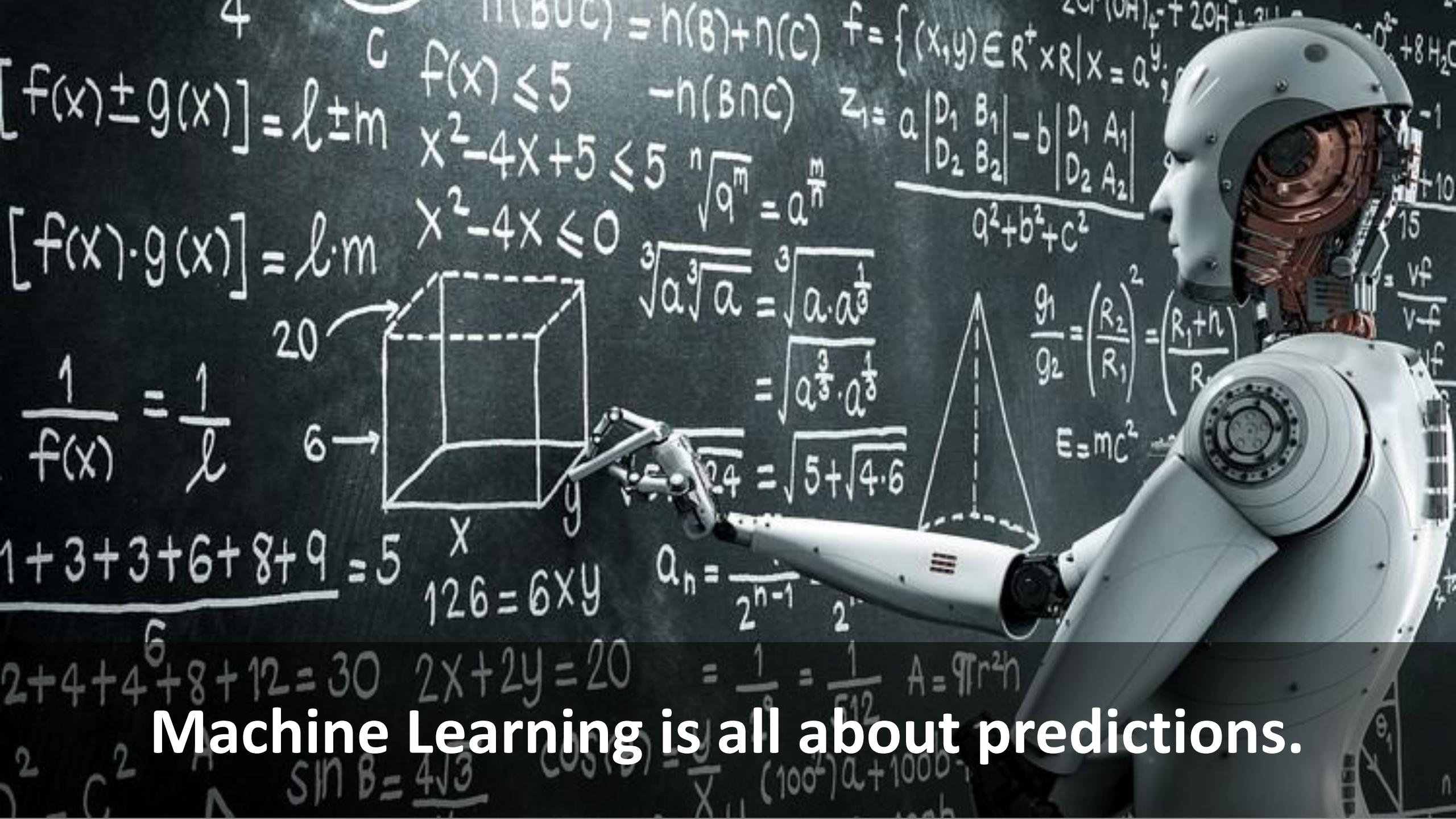
-Minsky

Aspects of AI



Designing AI Systems...

- Will an aircraft engine component function normally or fail in next 200 hours (based on the performance data obtained from the sensors)?
- How much lone can be sanctioned to a company so that it would be repaid back, considering their financial performance data?
- What are the chances that the patient, admitted in ICU will survive, give his medical test performance?
- What is common in these requirements?



Machine Learning is all about predictions.

How does a machine make predictions?

It learns patterns from the past data and makes a model. This model is used to make predictions for a new data.



What is Learning?

Learning is the pattern / relation in the data.

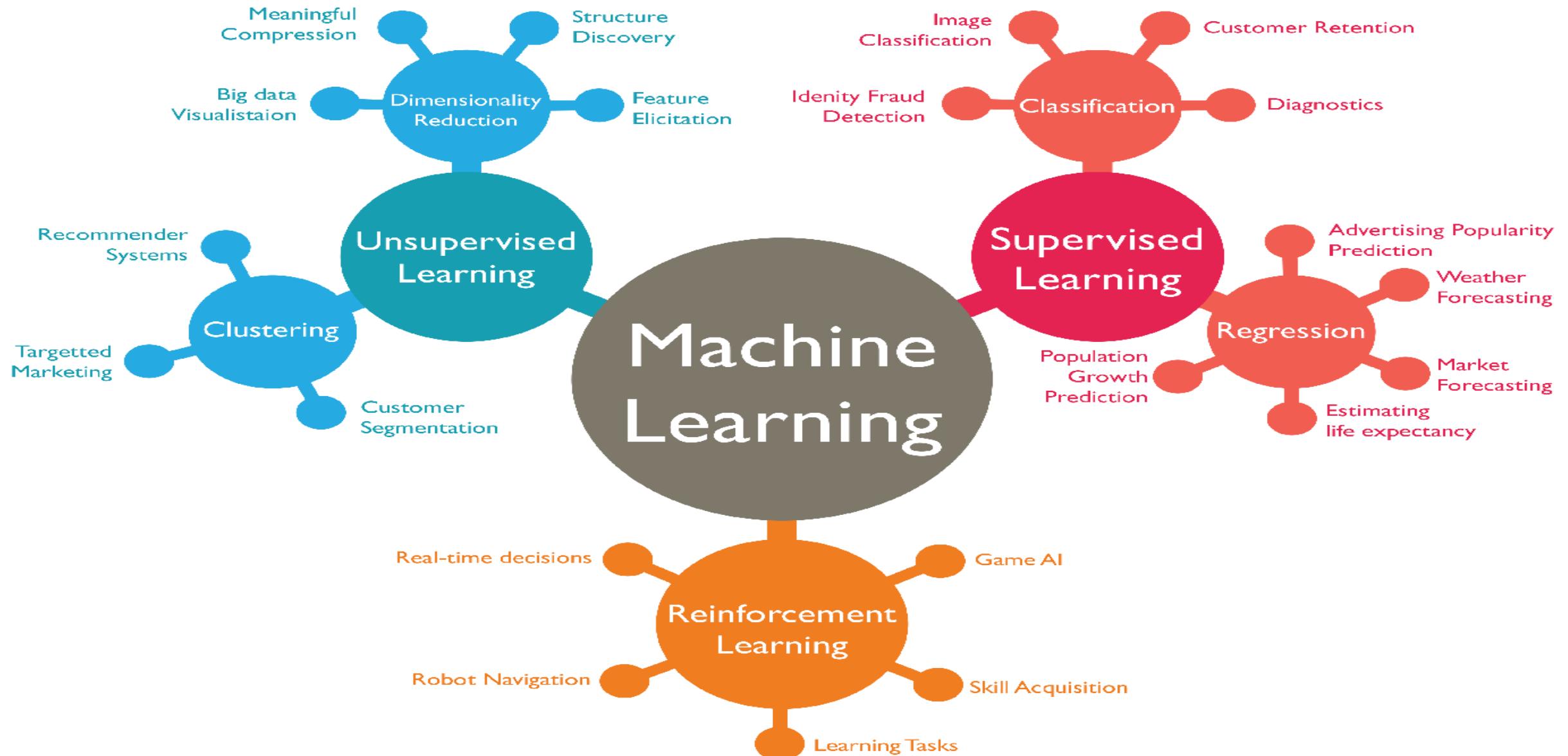
- Requires training data on which the system is trained.
- The system learns from the data.
- The learning is empirical and not causal.



Example

Bank has provided the personal and financial information for the clients along with their credit card payment history (defaulter / regular). They want to build a model that, given new data, can predict the risk associated with issuing credit card to this customer.

Machine Learning types



Machine learning concepts



Machine learning concepts

What type (of object, quality,) is it?



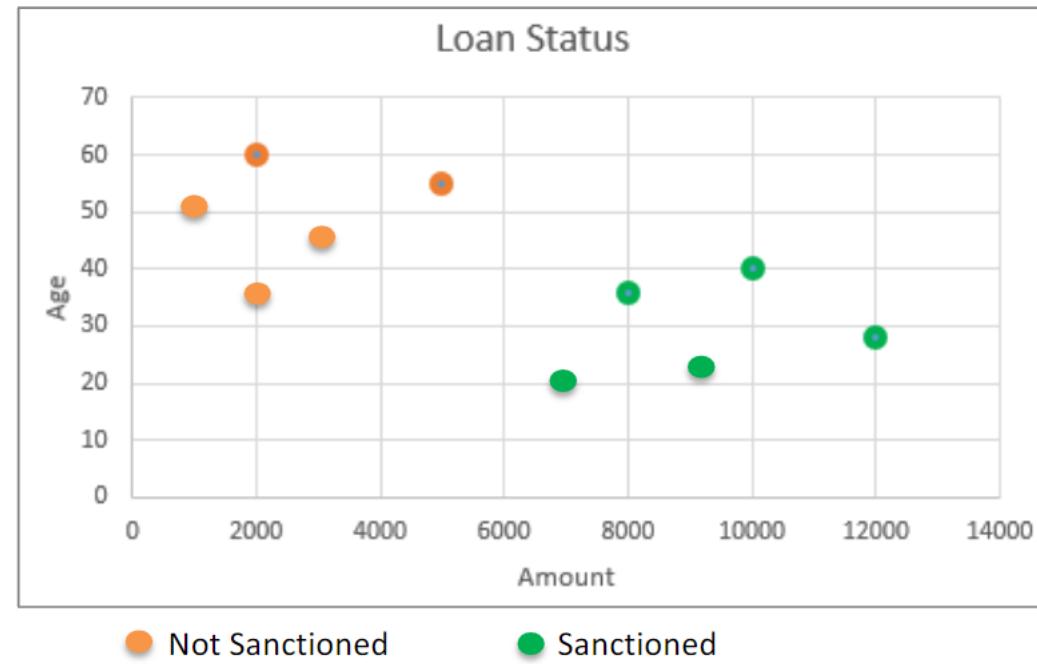
What is the key requirement in these situations?

- A UK retailer wanted to build a model that would signal -shipment delay / no delay based on the internal data (order placement delays, sample approval delays, etc.) and external events (political strife or climatic conditions, etc. in the supplier's manufacturing location).
- Staff at Mail and post want to segregate letters into bins based on the PIN code. An OCR based solution was provided to automate the process.
- The CPG company wanted a methodology by which the products could be automatically marked as "correctly / incorrectly labelled". The CPG (consumer packaged goods) client received products from multiple partners. Incorrect labelling on parts often created compliance issues. It was taking considerable amount of time in resolving issues.

Classification

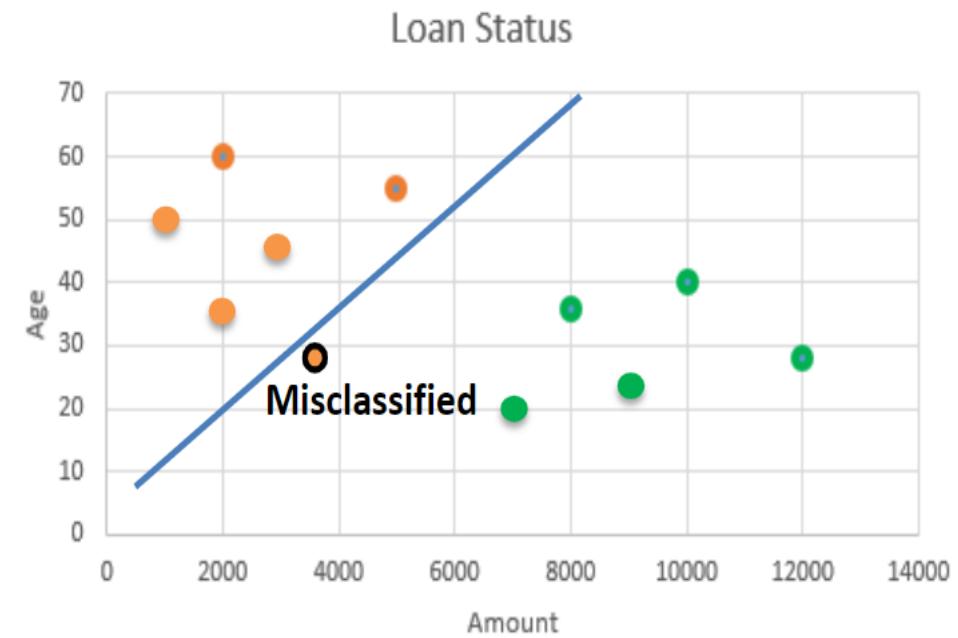
This data shows loan amount sought and age of the people of the applicant along with status of the loan application. Can you guess if loan will be sanctioned to the customer in the last row.

Loan Amount	Age	Sanctioned?
2000	60	No
8000	36	Yes
12000	28	Yes
5000	55	No
10000	40	Yes
...
3500	28	?



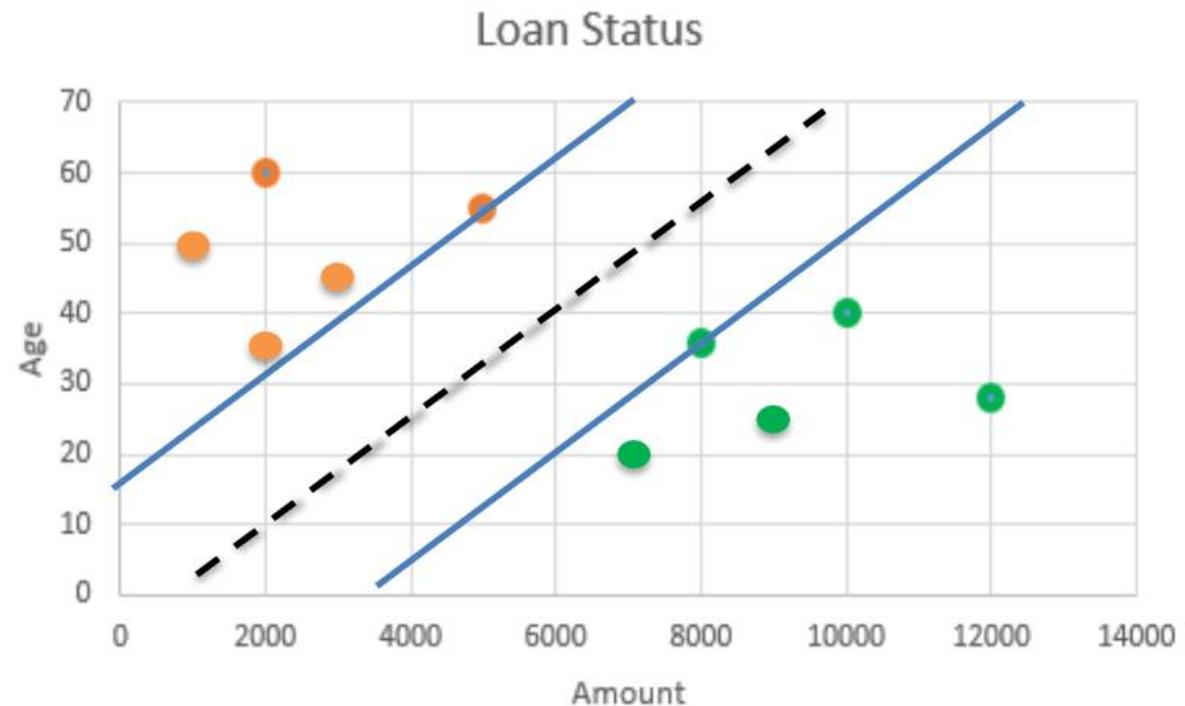
Support Vector Machine (SVM)

- The two classes are separated by a classifier.
- As you can see multiple classifiers are possible.
- Support vector machine is a technique to select the best classifier.



Support Vector Machine (SVM)

The classifier with maximum margin between classes is the best classifier.



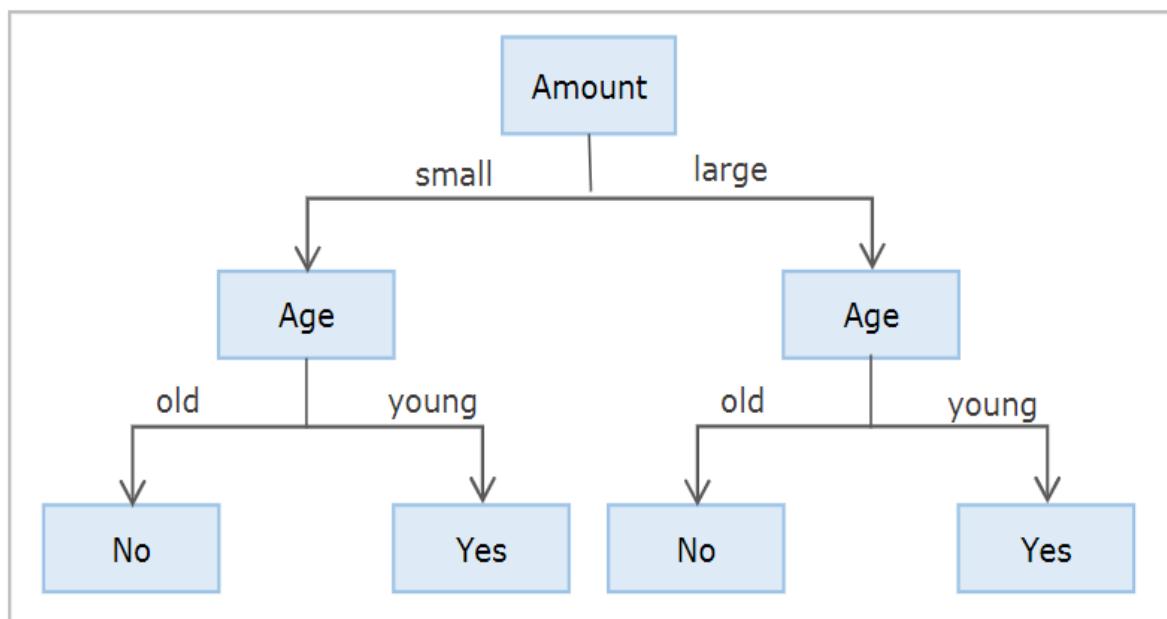
Decision Trees

Study the pattern in data and come up with a rule.
This rule is expressed as a tree. Simple and easy to interpret – if loan amount is “large” and applicant is “young” then “sanction” the loan.

Amount		Age	
<= \$ 9000	> \$ 9000	< 45	>= 45
Small	Large	Young	Old

Loan Amount	Age	Sanctioned?
Small	Old	No
Small	Young	Yes
Large	Young	Yes
Small	Old	No
Large	Young	Yes
...
Small	Old	?

Loan Amount	Age	Sanctioned?
2000	60	No
8000	36	Yes
12000	28	Yes
5000	55	No
10000	40	Yes
...
3000	45	?

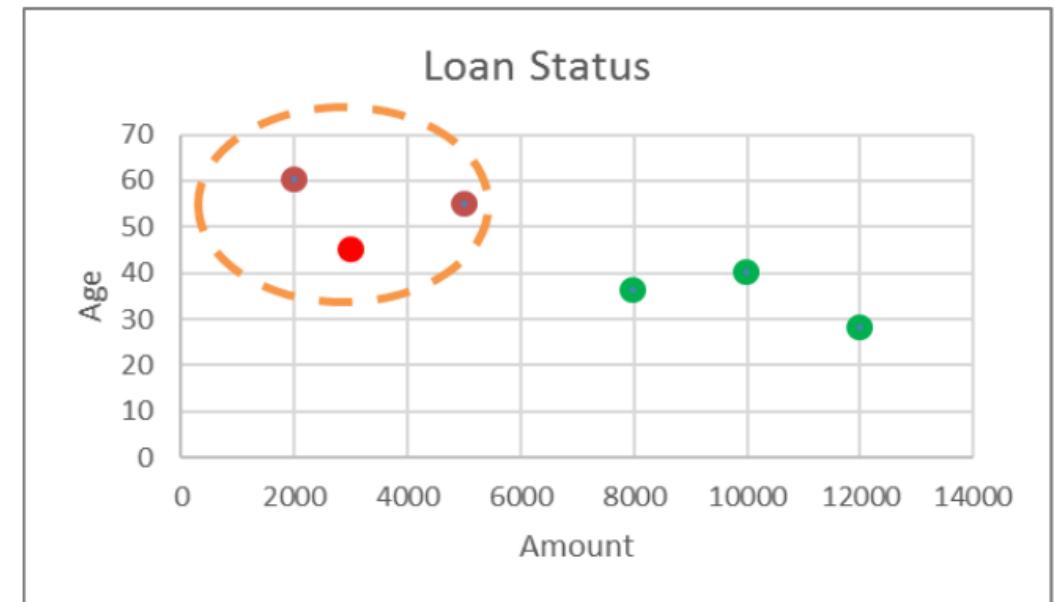
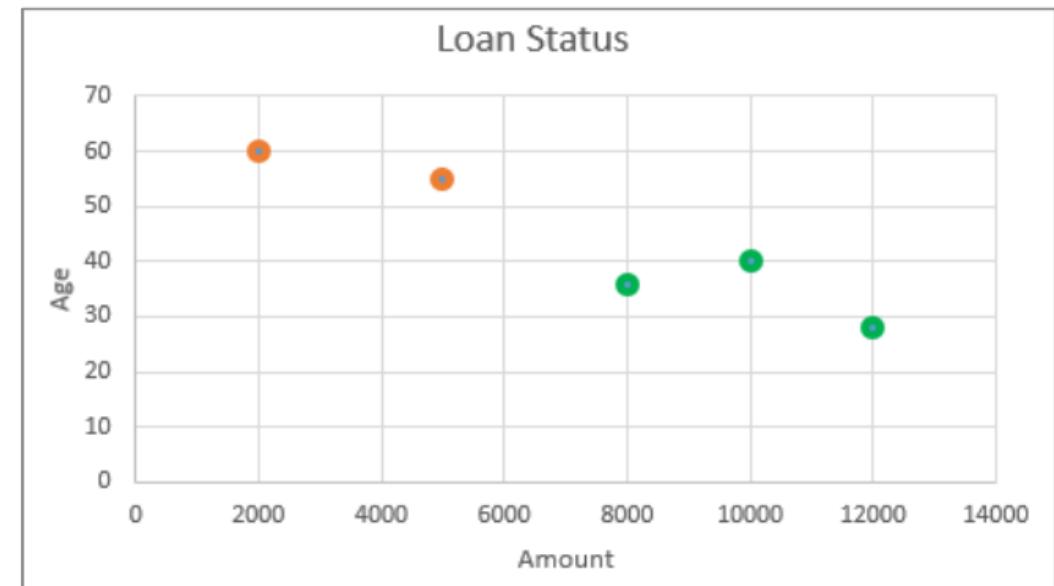


K- Nearest Neighbours

Classification of new data can be estimated by looking at the classification of the data in the neighbourhood.

Can you guess the decision for new data? Loan amount sought: \$3000 , age: 45 years.

Loan Amount	Age	Sanctioned?
2000	60	No
8000	36	Yes
12000	28	Yes
5000	55	No
10000	40	Yes
3000	45	?



Bayesian Classifier

- For the following data what is the probability that the customer (in the last record) will get the loan sanctioned?
- A Bayesian classification model considers the probability of getting the loan for each attribute : what is the probability of getting the loan sanctioned when the loan amount is small; what is the probability of getting loan sanctioned when the person is young.
- The individual probabilities are combined to arrive at the final probabilities of getting the loan for the customer.
- Simple to compute.
- Useful when the data is small.

Loan Amount	Age	Sanctioned?
Small	Old	No
Small	Young	Yes
Large	Young	Yes
Small	Old	No
Large	Old	Yes
Small	Old	?

Machine learning concepts

What value should it take?



What is the attribute of the data that we want to predict?

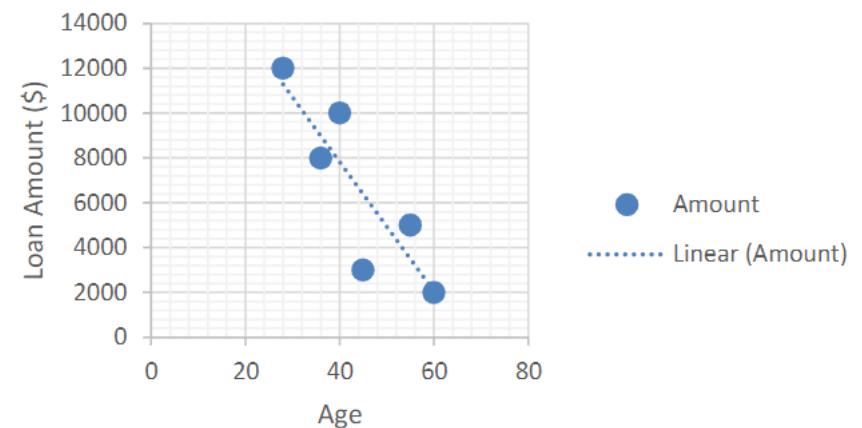
- A bank wanted to decide the credit limit of a new credit card application.
- A US wealth management organization wanted to predict the risk in monetary transactions as it saw substantial risk of fraudulent transactions by money transfer company operating in African countries.
- A wind energy company wanted precise prediction of wind detection. It saw significant loss in power production as wind turbine sonic anemometers were not able to capture wind direction accurately.

Predicting numeric values is done using a technique called Regression.

- Given the past data as shown, how much loan a customer of age 30 will apply for?
- Create a model(linear regression) with past data
- Use the model for predictions.

Age	Loan Amount
60	2000
36	8000
28	12000
55	5000
40	10000
45	3000

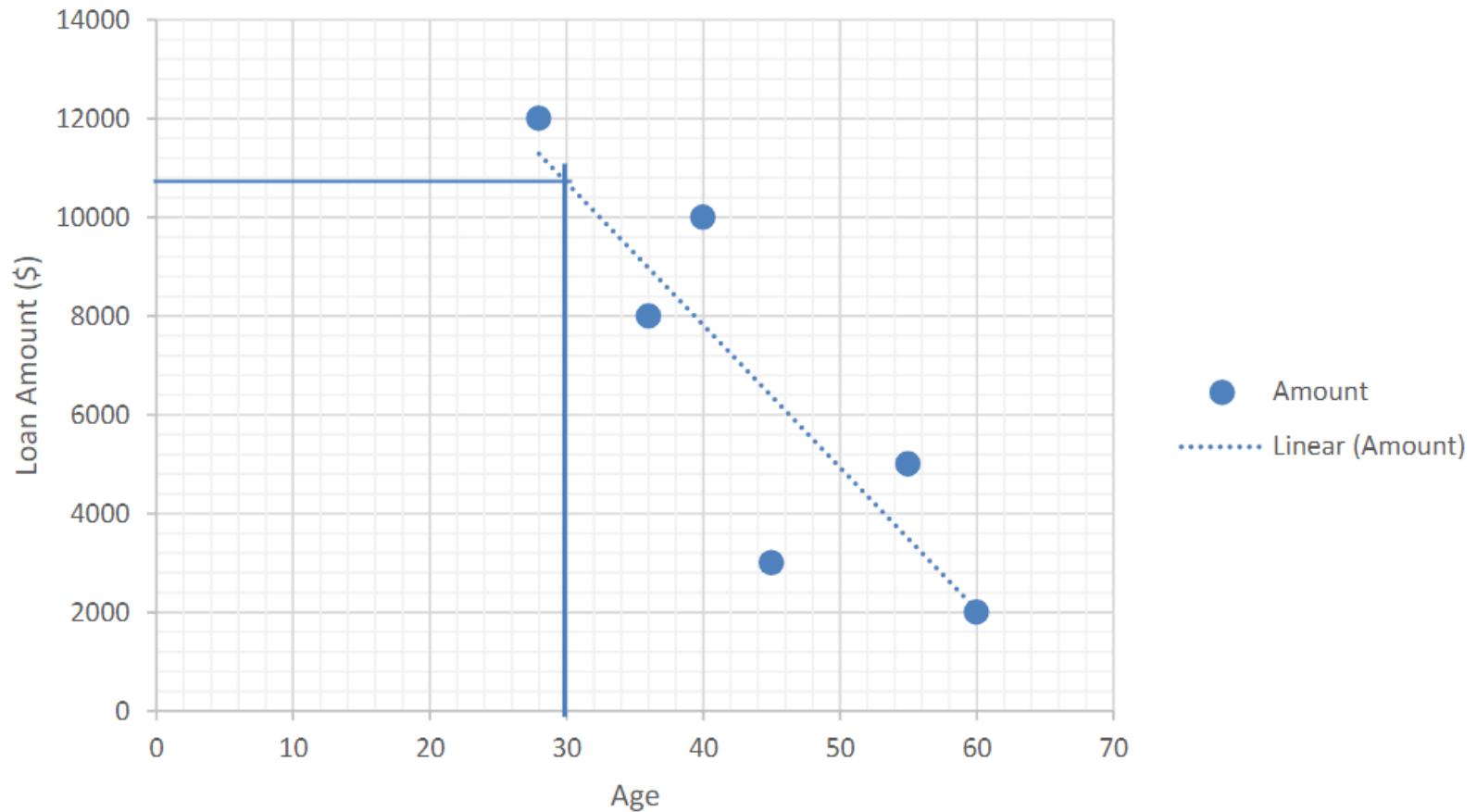
Relation between age and loan amount



Regression

Relation between age and loan amount

- This concept is used in forecasting such as demand forecasting, stock market, forex etc.



Machine learning concepts

What is the probability that:

- The object is of type A?
- Event A will happen?



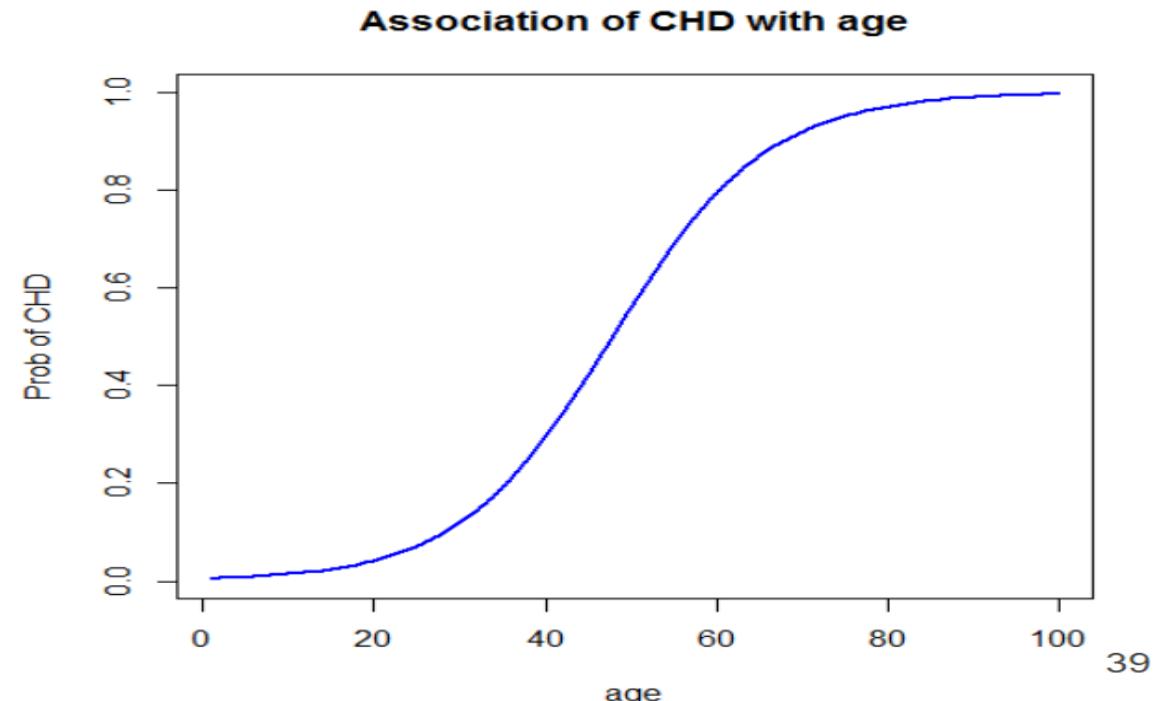
What do we want to know about these events?

- Xerox research problem: Based on the medical test parameters, what are the chances that a patient admitted to the ICU will survive?
- Based on the given data – personal and financial, what is the likelihood that this person will default in his EMI payment?
- Given the transaction data (amount, time, place to transfer, transaction history), what us the probability that the transaction is fraudulent?

Logistic regression is about estimating the probability of an event

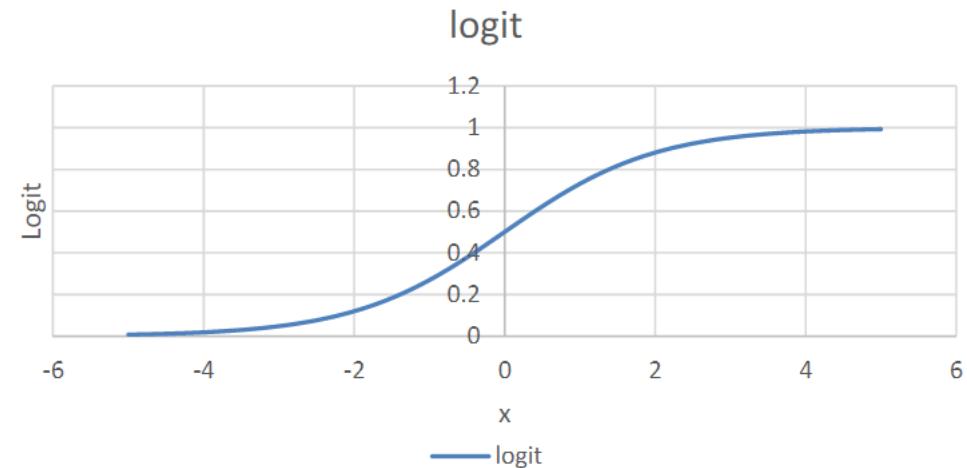
- The data shows the incidence of Coronary heart disease (CHD) for patients across ages between 20 and 69 years.
- Logistic regression model is built to predict the prob. Of CHD for any patient given age of the patient.
- This is done using a sigmoid function that converts the occurrence of event into probability.

AGE	CHD
49	1
49	0
49	0
50	1
50	0
51	0
52	1
52	0
53	1
53	1
54	1
55	1
55	1
...	...



Logistic Regression is about estimating the probability of an event.

- Finding the probability for a given data to belong to a particular class.
- A special function called logistic function is used ('S' shaped), shown in the diagram
- From the diagram, can you observe that the y-value lies between 0 and 1.—Can I use this value as probability.
- Independent variable is quantitative and response variable is qualitative.
- It is useful to find the probability of loan to be sanctioned for an applicant whose age is 45 and seeking a loan amount of \$3000



Loan Amount	Age	Sanctioned?
2000	60	No
8000	36	Yes
12000	28	Yes
5000	55	No
10000	40	Yes
...
3000	45	?

Machine learning concepts

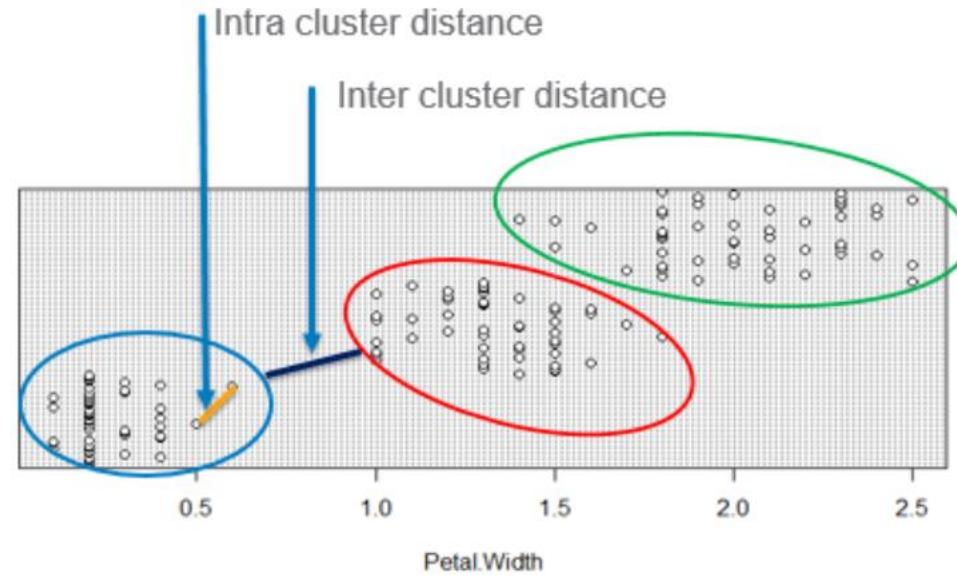
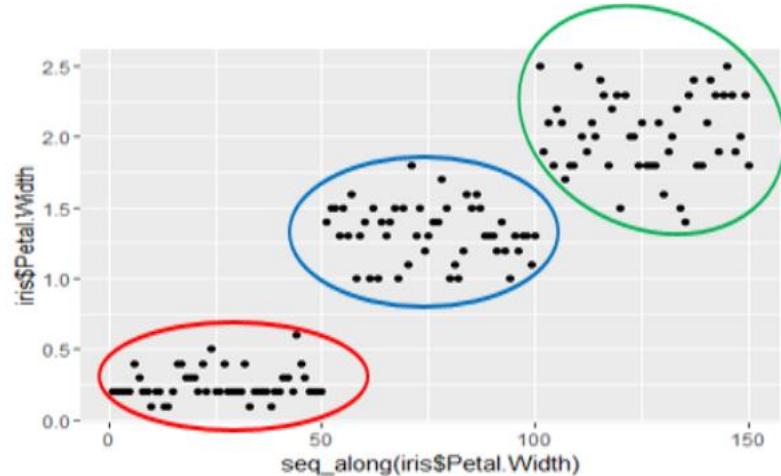
Is the data structured as groups?



How to gain insight from an unlabelled data?

- Law enforcement agencies / fire tender service / ambulance services are to be located at places that can best serve the people. It also needs to take care of changes in population and predict areas where the services are deficient and new ones are to be added.
- A European and APAC Telco observed that their campaign was not effective. It lead to in low Average Revenue per Unit (ARPU) and customer churn. The Telco major ran campaigns on pre-specified customer segmentation based on historical usage and spending patterns. They wanted to run a targeted and personalized campaign.
- A retail chain wanted to figure out the locations of stores so that it is well placed to serve the customers and optimize the gains. They wanted to gain more insight based on consumer demand, demographics, competition proximity etc.

Clustering



- Clustering in business is about getting meaningful groups.
- Every element in a group is more similar to other elements than elements in another group.
- Applied on unlabeled data.
- Similar data are grouped together.
- K-mean is a popular algorithm for clustering

Can this behaviour be leveraged to improve sales?

- High net worth individuals prefer high risk investment products.
- Most people who purchased health insurance purchased term insurance.
- People who purchase bread are highly likely to purchase butter.

Association Analysis: Things that are demanded together

Frequently bought together



- This item: Espoir Analogue Blue Dial Men's Watch- Latest0507 ₹ 445.00
- Espoir Exclusive Day & Date Display Analog White Dial Stainless Steel Men's Watch - WDD0507 ₹ 449.00
- Redux Rock Analog Blue-Grey Dial Men's & Boys Watch - RWS0042S ₹ 429.00

Customers who bought this item also bought



Espoir Exclusive Day &
Date Display Analog White
Dial Stainless Steel Men's
Watch - WDD0507
 46
₹ 449.00 ✓prime

Espoir Analogue Black Dial
Men's Watch - Andy0507
₹ 412.00 ✓prime

Redux Rock Analog Blue-
Grey Dial Men's & Boys
Watch - RWS0042S
 86
₹ 429.00 ✓prime

Fabiano New York Mens &
Boys Black,Grey Analogue
Watch
 85
₹ 545.00 ✓prime

Fogg Analog Blue Dial
Women's Watch 4035-BL
 12
₹ 499.00 ✓prime

Espoir Day and Date
Combo of 3 Analogue
Multicolor Dial Men's
Watch - Combo Latest...
 10
₹ 999.00 ✓prime

Espoir Analogue White
Dial Men's Watch -ES109
 351
₹ 349.00 ✓prime

Is there a predefined formula to achieve these?

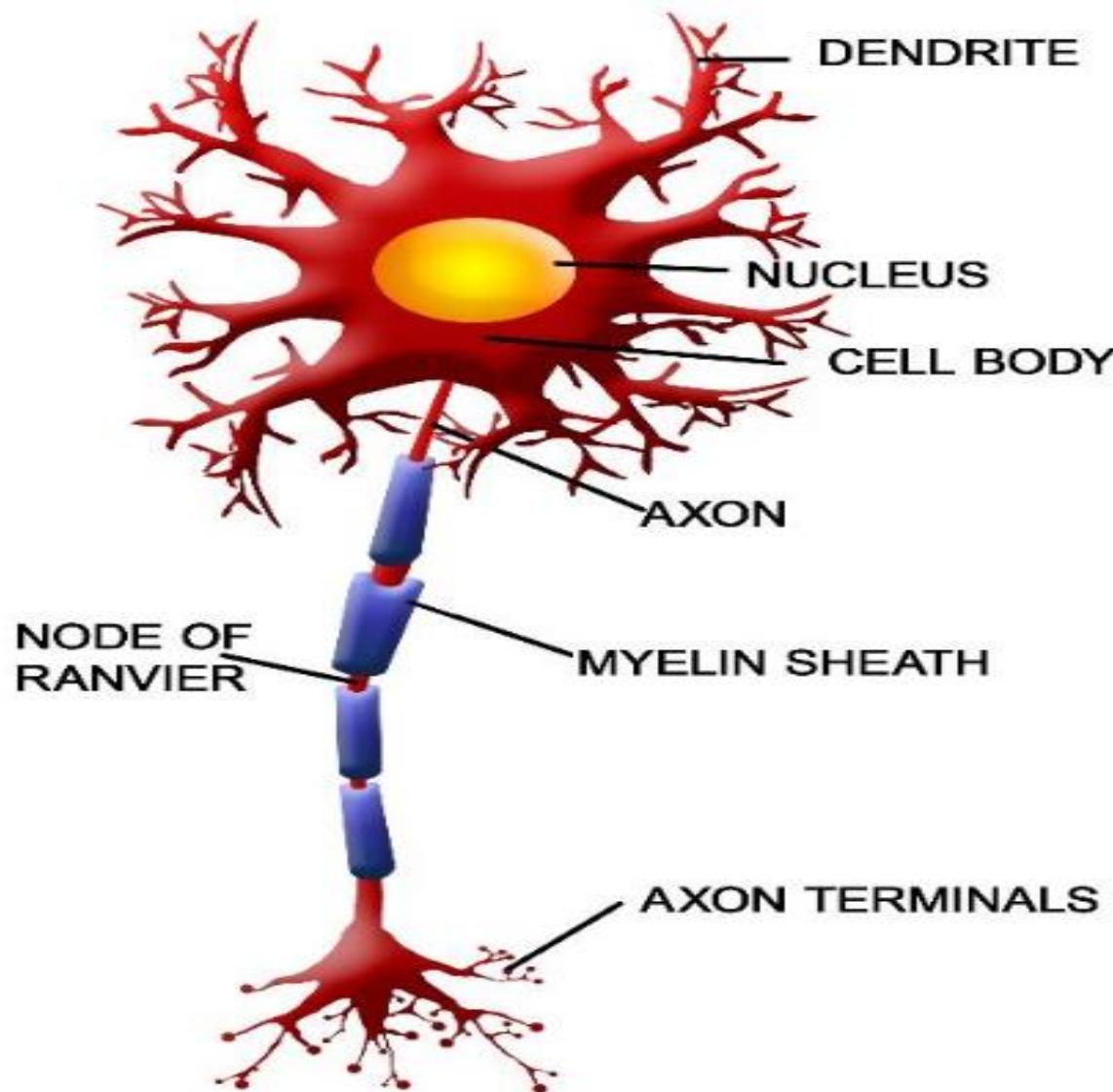
- A bank wants to automate the process of checking if a signature belongs to right customer in cheques.
- A big multinational company wants to identify employees from face and scrap the smart card.
- Postal department wants to sort letters automatically by recognizing hand-written pin codes

How can a system process the data like a human?

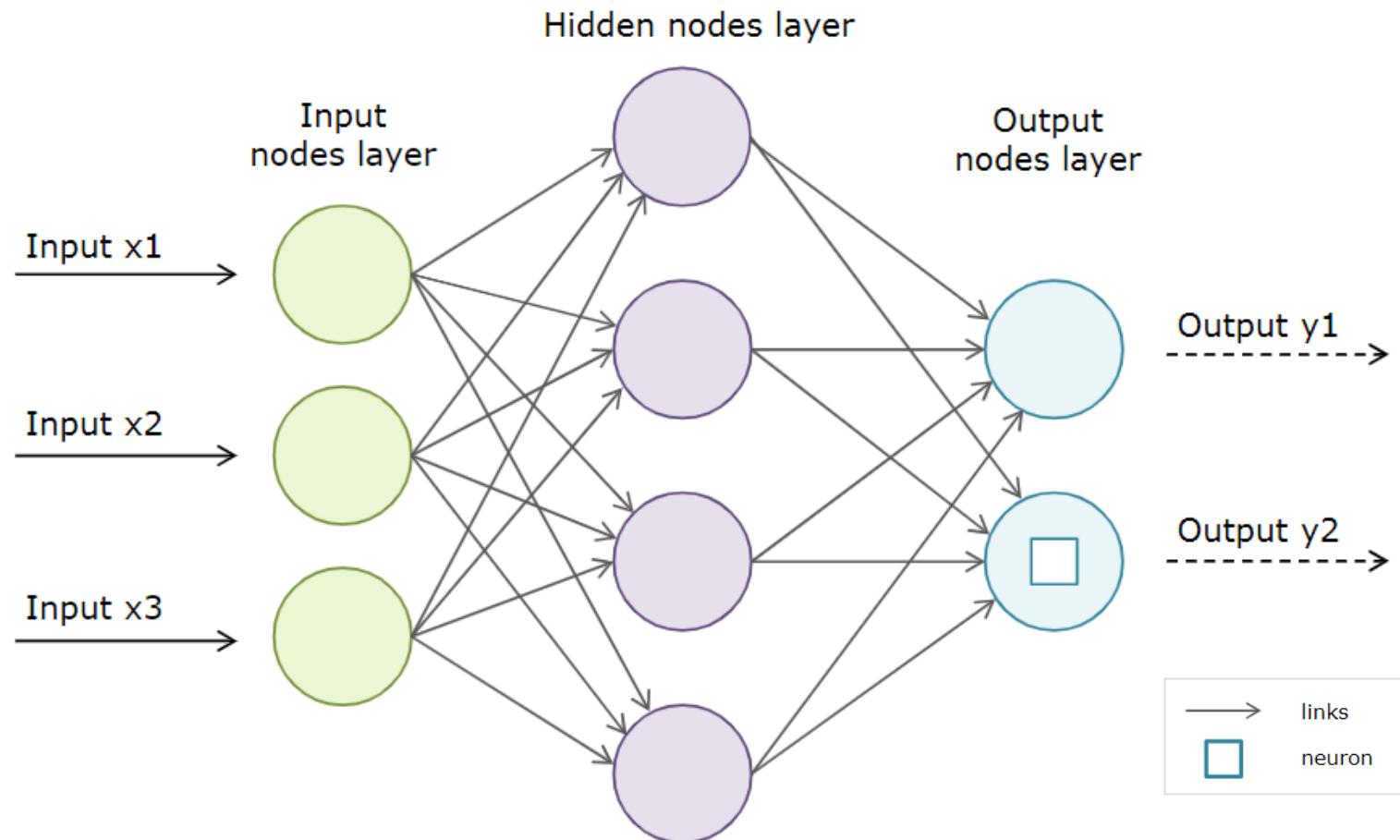
Artificial Neural Networks

- Human endeavor to create a machine that works like the human brain.
- Like the human brain, given the inputs and the outputs, figure out the relations automatically. An excellent model for “machine brain”
- This is contrary to our learning model –we establish cause and effect in our thinking. When we get an input, we apply this thinking and predict the effect.
- The learning of the model is still not comprehensible to us.
- Extended ANNs gave rise to deep learning models.

The human neuron

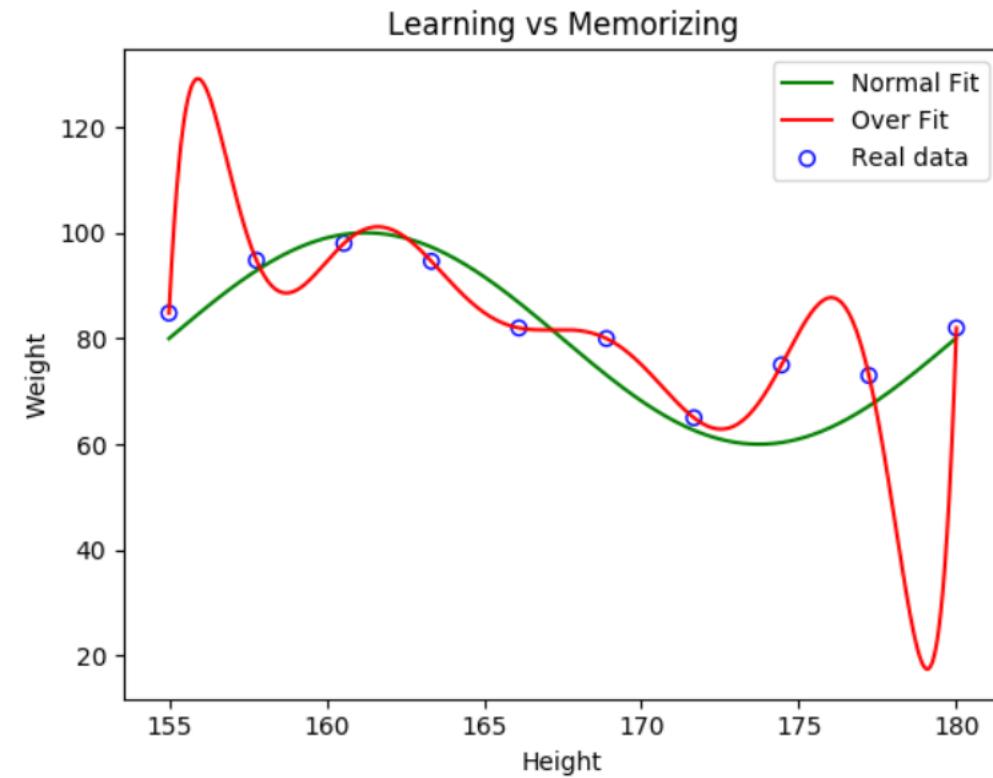


Artificial Neural Network



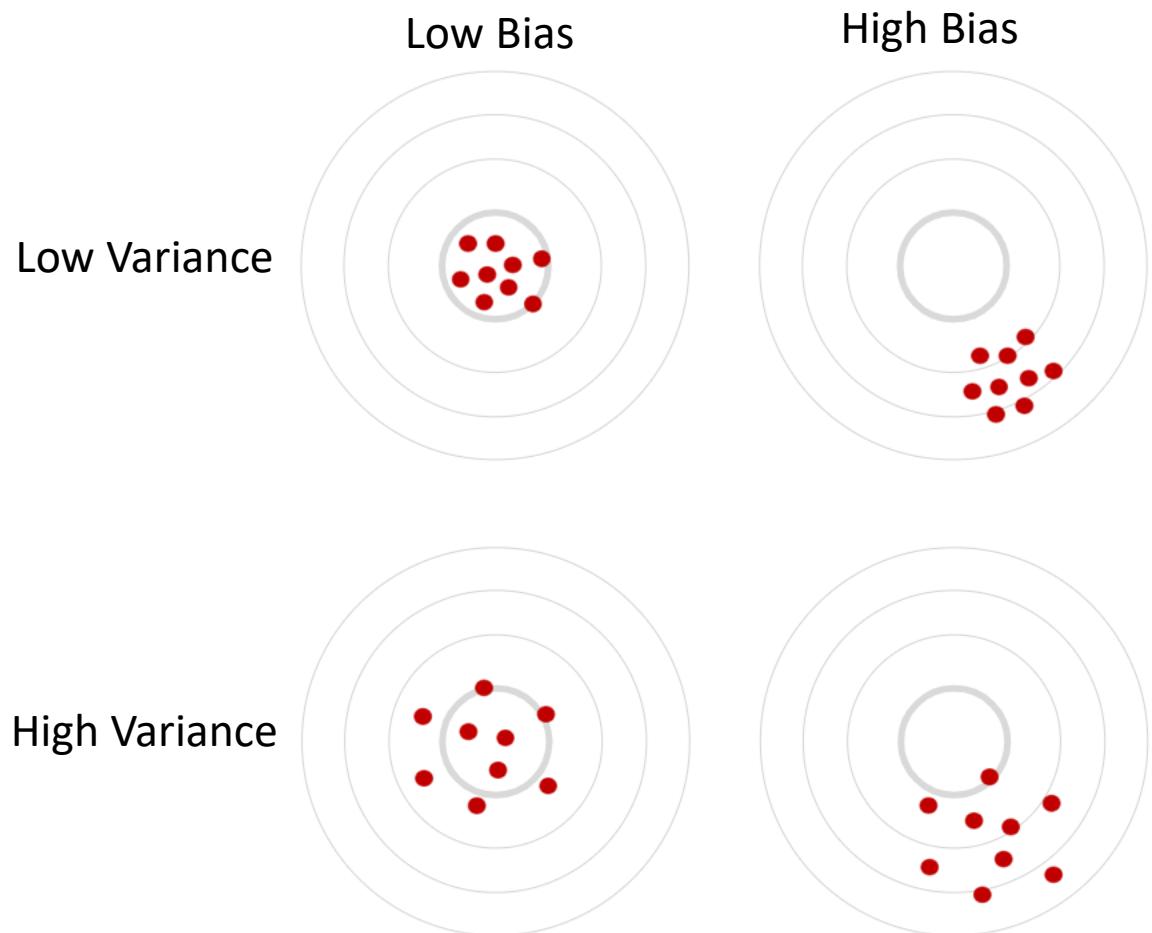
Overfitting : Learning vs Memorizing

- This is about model complexity. Over fitted model is complex.
- Over fitted model tend to memorize rather than learning.
- Poor performance and error prone.



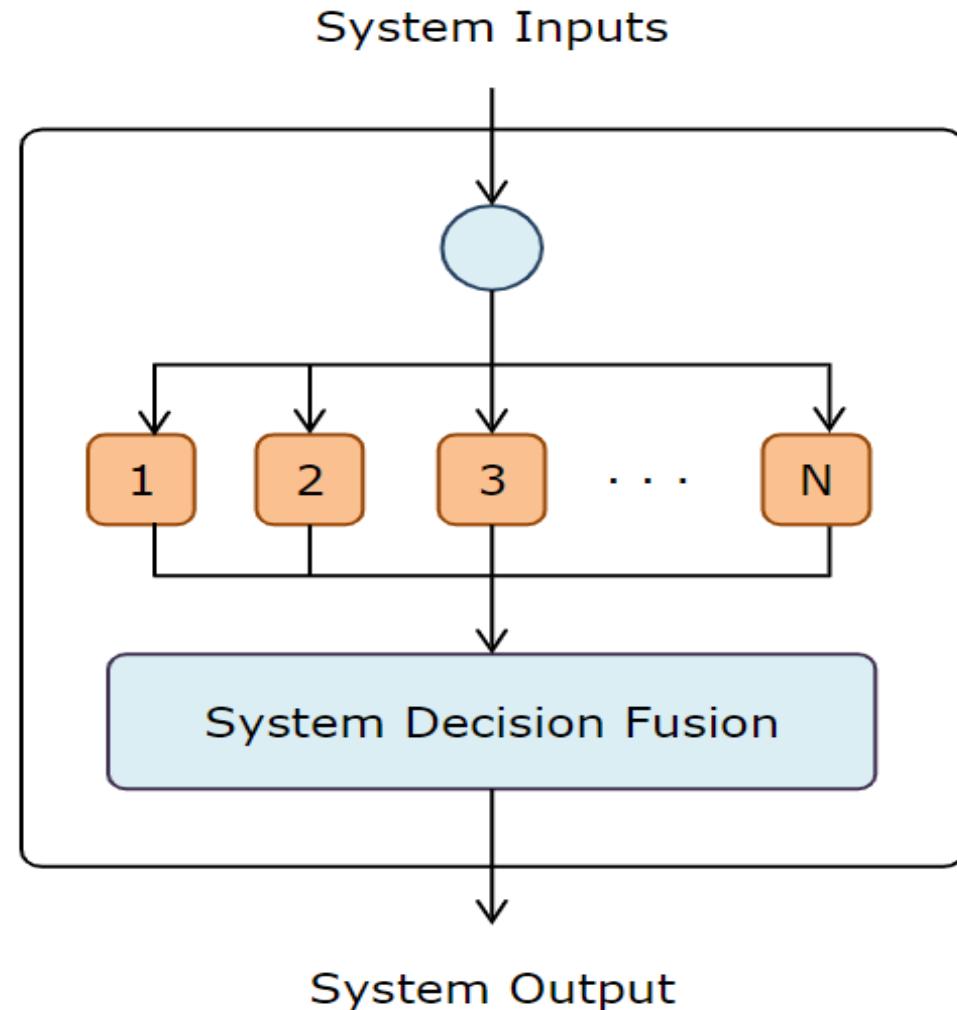
Bias – Variance : Model Performance

- How far your prediction from actual?
- Are they consistent?
- Which is more desirable among the four cases?
- When complexity of the model is low: High Bias and Low Variance.
- With increasing complexity: Low Bias and High Variance.
- It is a tradeoff



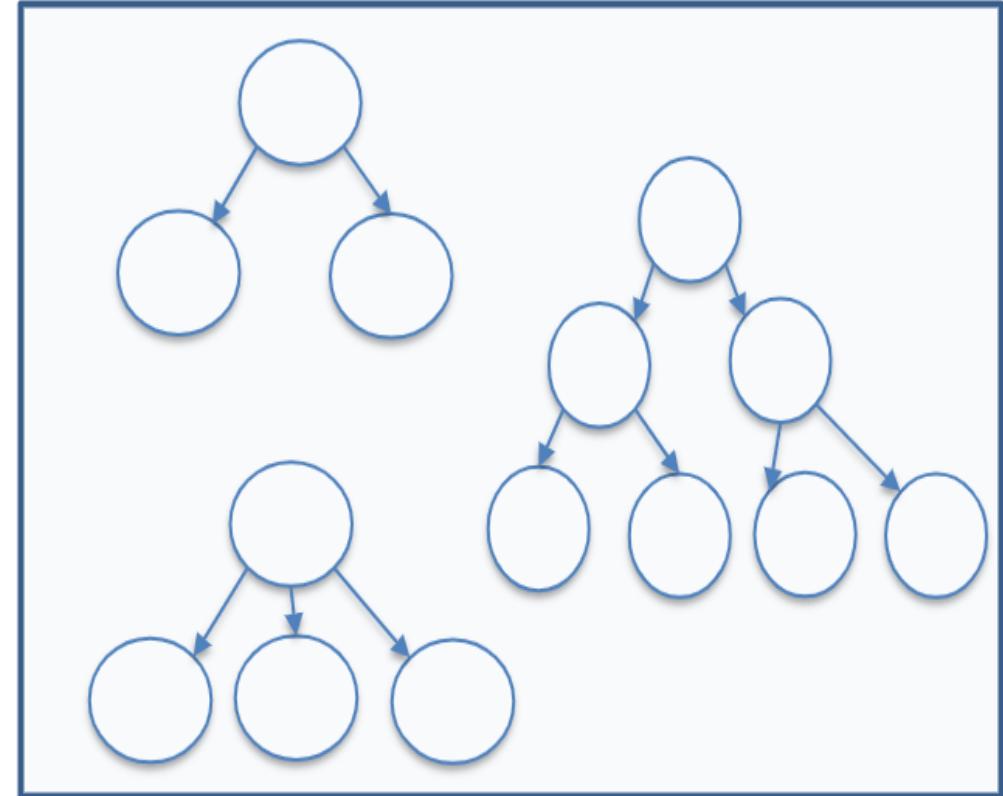
Ensemble methods: Combining Models for better results

- As an orchestra combines different instruments to produce better music, multiple learning technique can be combined for better predictive performance.



Ensemble methods: Random forest

- Create multiple decision trees by selecting random number of features.
- The results of these decision trees are aggregated to enhance predictive performance.





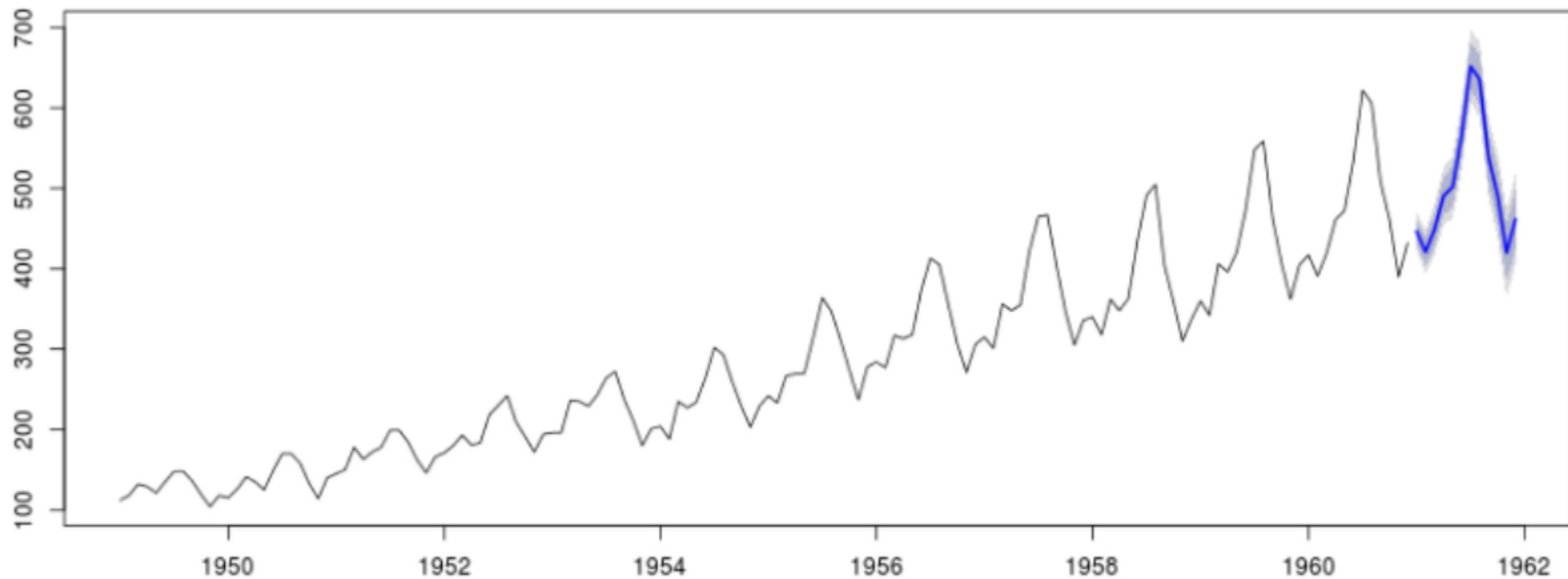
How will the past and present
impact the future?

Time series methods

Can we tell the future from the past and present data?

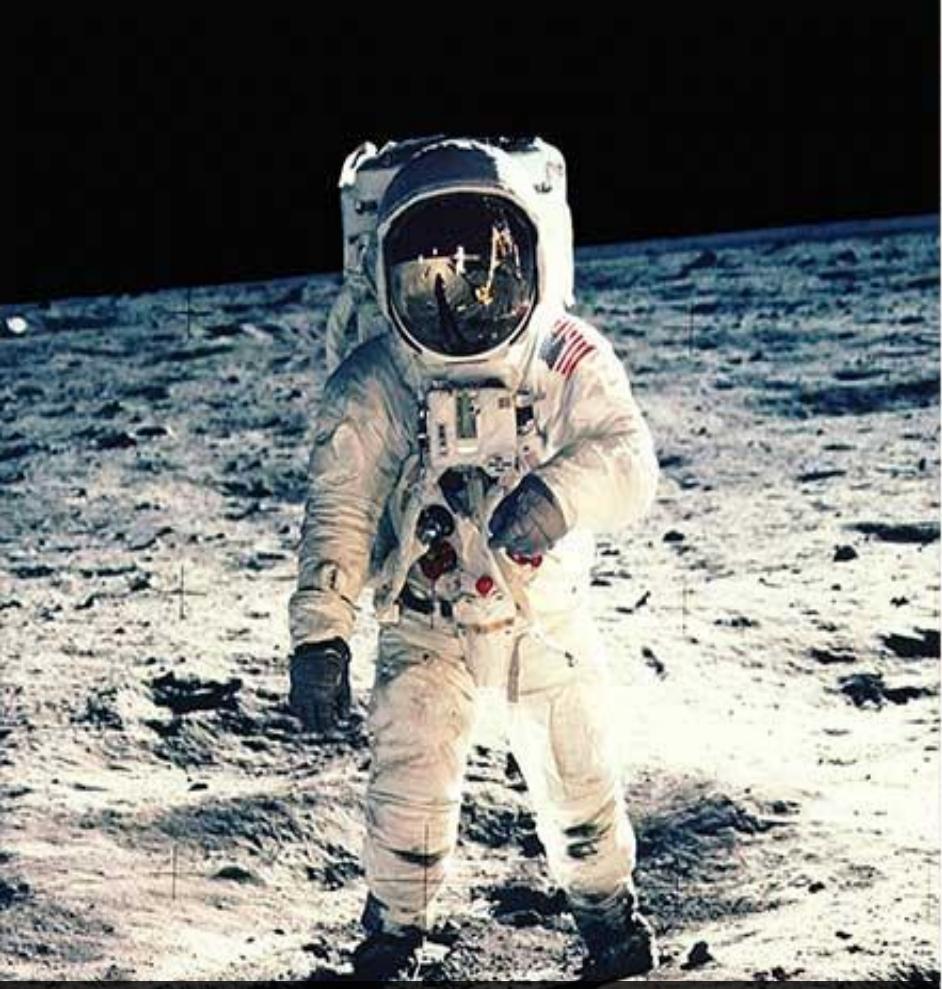
- An economist wants to forecast the GDP for the next year.
- A company wants to forecast the sales for the next quarter.
- An investor wants to do Stock Market Analysis.

Timeseries : forecasting





Can machines understand knowledge available in human languages?



What is the average basalt content?

What is the average concentration
of aluminum in the high alkali
rocks?

Apollo-11 moon landing mission and NLP

The LUNAR system was designed as a language interface to give geologists direct access to a database containing information on lunar rock and soil compositions obtained during the NASA Apollo-11 moon landing mission.

The design objective was to build a system that could respond to natural queries received from geologists.

Can machine understand knowledge available in human language?

- Banks have a written SOP for handling money laundering cases. Can a system understand these processes and apply them to each of the transactions for AML compliance?
- Can machine extract data from social media and do sentiment analysis?
- Online medical services company has lots of non-native speakers. It would like to design a system/app to check if their customers are doing good.



Can machines understand knowledge available in human language?
Can machines communicate with humans in their language?

NLP examples?

- Levi Strauss & Co. announced an AI-based chatbot tool called Virtual Stylist: personalized sizing recommendation technology from True Fit. It helps users determine which pair of jeans is the best fit for them.
- HDFC Life, one of India's leading private life insurance companies, announced the launch of India's first life insurance chatbot. The chatbot will act as a financial guide to help users choose the most suitable life insurance plans and solutions.
- Bots have also made inroads into the Indian wealth management industry. Chatbots are providing investment advice to clients.
- The operator of one of the largest freight railroad network in North America employed unionized labor and had multiple labor contracts with the different unions it worked with. Any labor related query or exception needed to be addressed in accordance with the rules defined in the pertinent labor contract. This resulted in long lead times to resolve exceptions. The client needed a knowledge model (for all labor contracts) and a conversational interface that provided natural language query into the knowledge models.

AI is the new UI

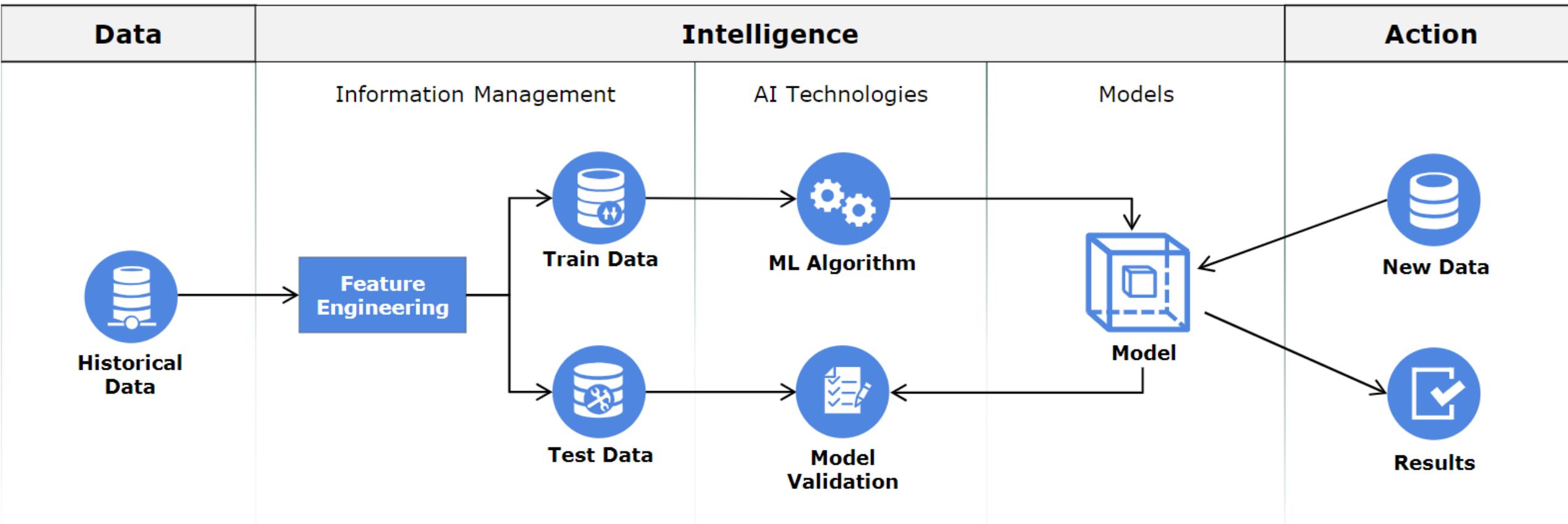
Chatbots help people access the knowledge repositories in natural language. The user experience is like talking to another human being.



Gartner: Chatbots driven by artificial intelligence (AI) will play important roles in interactions with consumers, within the enterprise, and in business-to-business situations. By 2019, more than 10% of IT hires in customer service will mostly write scripts for bot interactions.

Artificial Intelligence in Practice

Putting the concepts together : ML Process

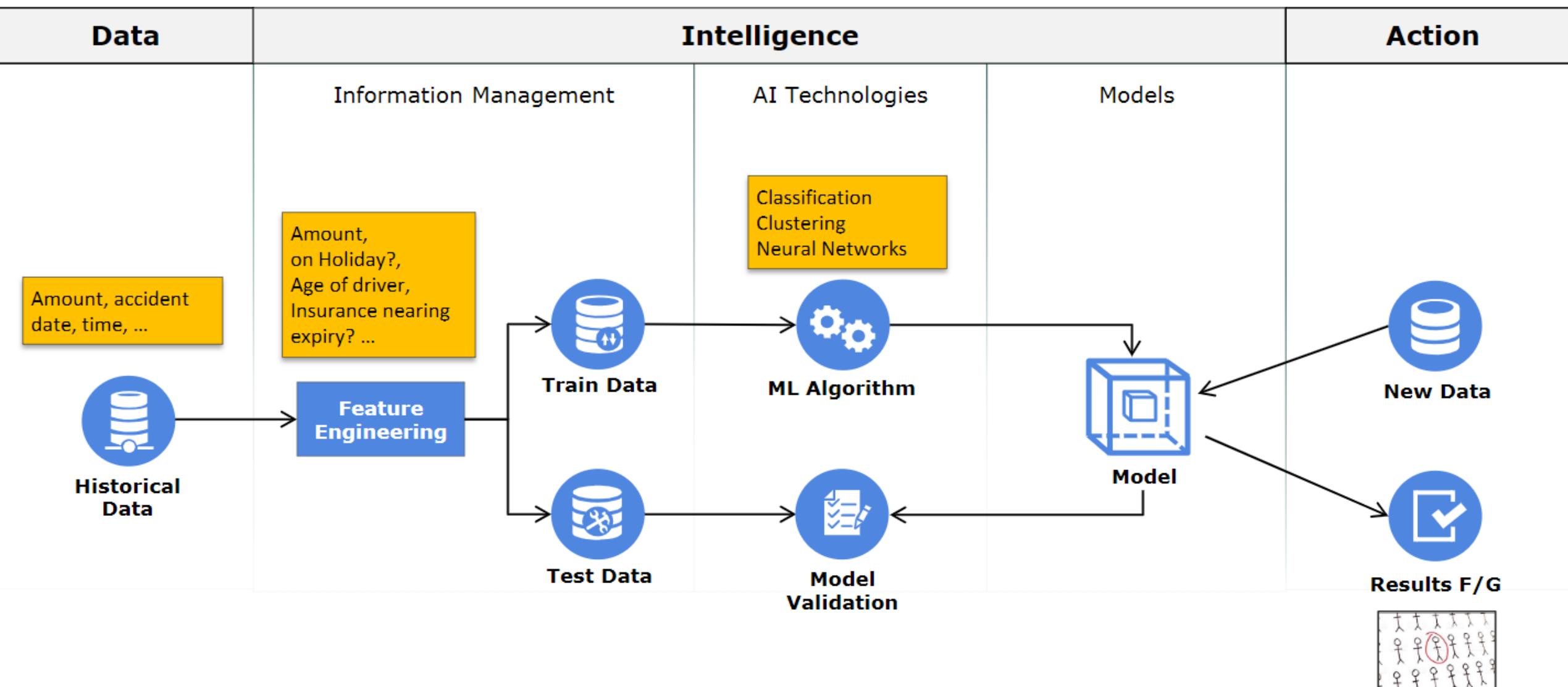


Historical data from various sources are cleaned and subjected to feature Engineering where significant features are selected. This engineered data is divided into two sets: Train data and Test data. Machine learning models are built using train data which are validated using test data. This validated model is used for prediction.

How AI can help

An insurance company employs 500 people to detect insurance claims manually. The suspect claims are then sent to a team of inspectors to physically verify them. The insurance company feels that the process is slow and costly.

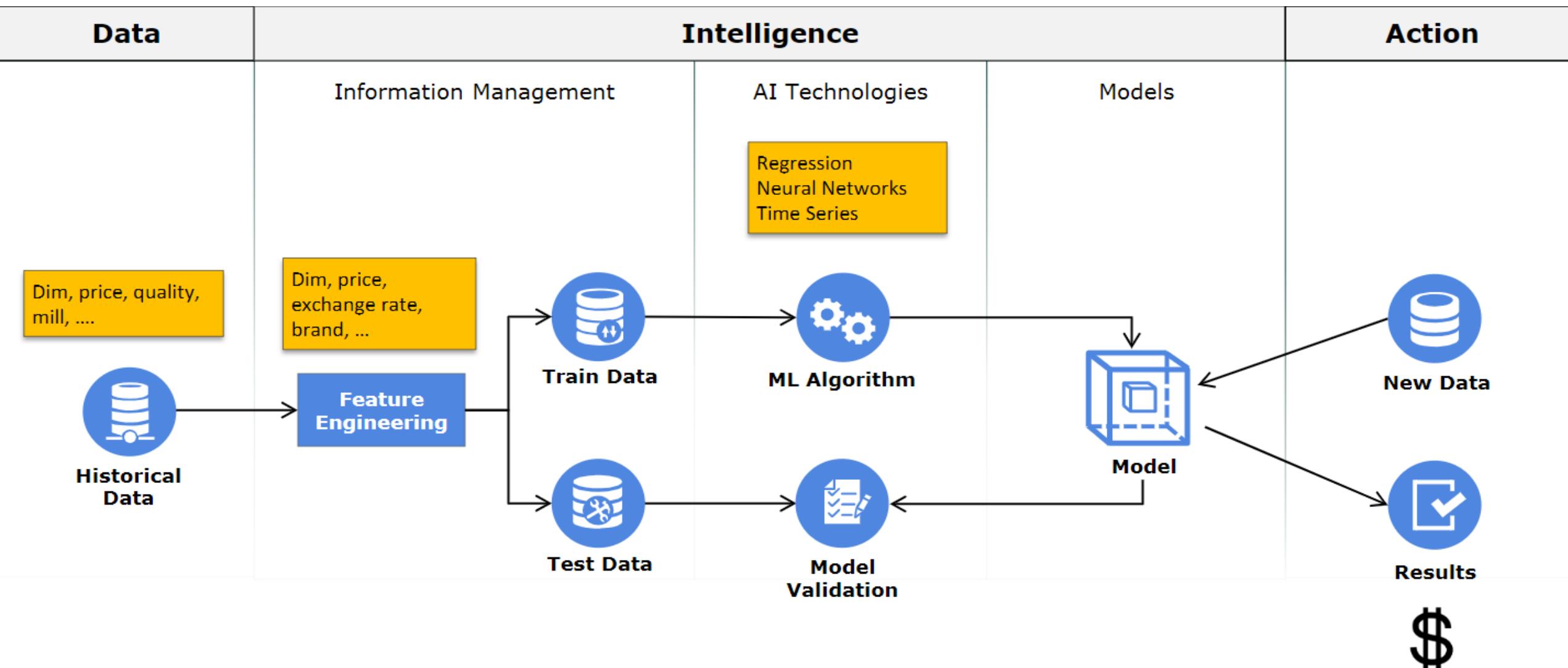
Fraud detection



How AI can help the apparel retailer?

A global apparel retailer was dealing with an extended product development cycle resulting from multiple design iterations to meet targeted cost. This was a result of variability in manufacturing (labor and material) cost between the design and development stages. The client was looking to leverage data analytics to accurately predict overall cost of production during the design stage.

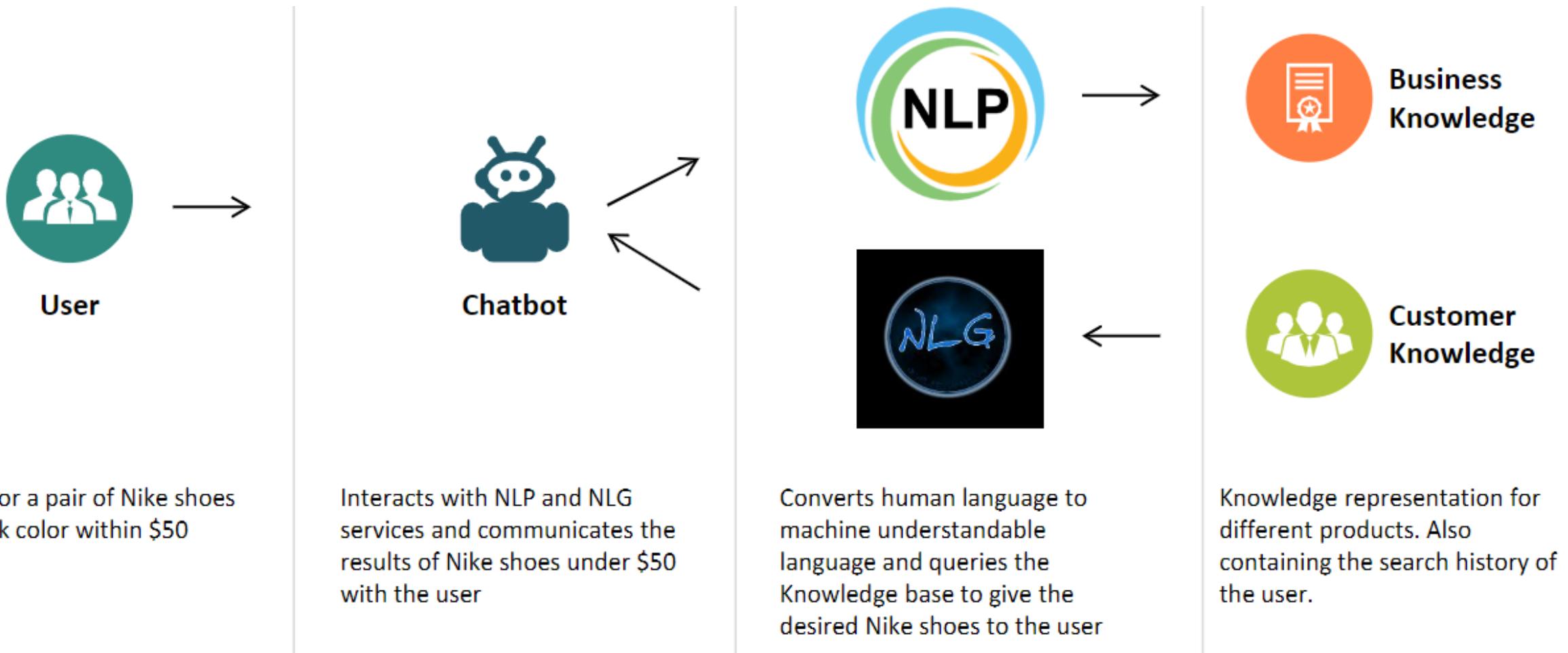
Apparel Retailer



How AI can help to client?

A client has a high cost of maintaining a call center for answering routine customer queries, logging service requests against complaints etc.

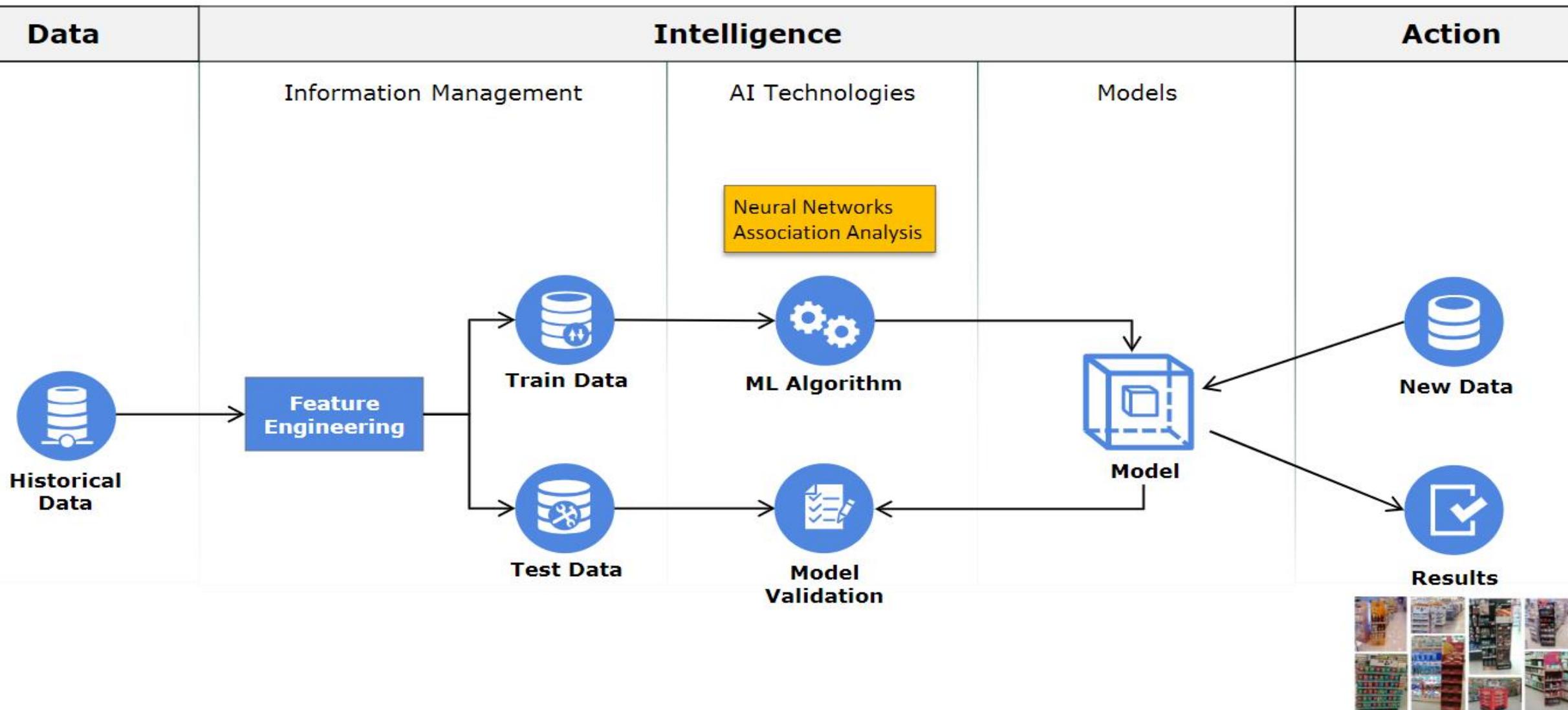
NLP Process



Association analysis: How can AI help find such product combination?

- Retail Kart hypermarkets worldwide want to Improve shopping experience and cross-selling of products by co-locating products that have a high likelihood of being purchased together (e.g., Biscuits, Tea, milk whitener).
- A customer on an online store wants to purchase a book on AI. The seller wants to make suggestions for up-selling and cross-selling.

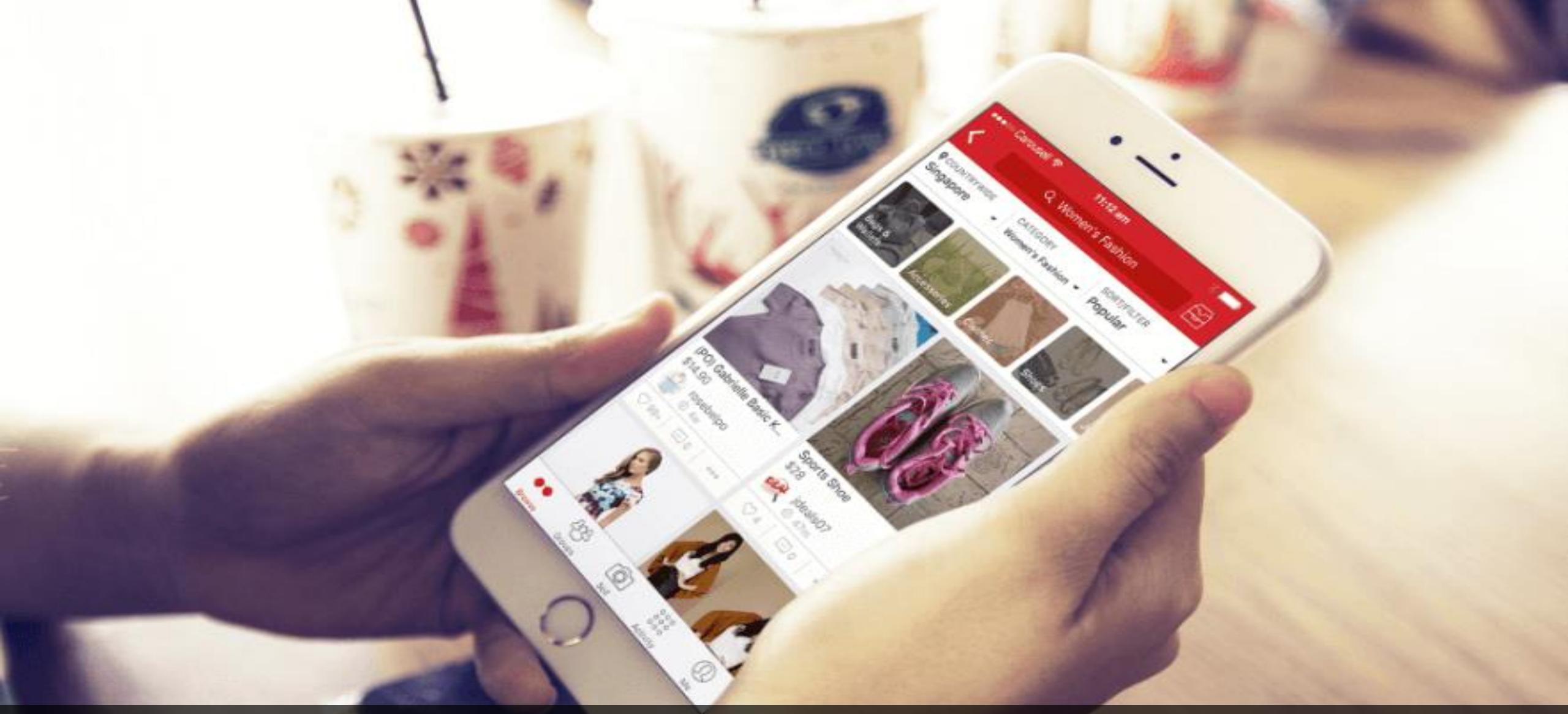
Association Analysis





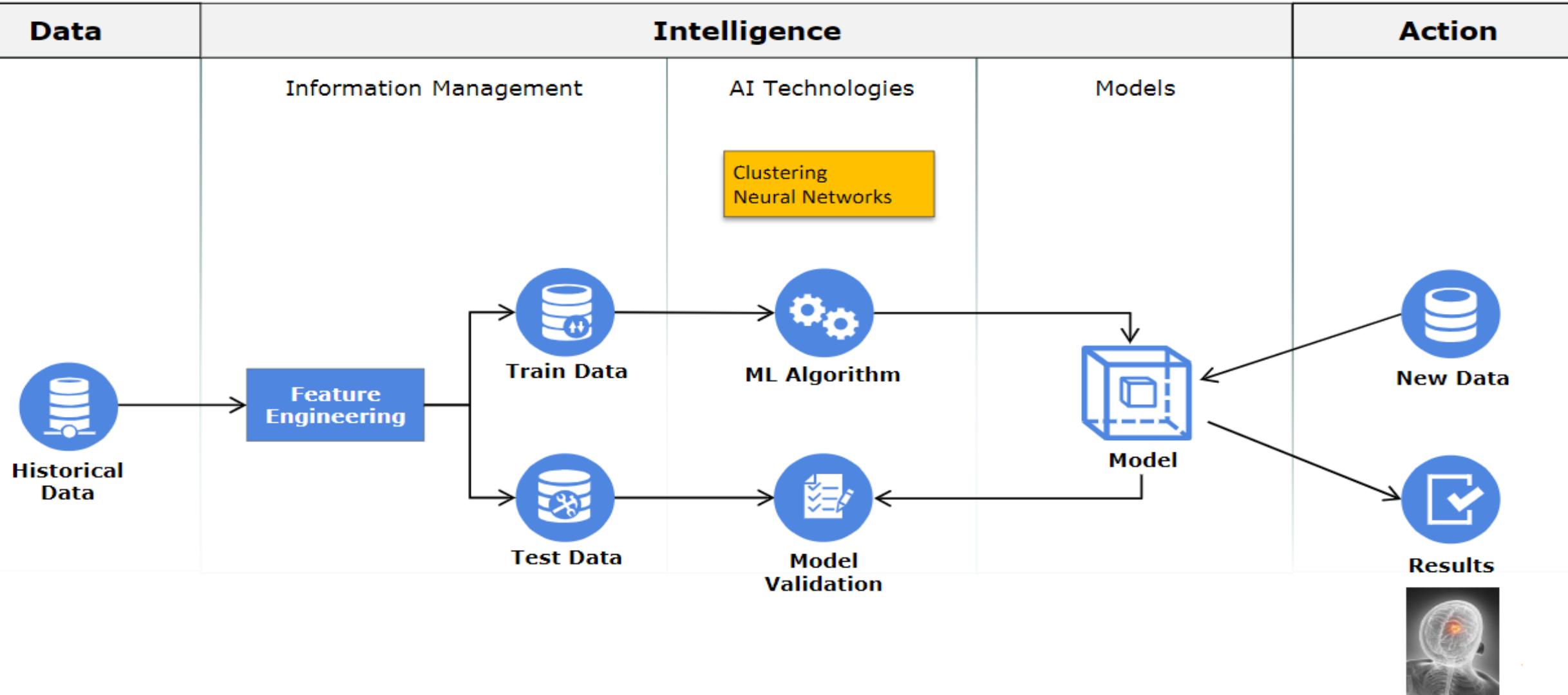
Medical Imaging: How can AI help?

A hospital manually checks MRI images to detect brain tumors. Doctors have to go through a number of images for this. It takes a lot of time and is subject to human errors.



A retail shop wants to create high level categories for unlabeled products using images of products as inputs.

Medical Imaging



Putting them all together – AI architecture

Data	Intelligence			Action
 Data Sources  Apps  Sensors and Devices	Information Management <ul style="list-style-type: none">DatabasesSparkHadoop	AI Technologies <ul style="list-style-type: none">Machine learningNLPRoboticsImage analyticsExpert systems	Models 	 People  Web  Apps  Mobile  Bots Automated Systems
	<ul style="list-style-type: none">Historic Business data that can be used to gain business insights.It can lead to gain in efficiency	<ul style="list-style-type: none">Construct and select features for the problemCleaning the dataDistributed/parallel computing environment for handling massive amounts of data	<ul style="list-style-type: none">Contains components that create a model based on the patterns in the training data.	<ul style="list-style-type: none">Is the pattern/knowledge extracted from the dataGiven new data, it produces the desired result (Classification, regression etc.)

AI led business process transformation

AI led business process transformation – Insurance Claim Process

- Insurance Claims cost almost 80% of the premium income.
- Time consuming , labor intensive , laws require settlement of claim within stipulated period

How has AI led to the transformation of the entire claims process?

AI led business process transformation – Insurance Claim Process



Conventional Process	FNOL	Claims triage	Inspection & cost estimation	Fraud detection	Recovery/litigation	Settlements & payments
AI Enablement	Chatbots accept FNOL. System can extract and transform data from handwritten and typed forms at a +99.9% accuracy.	Orders in which claims are handled. AI does this accurately and assigns work to the most suitable adjuster	Compute repair estimates using uploaded photographs of damages	AI techniques can point out the areas of fraud (false insurance claim or exaggerating damages, injuries or other losses)	Choose attorneys by using historical data: which Attorneys win before which Judges	Evaluation of personal injury claims based on medical reports. Cashless payments
Changed process	Automated	Automated	Automated	Automated	Manual + Automation	Automated
Technology	NLP, Chatbots	ML, Deep learning, optimization	Machine Vision , Image Analytics, Deep Learning	Deep learning, classification, clustering	Deep learning	Deep learning and predictive analytics

Cont.... AI led business process transformation – Insurance Claim Process



Conventional Process	FNOL	Claims triage	Inspection & estimation	Fraud detection	Recovery	Settlements & payments
Benefits	Better customer experience Reduced work load	Improve TAT and reduce expenses of reassignment	Reduce adjuster visits to repair workshop. Improves TAT	Reduce profit leakage.	Enhance chances of winning	Better customer experience Reduced work load
Product / Company	Lemonade, Captricity		Motionscloud, Tractable		Premonition	Zürich Insurance

- The business process is now almost completely Automated.
- Reduce claims “leakage”: the dollars lost through claims management “inefficiencies”.
- Enhances customer experience and satisfaction.

Business Process Transformation using Cloud, Big Data and AI - Amazon

- AMAZON has gained market Leadership by use of technologies (Is in the list of top 10 retailers in US).
- It has Built Competitive edge by using Cloud, Big data & AI technologies.
- 80% of e-commerce giants say that they lag Amazon in analytics maturity -EKN Research

Business Process Transformation using Cloud, Big Data and AI - Amazon



Process	Manufacturers/ sellers connection	Price determination	Warehouse Management	Customer Attraction	Order and shipment
AI enablement	Forecast Demand for partners	Determine prices every 10 mts.	Predict space requirement, optimize space utilization	Personalization, price, service	Route Optimization
Scale	<ul style="list-style-type: none"> • 1.5 billion products • 200 fulfilment centers • 50 million updates every week • half hourly churn of product catalogue • 2 million sellers across 10 countries 	<ul style="list-style-type: none"> • 24 x 7 Price monitoring • Price is modified every 10 mts 	45,000 robots across 20 fulfillment centers	<ul style="list-style-type: none"> • 200 million customers • 1000,000,000 GB data • 1,400,000 servers 	
Technology	Cloud , Big data , Machine Learning	Big data, Machine learning, Optimization	Robotics , Machine learning	Association analysis, Clustering, Sentiment analysis, Forecasting	Machine learning, optimization

Business Process Transformation using Cloud, Big Data and AI - Amazon



Process	Manufacturers/ sellers connection	Price determination	Warehouse Management	Customer Attraction	Order and shipment
Actions	<ul style="list-style-type: none"> New products to be added How much inventory to be maintained Sellers will have 100+ suggestions at any time with them for impl. 	<ul style="list-style-type: none"> 24x7 Price monitoring Price is modified every 10 mts Blue ray game price change - \$70 to \$134 in a week 	<ul style="list-style-type: none"> Predict How much space is required What is the ideal location for warehouse Uses robotics to locate and access items 	<ul style="list-style-type: none"> Personalization Targeted marketing 	<ul style="list-style-type: none"> Best route connecting manufacturer, warehouse customer. Optimize on schedule and cost
		<ul style="list-style-type: none"> Strategy: Huge discounts on best selling products, Better profits on others 		<ul style="list-style-type: none"> Innovation: Anticipatory Shipping, AMAZON GO 	
Benefits	<ul style="list-style-type: none"> Increase revenue, reduced inventory carrying cost. Continuous improvement. 	<ul style="list-style-type: none"> Profit up by 25% after impl of dynamic strategy 	<ul style="list-style-type: none"> Loyal customers 10-30% revenue due to personalization Is in the list of top 10 retailers in US. 		

Artificial Intelligence in Business

What do you think is the problem

- A software company uses 100 employees to manually verify the travel claims submitted by its employees. The work is laborious , monotonous and costly.
- A company is not aware what the customers feel about its newly launched product.
- An online retailer does not know which products to up-sell or cross-sell to a customer.
- Do you see such trends in other business areas?

Dark data & the big AI opportunities

- The company is not using its data to improve its systems/product/processes.
- Dark data is the information assets organizations collect, process and store , but generally fail to use for tangible and intangible gains –Gartner
- 80% of the data is Dark –IBM
- But this is fast changing, and it is creating a huge market potential for AI.

AI and business – The emerging trends

- By 2020, 85% of customer interaction in retail will be managed by AI –Gartner.
- Walmart to gain \$18.5 billion in additional profits by implementing AI solutions.
- AI software to grow for \$664 M in 2016 to \$37 billion in 2025.

Applications of AI



Retail



Healthcare



Banking



Manufacture



Energy

AI in Retail



Conversational
Commerce



Contextual
Commerce



Actionable
Analytics



Predictive
Marketing



Guided
Sales

Amazon

Puma

Flipkart

Amazon

Tesco

Retail: Ai will manage 85% of customer interactions in coming years



Conversational
Commerce

Benefits

- Computers will converse with clients in human languages. Will understand their needs and emotions and assist them in selection and solving issues.
- Personalized service.

Technologies

- NLP
- Speech recognition

Companies

- Alexa -Amazon

Retail: Ai will manage 85% of customer interactions in coming years



Contextual
Commerce

Benefits

- Contextual commerce is an online content –videos, articles, reviews, photos –from which consumers can buy the items featured within it directly, without being redirected to another site

Technologies

- Optimization, NLP, Machine learning

Companies

- PUMA, Bazaar, Ted baker

Reaching the right person with the right offer through the right channel at right time



Actionable
Analytics

Benefits

- Analysis of data that can be put into well defined action geared towards specific results.
- Inventory management, pricing, targeted campaign

Technologies

- Machine learning, Big Data

Companies

- Amazon, Filpkart

Retail: Using AI to make better decision about the world we want to see



Predictive
Marketing

Benefits

- To extract information from customer data sets to determine a pattern and predict future outcomes and trends.
- Can help generate more revenue by targeting only potential customers.

Technologies

- Machine Learning, Expert Systems

Companies

- Amazon, Myntra

Retail: Sell smarter with AI



Guided
Sales

Benefits

- Understanding Needs
- Suggesting the best match.

Technologies

- Machine Learning, Expert Systems

Companies

- Tesco

AI Based Retail Strategies

NLP, Chatbots

- Personalize
- Sentiment Analysis
- Branding
- Marketing

Machine Learning

- Inventory
- Store Layout
- Promotions
- Pricing
- 360-degree View

Image Analytics

- Offline stores
- Kiosks
- Virtual trial mirrors

VR

- Shop in a real store from anywhere
- (Buy+ by Alibaba)

AR

- How will things look in their actual place.
- (ios11)

AI in Healthcare



Automated
Image Diagnosis

SEIMENS



Robot
Assisted Surgery

INTUITIVE
Surgical



Virtual
Nursing
Assistants

SENSELY



Fraud
Detection

KPMG



Preliminary
Diagnosis

Manipal
Hospitals



Administrative
Workflow
Assistant

Backus
Hospital

Healthcare: AI assisted Medical Image Diagnosis



Automated
Image Diagnosis

Benefits

- Radiologists can work faster and accurately.
- It can identify anatomical features and abnormalities in medical images such as CT scans, X-ray and MRI scans.
- Also draws on text and other data in a patient's medical record to suggest possible diagnoses and treatments.
- \$3B

Technologies

- NLP, Machine Vision

Healthcare: AI Assisted Medical Surgery



Robot Assisted Surgery

Benefits

- In robot assisted surgery, surgeons use a computer-controlled robot to assist them in certain surgical procedures.
- Complex surgical tasks can be performed through tiny incisions.
- Greater precision.
- \$40B

Technologies

- Robotics, Machine Learning

Companies

- Intuitive Surgical

Healthcare: AI enabled Virtual Nursing Assistants



Virtual
Nursing Assistants

Benefits

- Clinicians to seamlessly monitor risk factors and adjust clinical protocol as needed.
- A personalized care plan at home itself.
- \$20B

Technologies

- NLP, Machine Learning, Image Analytics

Companies

- Sensely –Molly(nurse)

Healthcare: AI assisted Fraud and abuse detections



Fraud
Detection

Benefits

- Extracts useful information from thousands of claims for detecting health care fraud and abuse.
- Efficient and effective IT-based auditing system.
- \$17B.

Technologies

- Machine Learning, Expert Systems

Companies

- KPMG

Healthcare: AI assisted Disease detections



Preliminary Diagnosis

Benefits

- Can automatically detect diseases.
- The waiting time of the patients to get pathology reports would be reduced.
- Helps to avoid the more time-consuming methods for visual medical diagnosis and makes the process faster.
- \$5B, \$17B

Technologies

- NLP, Machine Learning, Data mining

Companies

- Manipal hospital with IBM Watson

Healthcare: AI assisted Resource Management



Administrative Workflow Assistant

Benefits

- Making best use of both humans and AI talent.
- AI offers a way to fill in gaps amid the rising labor shortage in healthcare
- \$17B

Technologies

- Machine Learning, Expert Systems

Companies

- William Backus hospital

AI and Banking



Risk
Assessment



Investment
Management



Trading



Credit
Approval Process



Customer
Support



Regulations &
Compliance

Bank of America

State Bank
of India

J.P. Morgan

Reserve Bank
of India

HDFC Bank

Bank of America

Banking: AI based solution for Risk Estimation



Risk
Assessment

Benefits

- Determination of the estimate of risk related to a situation
- Credit risk or Liquidity risk for example.

Technologies

- NLP, Machine Learning

Companies

- Bank of America

Banking: AI based investment banking solutions



Investment
Management

Benefits

- Management of bonds, securities, shares etc.
- Real time optimization of sales and marketing interactions and client services , predictive market modeling based on instantaneous processing of teraflops of data.

Technologies

- Machine Learning, NLP

Companies

- SBI, HDFC bank

Banking: AI based trading solution



Trading

Benefits

- Develop new strategies for trading volatility on behalf of clients.
- Can examine vast amounts of trading data and build a strategy based on learning from market patterns

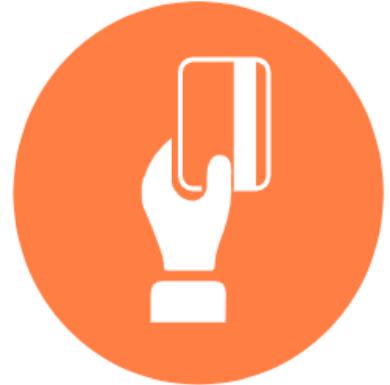
Technologies

- Machine learning, Analytics

Companies

- JP Morgan

Banking: AI assisted operations



Credit
Approval Process

Benefits

- AI can capture complex patterns in customer data and exploit these patterns to identify likely defaulters.
- Uses patterns that traditional underwriting models do not account for

Technologies

- Machine Learning, Expert Systems

Companies

- RBI , Bank of America

Banking: AI based Customer Care support



**Customer
Support**

Benefits

- Computer guides people on processes.
- Advises on investments.
- Takes care of support issues.

Technologies

- Machine learning, optimization, planning

Companies

- HDFC –Robotic assistant IRA

Banking: AI assisted Compliance Check



Regulations &
Compliance

Benefits

- Thousands of hours are spent in regulatory compliance filings to determine whether they comply with laws, terms and conditions.
- Using AI banks may be able to save 30% of compliance costs while accelerating throughput up to three times

Technologies

- NLP, Machine learning

Companies

- Bank of America

AI in Manufacturing



Digital
Twins

SIEMENS



Adaptive
Manufacturing

Rethink
Robotics



Predictive
Maintenance

GE



Automated
Qualitative
Control

PLETHORA



Demand Driven
Production

Amazon

Manufacturing: Smarter manufacturing



Digital
Twins

Benefits

- Products are already created in the virtual world.
- Security optimization, being tested and refined in the virtual world.
- Manufacturing processes are also on track to being developed, tested, and optimized this way.

Technologies

- Machine learning

Companies

- Siemens

Manufacturing: Adaptive manufacturing



Adaptive
Manufacturing

Benefits

- Humans and robots work side by side for maximum effectiveness
- Overcomes drawbacks of industrial robots (e.g., they require hours to reprogram)
- Easy, cost effective

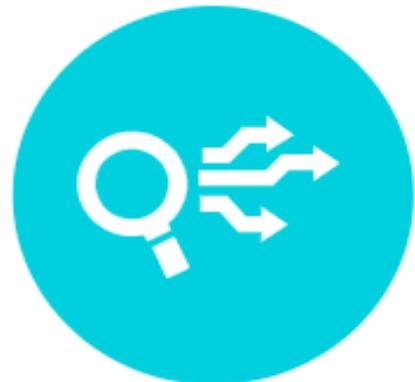
Technologies

- Machine Learning, Robotics

Companies

- Rethink robotics

Manufacturing: AI based Predictive maintenance



Predictive
Maintenance

Benefits

- Equipment can interpret data from hundreds of sensors, understand failure conditions, track anomalies, based on real-time demand.
- This allows manufacturers to achieve 60 percent or more reduction in unscheduled system downtime

Technologies

- Predictive analytics, robotics

Companies

- General Electric

Manufacturing: Boosting productivity using AI



Automated
Qualitative Control

Benefits

- Monitoring and adaptive control using AI can allow you to increase the productivity
- Faster feedback loops using AI can enable factories to tackle unplanned downtimes

Technologies

- Machine Learning, Expert systems

Companies

- Plethora

Manufacturing: Real time demand execution



Demand Driven
Production

Benefits

- Real-time demand visibility can be achieved by connecting consumer apps and IoT with industrial IoT.
- Consumer trends and behavioral data can inform downstream supply chain and manufacturing activities

Technologies

- Machine learning, information extraction

Companies

- Amazon Echo

AI in Energy



Smart
Exploration

ExxonMobil



Better
Development

BP



Faster
Production

GAZPROM

Energy: AI assisted smarter exploration



Smart
Exploration

Benefits

- Geoscientists locate oil reserves using their knowledge and experience with a helping hand from AI technologies.
- Testing the waters “virtually” before a drill ever disappears downhole could save a company anywhere between millions and billions.
- Improve quality of seismic analysis.
- \$6B

Technologies

Machine learning, Expert Systems

Energy: AI based development solutions



Better
Development

Benefits

- Faster delivery of capital projects from planning.
- Better availability of logistics and maintenance.
- Lower capital expenditure by rightsizing wells, crew.
- \$15B

Technologies

- Machine Learning, image analytics, robotics, planning

Companies

- Shell

Energy: AI based Onshore production solutions



Faster
Production

Benefits

- Reduce risks through predictive maintenance.
- Optimize stock levels.
- Faster maintenance.
- Better coordination between shifts.
- Better onshore offshore coordination.
- \$14B

Technologies

- Machine learning, supervised, unsupervised

Companies

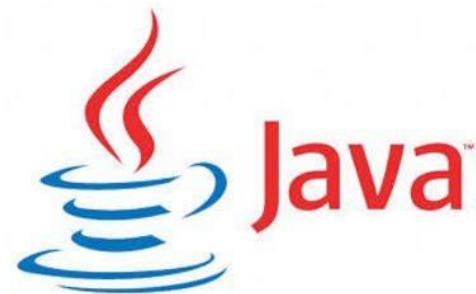
- Total, Gazpromavia

Summary of business benefits

- Competitive advantage
- New Business line creation
- Return on Investment (ROI)
- Turnaround time improvement
- Time to market

Artificial Intelligence Language, Tools and Frameworks

Programming Languages



R Programming



Big Data Tools



Machine Learning Frameworks



TensorFlow



Keras

Caffe



PyTorch

theano



Cloud Platforms

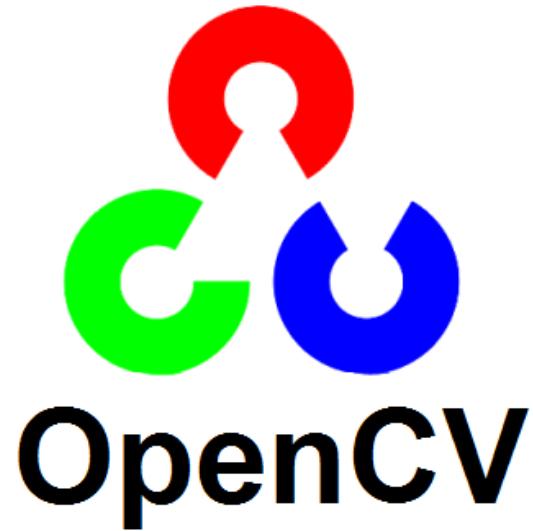


IBM Cloud



Google Cloud Platform

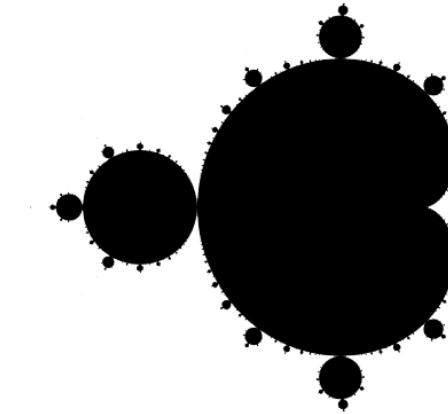
Computer Vision



Natural Language Processing Tools



spaCy



TextBlob

ML Operations (Mlops)



Flask

mlflow™



Apache
Airflow



Kubeflow

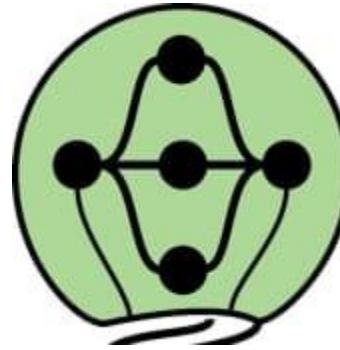


SELDON

AI Governance

What If...

you could inspect a machine learning model,
with minimal coding required?



Lime

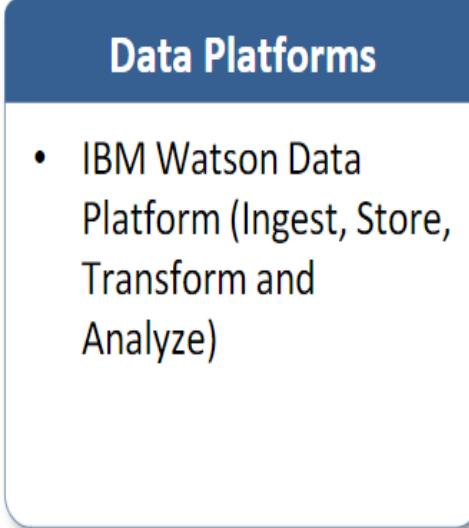
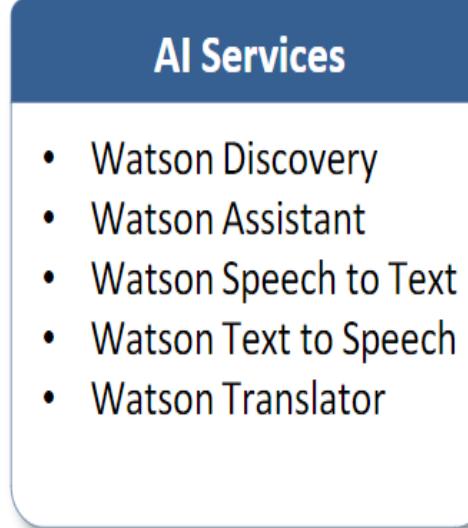
What-if Tool, LIME, DeepLIFT, Skater, Shapley , AIX360 etc....

Artificial Intelligence Cloud Platforms

IBM Watson

- Watson Studio helps to build, run and manage AI models anywhere using open-source code or visual modeling.
- Watson Machine Learning is a part of the Watson studio that helps to deploy and run machine-learning models anywhere, across any cloud.
- Watson Knowledge Catalog powers intelligent, self-service discovery of data, models and more. The cloud-based enterprise metadata repository activates information for artificial intelligence, machine learning and deep learning.
- Watson Assistant provides customers with fast, consistent and accurate answers across any application, device or channel.
- 25 + Microservices (Pre-trained models) including emotion analysis, tone analyzer, personality insights, etc.

IBM Watson

Data	Intelligence			Action
 Data Sources	 <h3>Data Platforms</h3> <ul style="list-style-type: none">• IBM Watson Data Platform (Ingest, Store, Transform and Analyze)	 <h3>Analytics & ML</h3> <ul style="list-style-type: none">• Watson Knowledge Catalog• Watson Studio• Watson Machine Learning	 <h3>AI Services</h3> <ul style="list-style-type: none">• Watson Discovery• Watson Assistant• Watson Speech to Text• Watson Text to Speech• Watson Translator	 People  Web  Apps  Mobile  Bots Automated Systems

IBM Watson – Case Studies

- Moosejav uses IBM solutions target abandoned carts and drastically increase email open rates.
- Staples uses IBM Watson to create an intelligent ordering ecosystem that business customers can use to order supplies easily using voice, text or email..
- At Point of Care, LLC wanted to create a mobile platform powered by cognitive technology to simplify the process of searching through vast volumes of material and deliver precisely targeted results at the point of care.
- Other case studies: <http://www-03.ibm.com/software/businesscasestudies/jo/en/corp/>

Amazon AI ecosystem

- Amazon Sage Maker is a fully managed service that provides the ability to build, train, and deploy ML models at scale. It removes the complexity and helps to easily deploy your ML use cases, from predictive maintenance to computer vision to predicting customer behaviors.
- AI Services (Pretrained models) provide ready-made intelligence for your applications and workflows to help you improve business outcomes. Some of the services are computer vision, speech, translate, personalized recommendations, demand forecasting, fraud prevention etc.
- Provides Amazon Lex, the same conversational engine that powers Amazon Alexa for building conversational interfaces for any applications using voice and text.
- Offers scalable (elastic) infrastructure with preconfigured dev environments with deep learning capabilities for developing custom AI applications.

Amazon AI ecosystem

Data	Intelligence			Action
 Data Sources  Apps  Sensors and Devices	Data Platforms <ul style="list-style-type: none">• Amazon S3 (Storage)• Amazon Kinesis (Streaming data)• Amazon Data Pipeline (Data transformations)	Analytics & ML <ul style="list-style-type: none">• Amazon SageMaker	AI Services <ul style="list-style-type: none">• Amazon Rekognition (Computer Vision)• Amazon Polly (Text-to-Speech)• Amazon Lex (Conversational Engine)	 People  Web  Apps  Mobile  Bots Automated Systems

Amazon ML – Case Studies

- [BuildFax Case Study](#): Predict the age and condition of a building's roof in order to help its customers (insurance companies) establish better policies and premiums when insuring building roofs.
- [ArtFinder Case Study](#): Recommend art works to buyers based on their preferences using machine learning and image recognition.
- Other case studies: <https://aws.amazon.com/solutions/case-studies/big-data/>

Google Cloud Platform

- AutoML helps to build best-in-class ML models without writing any code with easy-to-use UI, or using your own code written in Notebooks, a managed Jupyter Notebook service.
- Access to state-of-art services used by Google such as search, translate, video analysis, speech analysis, recommendation etc.
- Provides high performance TPUs (Tensor Processing Units) to build scalable and portable deep learning models with TensorFlow.
- Dialogflow helps to build virtual agents and other conversational experiences.

Google Cloud Platform

Data	Intelligence			Action
 Data Sources	 Data Platforms <ul style="list-style-type: none">• BigQuery (Enterprise Data warehouse)• Cloud Dataflow (managed service for transforming and enriching data in stream (real time) and batch (historical) modes)	 Analytics & ML <ul style="list-style-type: none">• Google Cloud AutoML	 AI Services <ul style="list-style-type: none">• Speech API• Vision API• Translate API• Text to Speech• Speech to Text• Dialogflow	 People

Google Cloud Platform – Case Studies

- Johnson and Johnson optimizes its career site using Google Cloud machine learning.
- VictoriaPlum is using machine learning APIs to recognize items in customer photos and enhance the user experience based on it.
- Evernote plans to add voice recognition and translation features using Google Cloud machine learning to give customers more power to capture their ideas on the fly.
- Other case studies: <https://cloud.google.com/customers/directory/>

Microsoft Azure

- Azure machine learning helps build train and deploy machine learning models. Best-in-class support for open-source frameworks and languages is provided.
- Azure Databricks helps in bigdata analytics and AI with Apache Spark.
- Integrates with Microsoft cognitive services such as Vision, Speech, Knowledge, Search and Language.
- Azure Bot services helps inbuilding conversational experiences.
- Provides Deep Learning Virtual Machine (DLVM) which specially configured to make it easier to use GPU-based VM instances for training deep learning models.

Microsoft Azure

Data	Intelligence			Action
 Data Sources  Apps  Sensors and Devices	Data Platforms <ul style="list-style-type: none">• Data Lake Store• SQL Data Warehouse• Document DB	Analytics & ML <ul style="list-style-type: none">• Azure Machine Learning• Azure Databricks	AI Services <ul style="list-style-type: none">• Microsoft Cognitive Services – Vision, Speech, language• Azure Bot services	 People  Web  Mobile  Bots Automated Systems

Microsoft Azure

- Scheider Electric: Predict abnormal operating conditions of assets in oil and gas before they happen and take preventive actions.
- FastShop: Brazilian retailer optimizes pricing and customer engagement using machine learning.
- Other case studies: <https://azure.microsoft.com/en-in/case-studies/?service=machine-learning-overview>.

