Introduction to AI

“I cannot teach anybody anything, I can only make them think.”

-Socrates

What is Artificial Intelligence?

Anything that enhances the intelligence of a machine

Enabling machines with cognitive abilities

Creating a technology that replicates what human do

Imparting the machines an ability that enables them to think and learn

What is Artificial Intelligence?

Using computers to do the task automatically or semi-automatically with an intention to limit human intervention

Combination of technologies that helps in extracting information/knowledge from the data. It identifies and extracts patterns

AI is in fact machine learning, that uses mathematics/statistics on computers to discover patterns from data

Examples

- Image processing
- Video Analytics
- Pattern recognition

It is enabling predictions with supreme accuracy and automating business processes and decision-making.

Benefits: greater customer experiences, intelligent products and more efficient services many more

Adopting AI

- *Componentry* and the *process*

The Componentry

- **Data fabric**
  - Customized data for AI.
  - Logical representation of all data assets
  - Standardizes data management practices and practicalities across cloud, on premises, and edge devices
  - It pre-organizes and labels data across the enterprise.
  - Seamless access to all data is available through virtualization from the firewall to the edge.
- **A development environment and engine**
  - Infrastructure to build, train, and run AI models.
  - This enables end-to-end learning, from input to output.
  - Machine learning models discover patterns data that are inferred, rather than explicit.

The Componentry

- **Human features**
  - Connecting models and applications to human features like voice, language, vision, and reasoning
- **AI management and exploitation**
  - This enables you to insert AI into any application or business process, while understanding versions, how to improve impact, what has changed, bias, and variance.
  - This is where your models live for exploitation and enables lifecycle management of all AI.
  - Lastly, it offers proof and explain-ability for decisions made by AI.

The Process

- **Identify the Right Business Opportunities for AI**
  - Deciding where to apply AI i.e., manufacturing, productivity, automation, consumer service, supply chain and many more.
  - IT SHOULD BE DEFINABLE, PROGRAMABLE AND IMPLIMENTABLE
- **Prepare the Organization for AI**
  - Data science and technical manpower will be needed.
  - Many tasks will be automated, organizational resistance will come in
  - Trained AI executors will be needed

The Process

- **Select Technology & Partners.**
  - Careful selection of the technologies needed and their deployers
  - We can not have many deployers, judicially choosing of a handful of deployers
- **Accept Failures.**
  - Many AI projects fail, we need to be mentally ready for accepting it
  - Need to learn from failures

Do you think it is an alternative to human Intelligence?

It extends human capabilities in the complex task

Automation in repetitive tasks

- Here logics are been provided by human in form of instructions/codes and machines repeat the task
- Data coming from WEB, IOT, smart infrastructure may be semi-structured/unstructured
- We use AI to pre-process/process the data to extract the information needed in decision making

Examples

- Thermal sensors and maintenance
- Extracting the sentiments from reviews
- Extracting the topic been discussed in a tweet

Do machines have Intelligence?

The machines only have the intelligence that we provide them

The provided intelligence helps them in examining the examples/data and building machine learning models. That needs

- Inputs
- Desired outputs

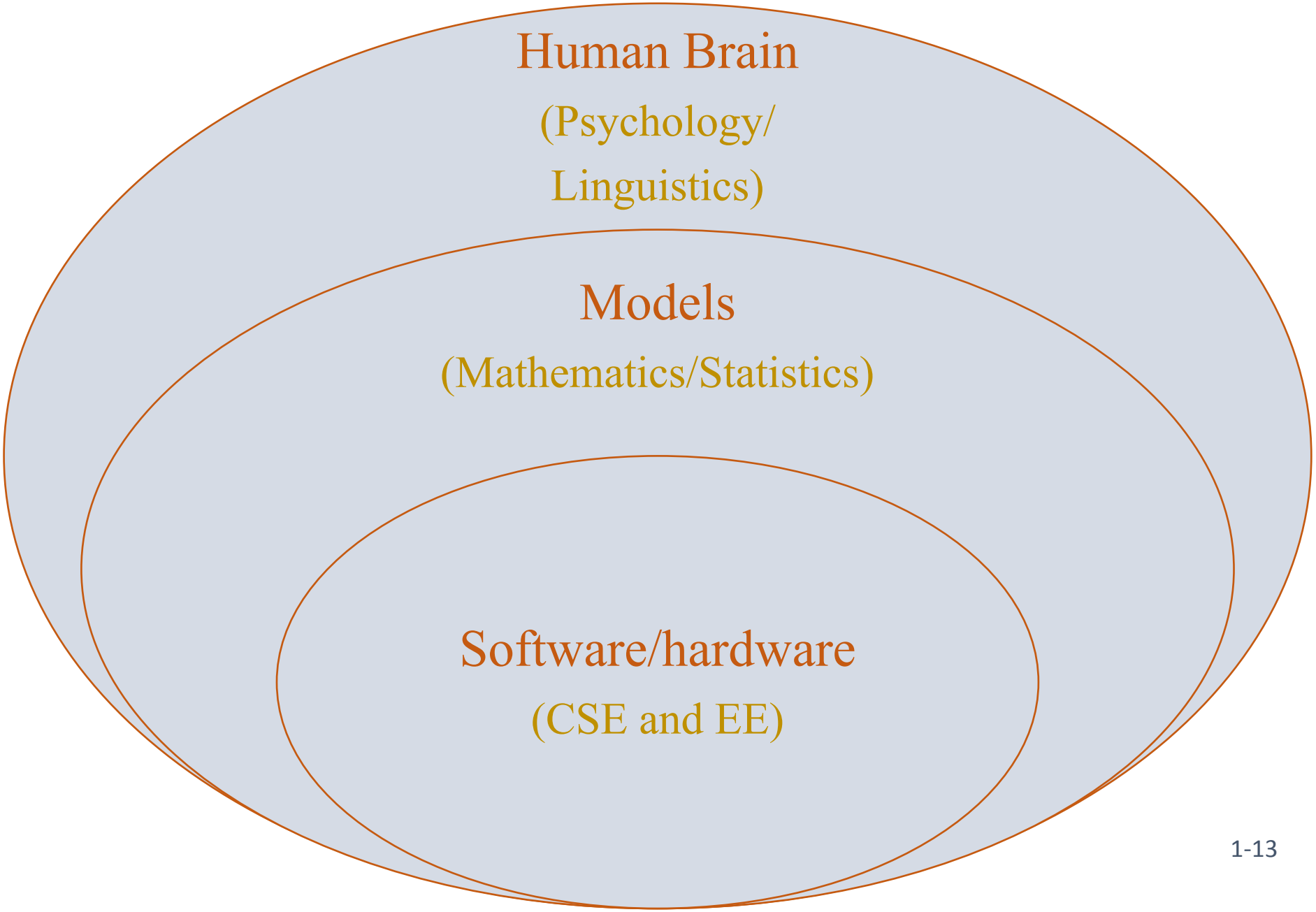
Ways of learning

Supervised learning

Unsupervised learning

Reinforcement learning

Is AI interdisciplinary?



Examples in daily use

All of us may have noted that intentionally or unintentionally all of us are using AI in some or other form

Can you provide some examples from our day to day life

- Email (Spam non-spam)
- Fake/junk calls
- Voice assistance– Google home, SIRI, Alexa

Voice Assistants

- They use AI-backed Voice User Interfaces (VUI) to process and decipher voice commands.
- AI enables these applications with not only relying on user provided voice commands but also utilise various cloud based databases, processing huge information in seconds, and helping users with tailored search engine results

Voice to text conversion, preparing the corpus out of the texts, computing the similarity of the corpus with thousands of similar documents in cloud based database, accordingly reporting tailored search engine results.

Applications of voice assistance

- Listening Music
- Shoping list (When you're in the store, open the Alexa app on your phone to view the list. Swipe right to cross off products as you put them into your cart. Plus, anyone at home can add last-minute items without the need to call or text.)
- Smart Home (voice-activated assistants can dim lights, change their colors, or control the thermostat, blinds, and oven. Did you forget to close the garage door?); "I'm going to bed" and your smart home will turn off all the lights, turn on your nightstand light, make sure the garage door's closed, and start playing gentle rain sounds in the bedroom
- Entertain the kids
- Drive hands-free
- Find lost phones (oice assistant uses can keep you from being late to work or dinners out.)

Entertainment Streaming Apps

Netflix, and other streaming platforms use constantly analyse data using ML algorithms to maximise user experience.

- Careful analysis of users' interaction with different media, users' search history, clicks, time spend, likings, these platforms recommend customised content to the users
- AI helps in dealing with huge data, creating catalogs of music, movies, and TV customized for individual user or household
- Automating the allocation of resources such as bandwidth and server to provide seamless streaming depending on the popularity and need

Personalized marketing

In a survey, around 88 present of the respondents replied that personalised product or service recommendations make them feel better about the brand

- Recommender system
  - Personalized marketing via automated e-mails
  - AI enabled automated feedback forms.
- Market basket analysis
- Did you forget

Personalized marketing

- **Tracking Brand Logo Through Object Recognition**
  - Consumers leave reviews on a variety of platforms online.
  - Companies hire entire teams to scour individual social media platforms or websites to find posts that could potentially harm or help the brand.
  - Through marketing with this technology, brands can discover how customers interact with their product and gather valuable feedback on what may need improvement.
  - Advanced text analytics tools may be used detect the keywords related to a brand or product
  - Advanced DL tools such as image recognition, object detection can be used to search the logo

Visual Product Discovery

- Usually, the products are searched through certain keywords. Keywords may vary from platform to platform, hence sometimes while customers search about the product may not be tagged with the product on certain platforms and finally there might be the loss of sales.
- With the advent of computer vision, there are many platforms such as Pinterest have started allowing customers to search products using image
- This may remove the need for manual tagging entirely, and it can be used as an excellent search and filtration tool.

Predicting the performance of advertisement

- Problem to be solved: Identify which ad will perform the best before launching it
- While testing different ad variations is essential and predicting to find the most effective designs and messaging and their impact
- Using the historical data (image (logo, colour, size), type, time, platform, text, performance indicator, demographic data), ML algorithms
- It gives them insights into what elements work best in their niche market or correctly portray their products/services.

- Type of the creative
  - Text or image or video
- Data about the Ad Creative
  - This includes logo, colors, size, text, any images used
- Who was it sent to?
- What time was it sent?
- Which device was used?
- What social media channel was used?
- How long customers stay on the page with the advertisement?
- How many clicks?

Consumer Emotions/mood tracking using computer vision

- Improved computational power, better camera, and advances in image and video analytics help organizations in tracking consumers reactions and emotions which their product/service elicited (Emotions: Anger Disgust Fear, Happiness, Sadness, Surprise, and Neural)

Read more at: https://viso.ai/deep-learning/visual-emotion-ai-recognition/)

- Disney introduces a system that records audience's reactions to capture consumers facial cues and gestures to predict which part of the video was liked/disliked by the customers.

- If brands are able to capture consumer reactions, they can predict how potential customers are going to react to the product in the market and what expected sales or demand may be

IKEA

- Kitchen
- Bedroom
- Dining hall
- Home office

Multipurpose store

- Grocery
- Vegetables
- Apparel
- Sports

Car showroom

- Car models

More Examples

Rank Images, and textual information

- Yelp uses convolutional neural network (CNNs) to analyse the images and RNNs to analyse the textual information to rank both restaurants and the reviews.
  - Based on the quality of reviews and image they provide differential rank to the reviews and accordingly rank the restaurants
  - Ranking the reviews: based on the quality of image (DSLR or Non-DSLR image)

Smart Input Keyboards

- Autocorrection and language detection for user-friendly experience
  - Efficiently correcting mistakes
  - Switch between languages
  - Predict the next word in a non-intrusive manner
  - Understand the context while making predictions.

- Typewise and Swiftkey kind of apps have integrated around 300 languages and dialects.
  - Real-time translation and integrated search engines

Navigation and Travel

- Google Maps
  - Yottabytes of dynamic geographical data needs cross-checked by ML algorithms unleashed on satellite images.
- MIT research team has developed a new navigation model that tags road features in digital maps on real-time basis.
  - These digital maps also incorporate satellite imagery information about cycling lanes and parking spots.
  - These algorithms utilise Convolutional Neural Networks (CNN) and Graph Neural Networks (GNN)
  - AI also helps ascertain routes on satellite images

Self-driving Vehicles

- Computer vision, sensor fusion, localization, path planning, and control.
  - AI for detecting pedestrians, vehicles, cyclists, and work and obstacles.
  - Help to determine and suggest alternative routes based on real-time traffic conditions. Indeed, an amazing technology.
  - Autopilots to enable automatic steering, accelerating braking, lane changing, and parking actions.
- Deep Reinforcement Learning (DRL), helps in operating vehicles independently.
- Predictive AI that helps in path planning under static and dynamic condition

Facial recognition

A biometric method that recognizes people by their facial characteristics.

Uses:

- **Surveillance and security**
  - delivering alerts for targeted human action
  - Find criminals and stop crime
  - Find Missing Children
  - Quicken Investigations
- **Finance**
  - Banking is another sector where facial recognition software is gaining ground. Passwords, PINs, and other ostensibly conventional security measures are no longer necessary, thanks to some banks' integration of such technology into their mobile banking systems. In addition, some ATMs use facial recognition software as an added layer of security.
  - This can help confirm that the individual withdrawing the money is the account owner and identify any possible background manipulation. In today's banks, face recognition is frequently employed for various functions. Special clients can be recognized and assisted as soon as they enter a facility, known criminals can be closely monitored, and staff can move around the property without scanning their keycards every few feet. Due to these factors, banks and other financial organizations no longer need to exert as much effort as they often do when dealing with customers.

Other Examples

Healthcare
Finance
Robotics, and automation
Unmanned vehicle (Automatic Car): Vision System, Navigational intelligence, Planning and control
Collaborative robots: Robots to work in coordination with human

- Manufacturing, logistics, warehousing

Taking large data and extracting and using it in decision making or making sense out of them

- Processing/analysing the data on real-time basis

Query and search engine

Have you watched Panchayat 2?

Link to the scene where they were looking for CCTV footage to see who has exchanged the slippers in the temple and searching the goat?

Video games

Chatbot: Health care (basic diagnostic); Education (interactive conversional interfaces)

NLP: Alexa, Speech to text conversion

Automatic cars

Facial Recognition

Computer vision: Detecting cancerous moles in skin image, finding symptoms in X-ray and MRIs

Movie/songs suggestions in Netflix, YouTube etc.

Spam detection

Navigation app

Smart watch, sleep monitoring system

Frauds in transactions, Preventing financial crimes

Transaction based consumer profiling

Predicting product demand; Targeted promotions

Banks: Predicting the purchase power of the customer, predicting the probability of a customer to repay the loan, Deciding credit card limit

Transactional data based purchase pattern, Customized product promotion; discount etc.

Predicting consumer behaviour

Doctors:

- Helping doctors in preliminary diagnosis
- Recommending appropriate clinical trial
- Assisting them in referring the patient to other hospital
- Making operational process less expensive
- Finally decreasing the operational cost

Case Study: Dr. SK Katiar

Health and financial recommendation

Imitating human through Robots

Case Study: Dr. SK Katiar

Assignment (Applications and theoretical note on how you can apply AI)

- Healthcare
- Education
- Transcription
- Law Enforcement
- Customer Service
- Mobile and Social Media Apps
- Financial Fraud Prevention
- Patient Diagnoses
- Clinical Trials

Relationship of AI with cognitive computing

Human decision making steps

Observing, looking for evidences

Hypothesizing or making assumptions based on what we know

Testing the assumptions based on the evidences

Deciding on the best available options

Human develop the expertise based on their observations, evaluations and decision making

This cognitive ability is mimicked in cognitive computing

It is advantageous in terms of volume of the data it can handle and the speed of the evidence collection, evaluation and decision making

Cognitive system rely on Natural Languages

It is governed by the rules of grammar, context, culture, and semantics

Cognitive systems keep on learning from interactions with human experts, and their own past experiences (success/failure)

Cognitive Computing VS Conventional Computing

- Read and interpret unstructured data, understanding not just the meaning of words but also the intent and context in which they are used
- Reason about problems in a way that human reason and make decisions
- Learn over time from their interactions with humans and keep getting smarter

Conventional Computing

It is a radically disruptive systems that

- Understands unstructured data
- Formulate hypotheses
- Learns form the experience and interacts with human
- Its utility and success will be dependent how it derives intelligence from it

Why human interactions are needed?

Conventional Computing

It is a radically disruptive systems that

- Understands unstructured data
- Formulate hypotheses
- Learns form the experience and interacts with human
- Its utility and success will be dependent how it derives intelligence from it

Why human interactions are needed?

Why Suddenly cognitive computing has become very important?

because cognitive systems improve as they learn, they actually become *more* valuable. This quality among others makes cognitive technology highly desirable for business, and many early adopters are leveraging the competitive advantage it affords.

AI VS ML VS DL

AI is a branch of computer science that simulates the human intelligence

- Planning, learning, problem solving, knowledge, perception, manipulation, creativity etc.

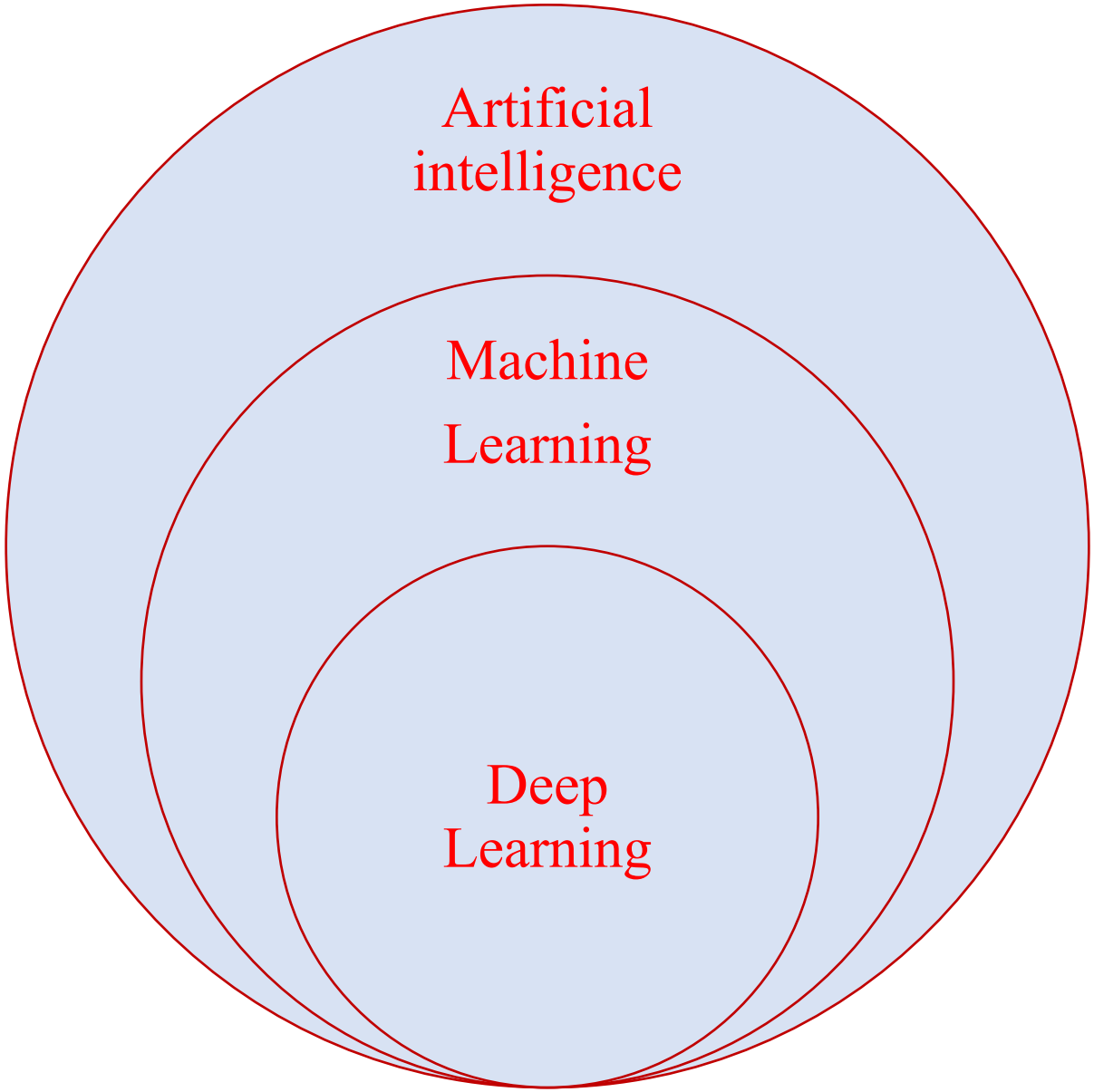
ML is a subset of AI, that helps in analysis of data and making intelligent decisions without being explicitly programmed

- It does not need any explicit programing and it learns from the data itself

DL is a specialized subset of ML

- It uses layered neural networks to simulate human decision making

AI VS ML VS DL



Machine Learning

ML

ML uses computer algorithms to make intelligent decision based on the learning from the data.

Computer algorithms?

Intelligent decision?

Learning from data?

Example

If a borrower will repay the loan to the bank is a ML problem?

Input

Loan Amount
Total Income
No of earning members
No of Dependents
Elderly
Children

Output

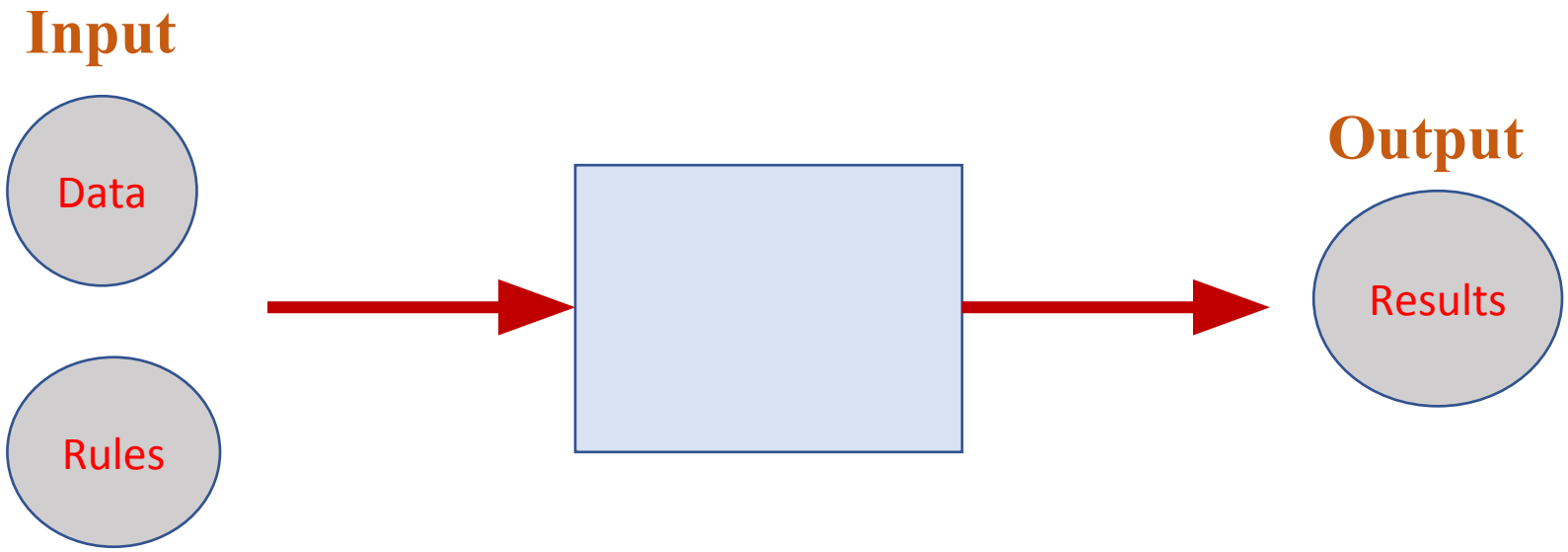
Repay

- Yes
- No

Data

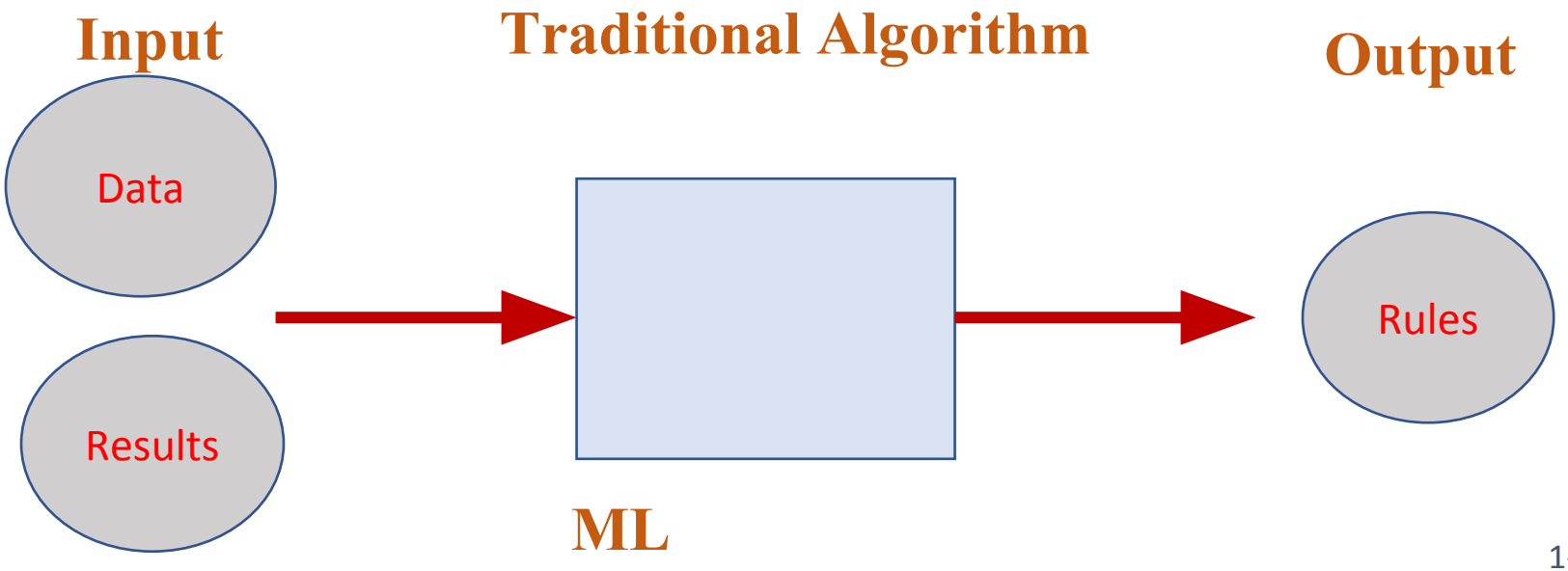
Loan Amount	Total Income	Dependents	Children/elderly	Repay
10 L	15 LPA	3	1	Yes
16 L	11 LPA	3	2	No
12 L	18 LPA	2	1	Yes
26 L	11 LPA	2	1	No
16 L	18 LPA	2	0	Yes
15	12 LPA	4	3	No

Traditional programming VS Machine Learning



If/Else rules

Traditional Algorithm

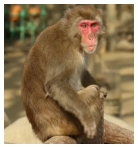


ML Algorithm

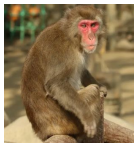
Supervised Machine Learning

Horse

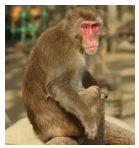
Horse

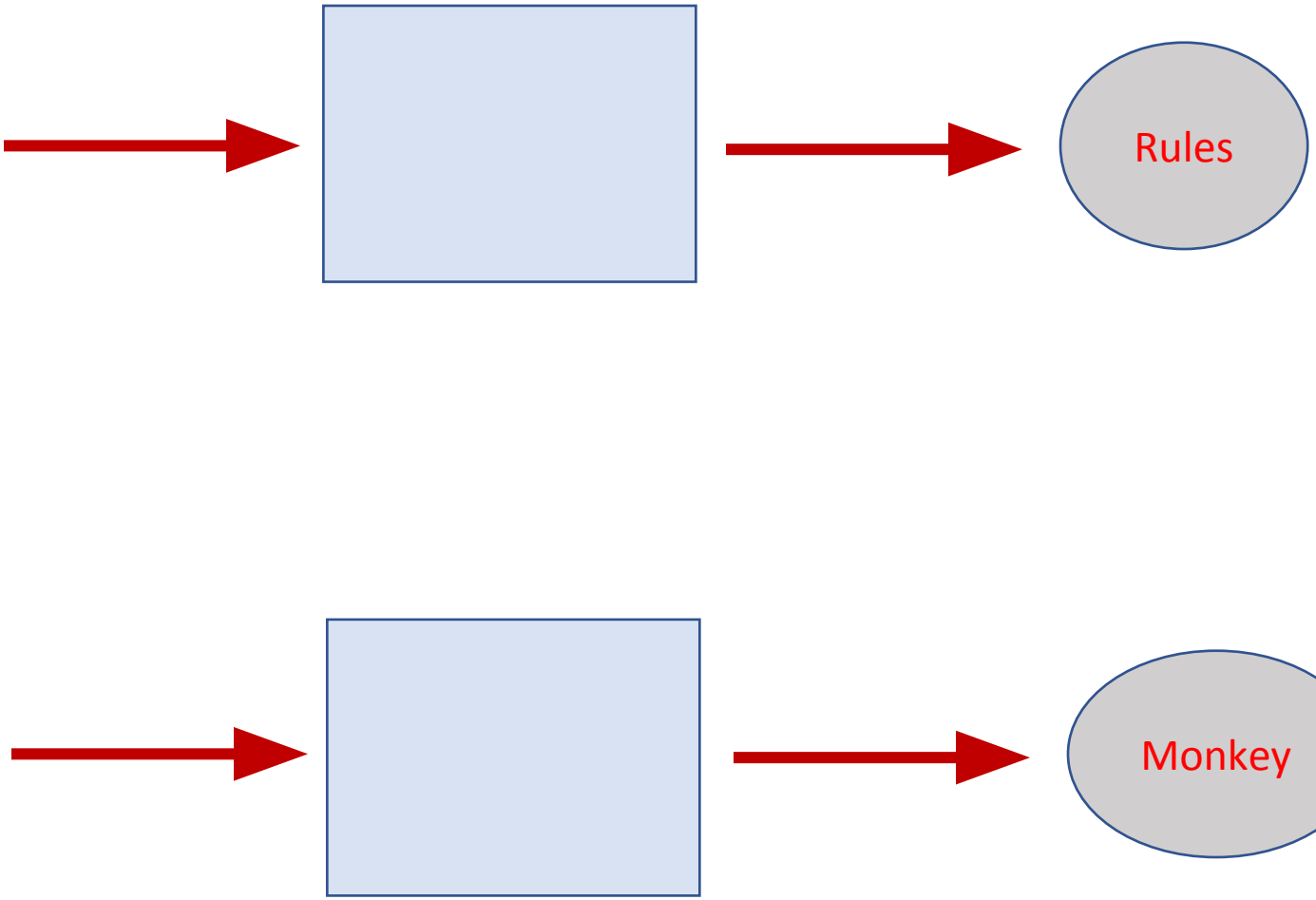


Monkey



Monkey





Supervised Machine Learning

In supervised machine learning, we have input data with labels

Horse

Horse

Loan Amount	Total Income	Dependents	Children/elderly	Repay
10 L	15 LPA	3	1	**Yes**
16 L	11 LPA	3	2	**No**
12 L	18 LPA	2	1	**Yes**
26 L	11 LPA	2	1	**No**
16 L	18 LPA	2	0	**Yes**
15	12 LPA	4	3	**No**

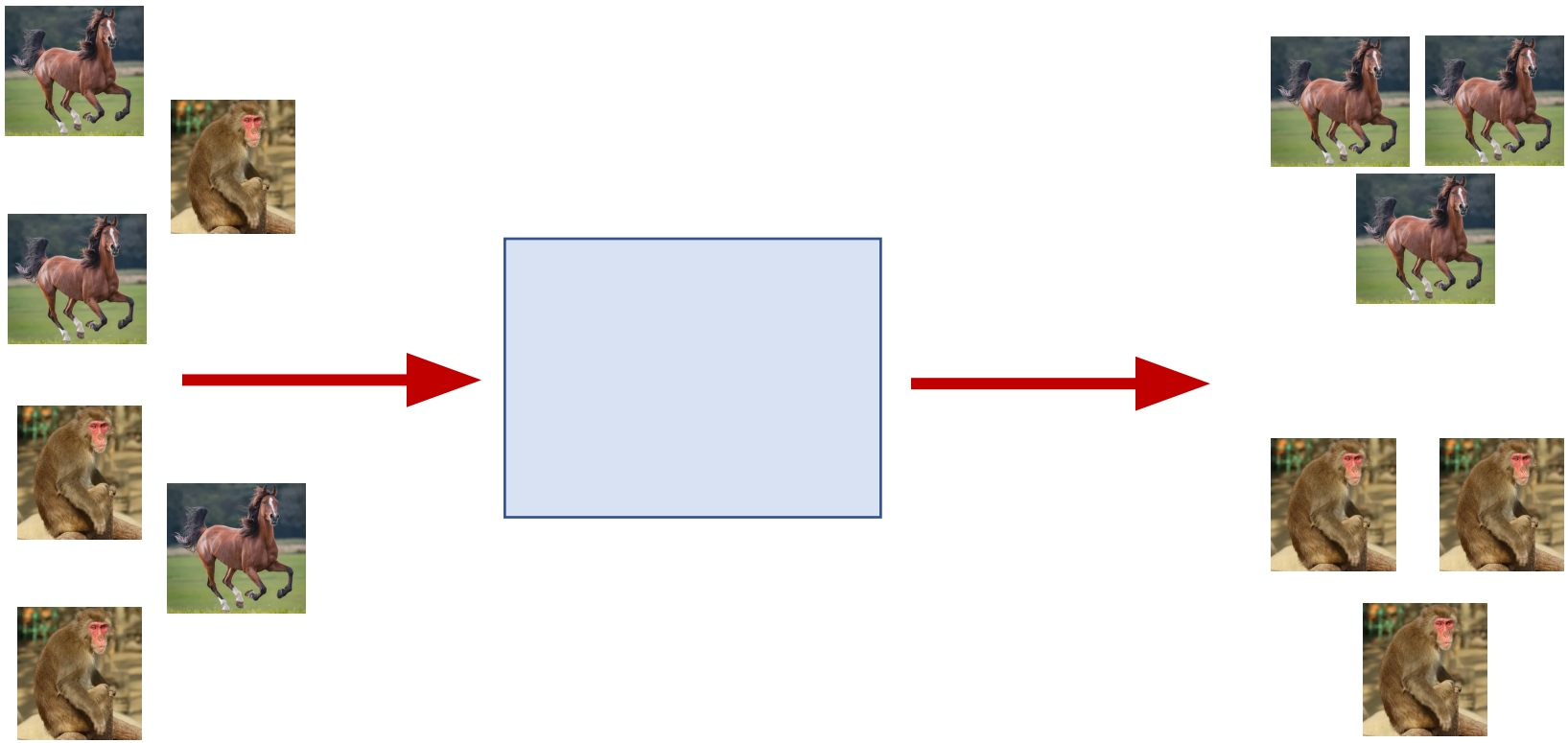
Supervised Machine Learning

Regression

Classification

Neural Networks (Deep Learning)

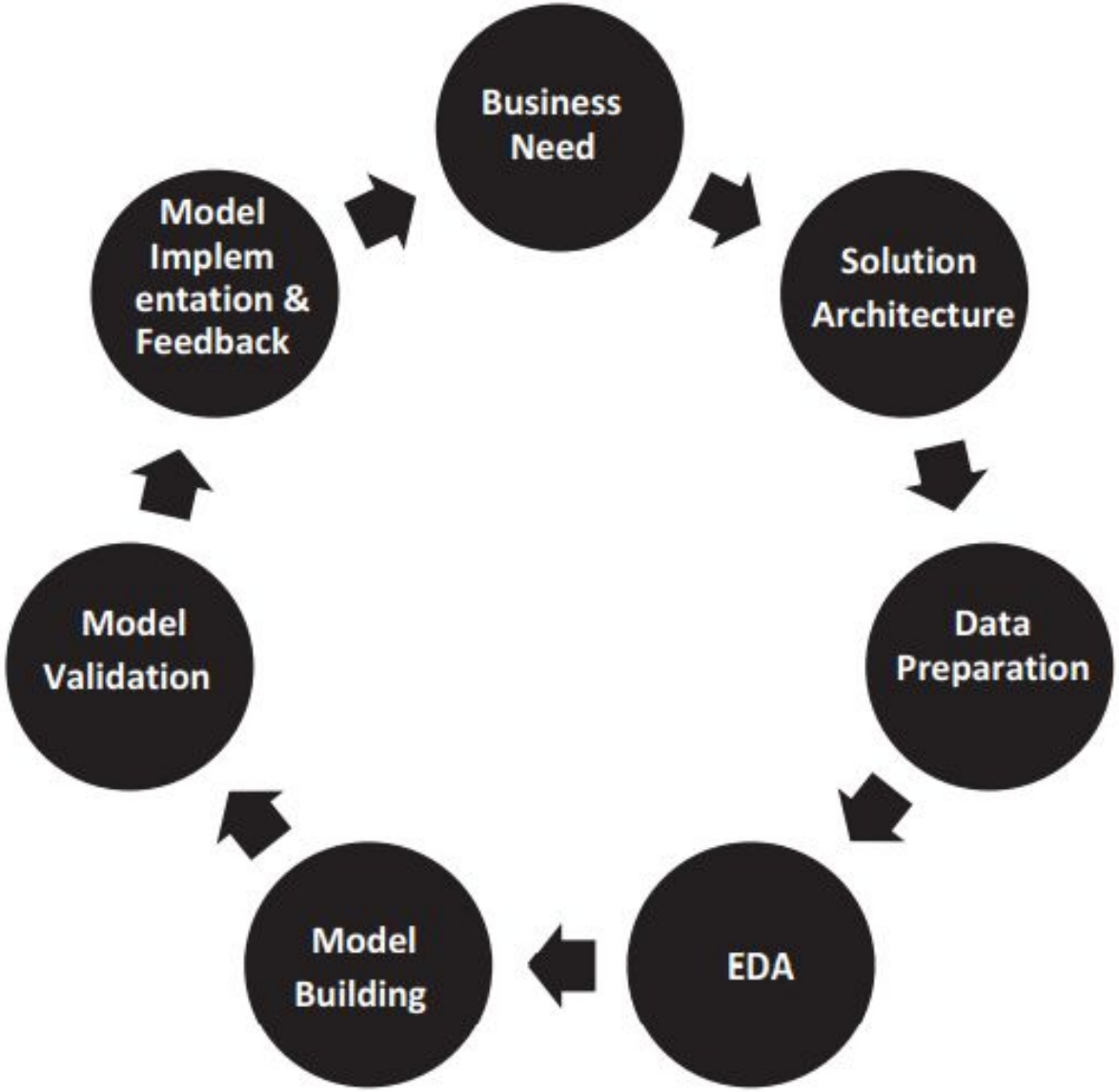
Unsupervised Machine Learning



Unsupervised Machine Learning

- **Clustering**
- **Association**:
  - Market Basket Analysis.

Unsupervised Machine Learning



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Thank You

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AI and IPR

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Intellectual Property (IP)

- Companies protect knowledge via IP (Intellectual Property) management.
- IP management involves administration and organisation of intellectual property matters in institutions such as companies, public or private research institutions and any other entity engaged in the creation and commercialisation of immaterial rights.
- Includes any immaterial asset that may have commercial value or that may be required for facilitating future exploitation

IP Rights Relevant to AIs

- Patents
- Copyrights
- Database Rights

Patents

- Legal right granted to exclusive commercial use of an invention, normally for a limited period of time.
- To be patentable, an idea (usually in the form of a *product* or a *process*):
  - Must be *novel* and *nonobvious*
  - Must involve an *inventive* step,
  - Must have a *practical application*, and
  - Must *not* be in an *excluded* category.
- Generally granted for a limited duration (usually 20 years)
- Patentee has to pay one-time or renewal fee

Copyrights

- Protects writing, music, computer programs, electronic circuit layouts, web pages, photographs, works of art etc. from unauthorised copying for *commercial* use
- Created automatically when the work is complete and requires no registration or payment
- Copyright does not protect mere data or information but only the expression of such information in a particular form.
- Copyright protection usually only arises where a certain degree of originality can be shown.
- Stays until 50-70 years following the death of the creator
- Copyright does not, unlike a patent, give a right to commercially use the work but entails more specific exclusive rights such the reproduction, distribution and certain communication to the public rights.

Database Rights

- Recently introduced in the EU (*sui generis database right*)
- This right arises automatically and is granted to the maker of the database, which may be a company or other institution such as a university.
- The right requires that a substantial investment in the obtaining, presentation or verification of the contents of the database can be shown.
- It lasts fifteen years from the date of first publication of the database, but this can be extended by proving on-going substantial investments.
- The right protects the maker against the copying, distribution and public communication of the whole or a substantial part of the database.

AI and Patents

- Patent offices have started developing AI technologies to supplement or complement their work, improve examination quality, enhance applicant experience, and make the patent process robust.
- At USPTO, AI related patent filings increased by 100 percent between 2002 and 2018 growing from 30, 000 to 60, 000 applications per year.
- AIs share of total patent applications also grew from 9 to 16 percent, and their share in different technology sub-fields grew from 9 percent to 42 percent between 1976 and 2018.

Patenting an AI

- In most geographises, you cannot patent a software program.
- However, most countries recognize software code as ‘copyrightable’.
- As such an algorithm is not considered patentable as it is considered abstract.
- However, an algorithm (or an AI) <u>may</u> be patentable only if you can show it as a series (process) of *distinct and innovative steps* for solving a *specific problem*

Patents by AI?

- As of now patents require an individual or a group of individuals to be behind a patentable invention, with individual often defined as a natural person.
- Hence, a patent to AI is not granted.

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AI and Leadership

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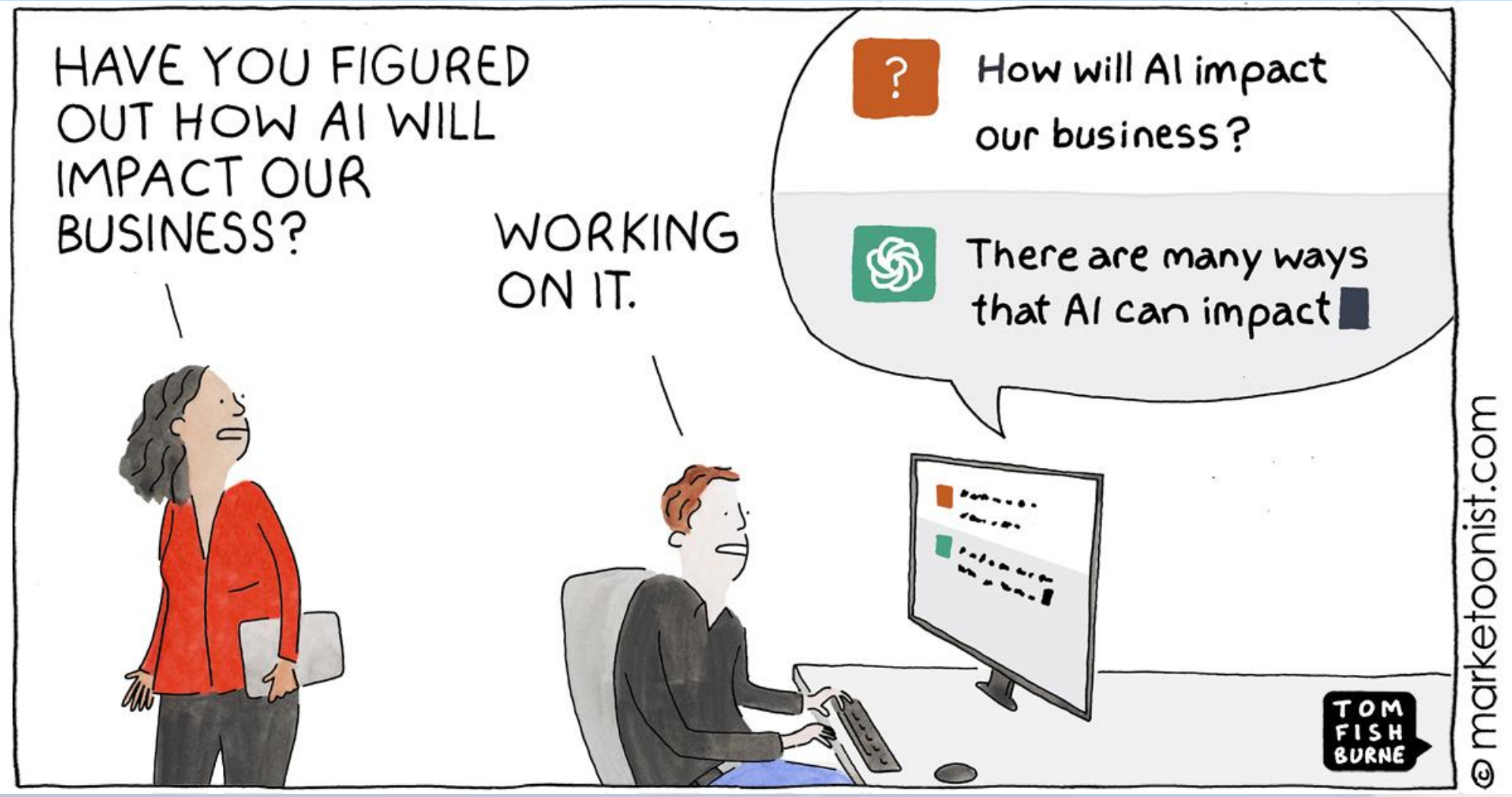
Two questions

- What is the impact of AI on leadership?
- How do digital leaders exploit AI?

Impact of AI on Leadership

- Enhancement perspective
- Replacement perspective
- Skeptical perspective

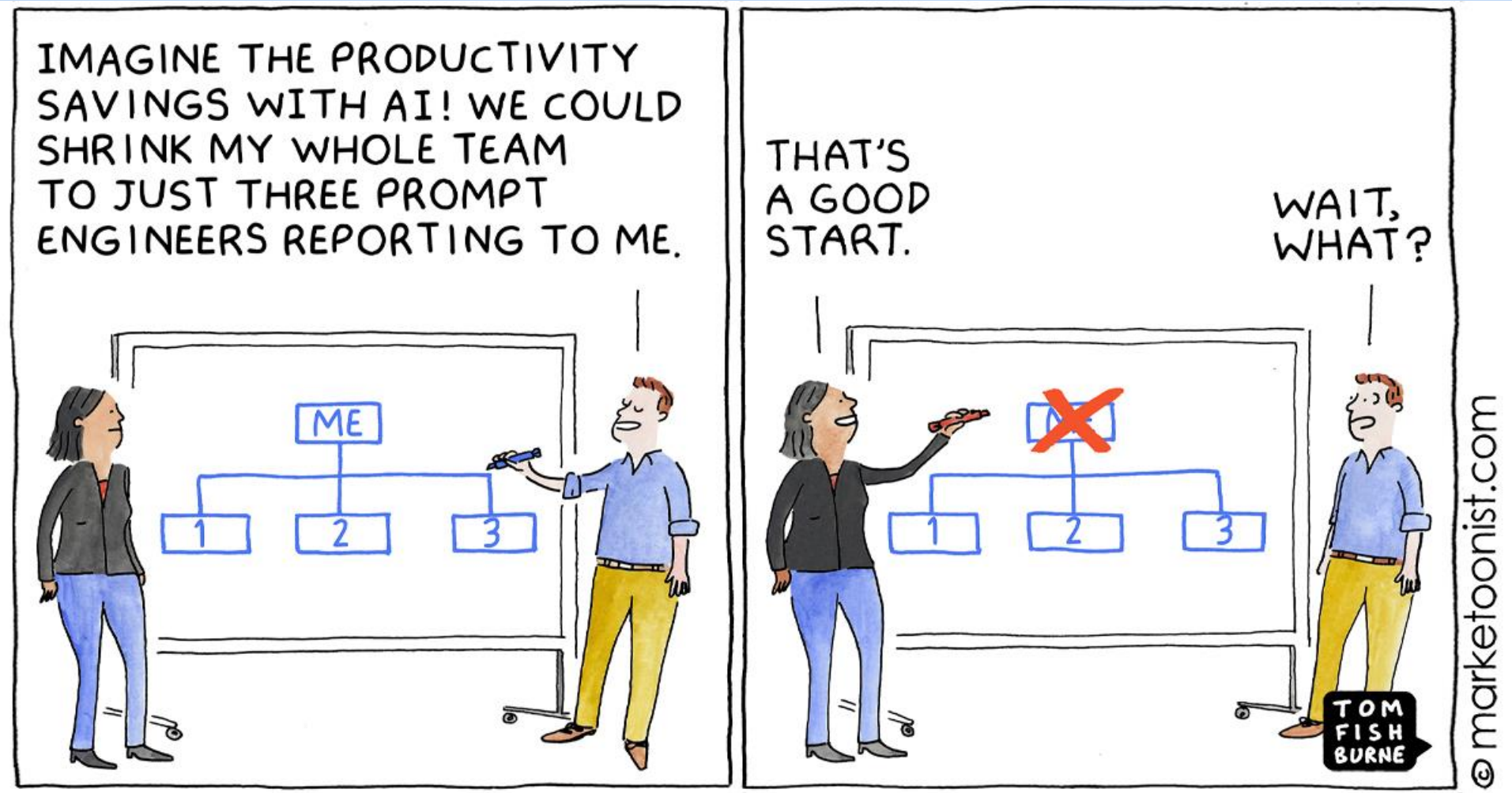
Enhancement Perspective



Enhancement Perspective

- AI is an additional assistance to current leadership functions.
- Technologies and leaders come together and create new cooperation models
- Where (human) leadership would still matter:
  - Creativity,
  - Ability to show empathy and care,
  - Imagination and curiosity,
  - Genuine respect and understanding

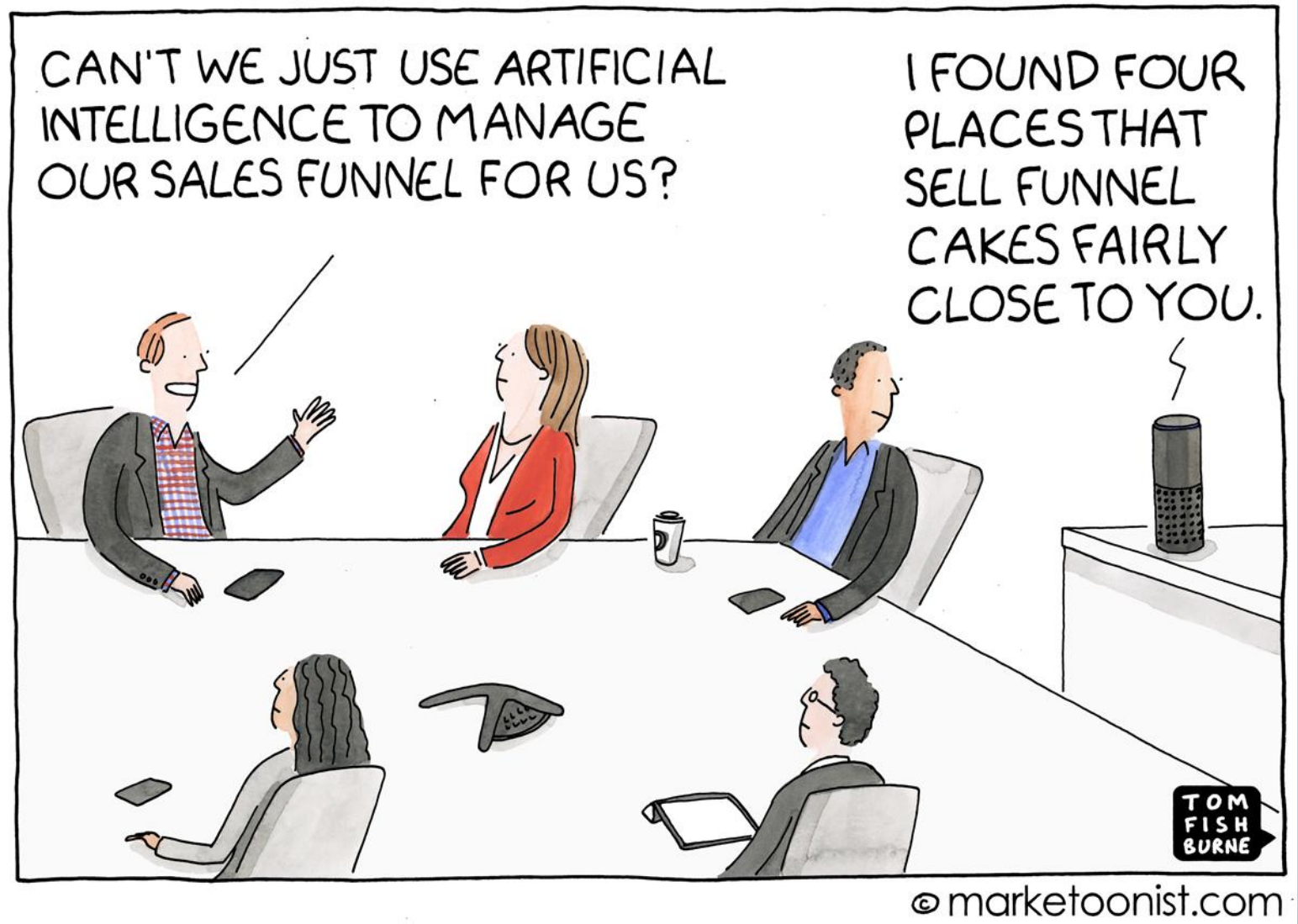
Replacement Perspective



Replacement Perspective

- AI might replace followers and leaders.
- *Algorithmic leadership* – where machines or programs assume activities ordinarily associated with leaders, such as motivating, supporting, and developing workers.
- With this new position, (human) AI leaders will engage in processes that focus on leading the programmers of the AI machine as well as influencing decisions made by AI machines post-programming.
- Risk - eventually might lead to unethical and sometimes even disastrous decisions and actions.
- Therefore, developers must be very cautious and take into account a great deal of the ethical and legal considerations.

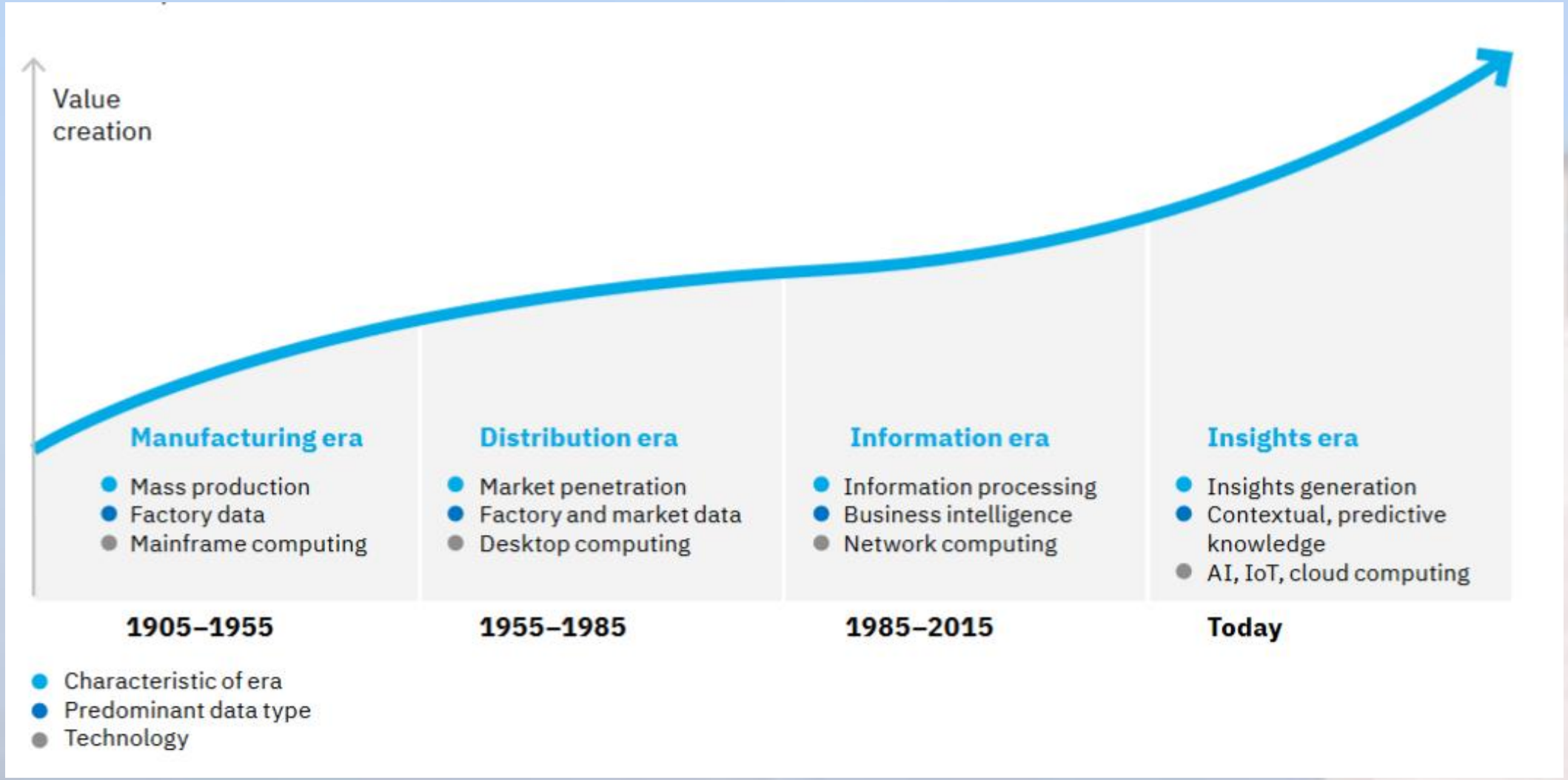
Skeptical perspective



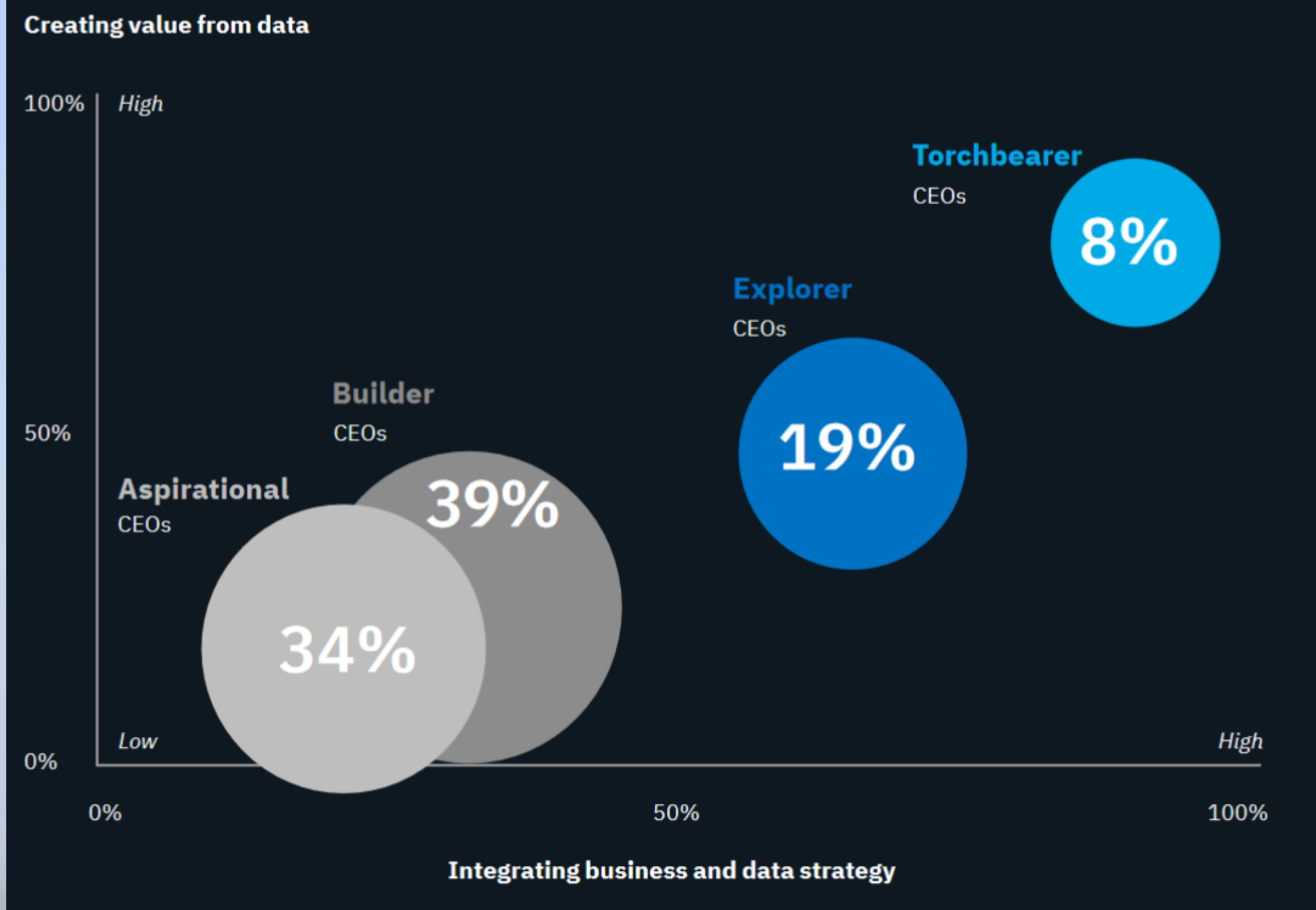
Skeptical perspective

- AI as an *oversold* idea
- The possibilities and influence of AI in the modern world, including leadership and management, is an exaggerated idea, and it must be considered and evaluated critically.
- AI is perfectly suited to do *one thing* very well and, in that respect, outperforms any human
- However, leading an organization represents a more complex reality where the context and social sensitivities of any decision will have to be taken into account.
- AI, as it stands now, does not have such emotional and empathic skills.

AI use for Leadership



Four Types of Leaders



How torchbearers exploit AI and Data

1. Intelligent automation with AI
2. Strategize with ecosystems
3. Extract value through new business models

How torchbearers exploit AI and Data

1. Intelligent automation with AI
   a) Build a robust technological infrastructure, based on hybrid clouds, 5G, the IoT, and edge capabilities.
   b) Put data at the heart of every business decision.
   c) Assess and address the impact of re-engineering your workflows on your workforce.
2. Strategize with ecosystems
3. Extract value through new business models

How torchbearers exploit AI and Data

1. Intelligent automation with AI
2. Strategize with ecosystems
   a) Harness the power of network effects
   b) Establish enterprise- and ecosystem-wide rules for collecting, using, and sharing data
   c) Implement strong policies and processes for sharing data ethically and securely with the other members of your ecosystem
3. Extract value through new business models

How torchbearers exploit AI and Data

1. Intelligent automation with AI
2. Strategize with ecosystems
3. Extract value through new business models
   a) Work backwards from the business case
   b) Conduct a comprehensive review of your existing data to assess the opportunities for monetizing it.
   c) Map your data and analytical resources to each of your long-term business goals.

References

- Titareva, T. (2021). Leadership in an Artificial Intelligence Era. URL: https://commons.lib.jmu.edu/cgi/viewcontent.cgi?article=1012&context=leadcc
- IBM (2020). Seizing the data advantage. https://www.ibm.com/downloads/cas/XAMDQBE7

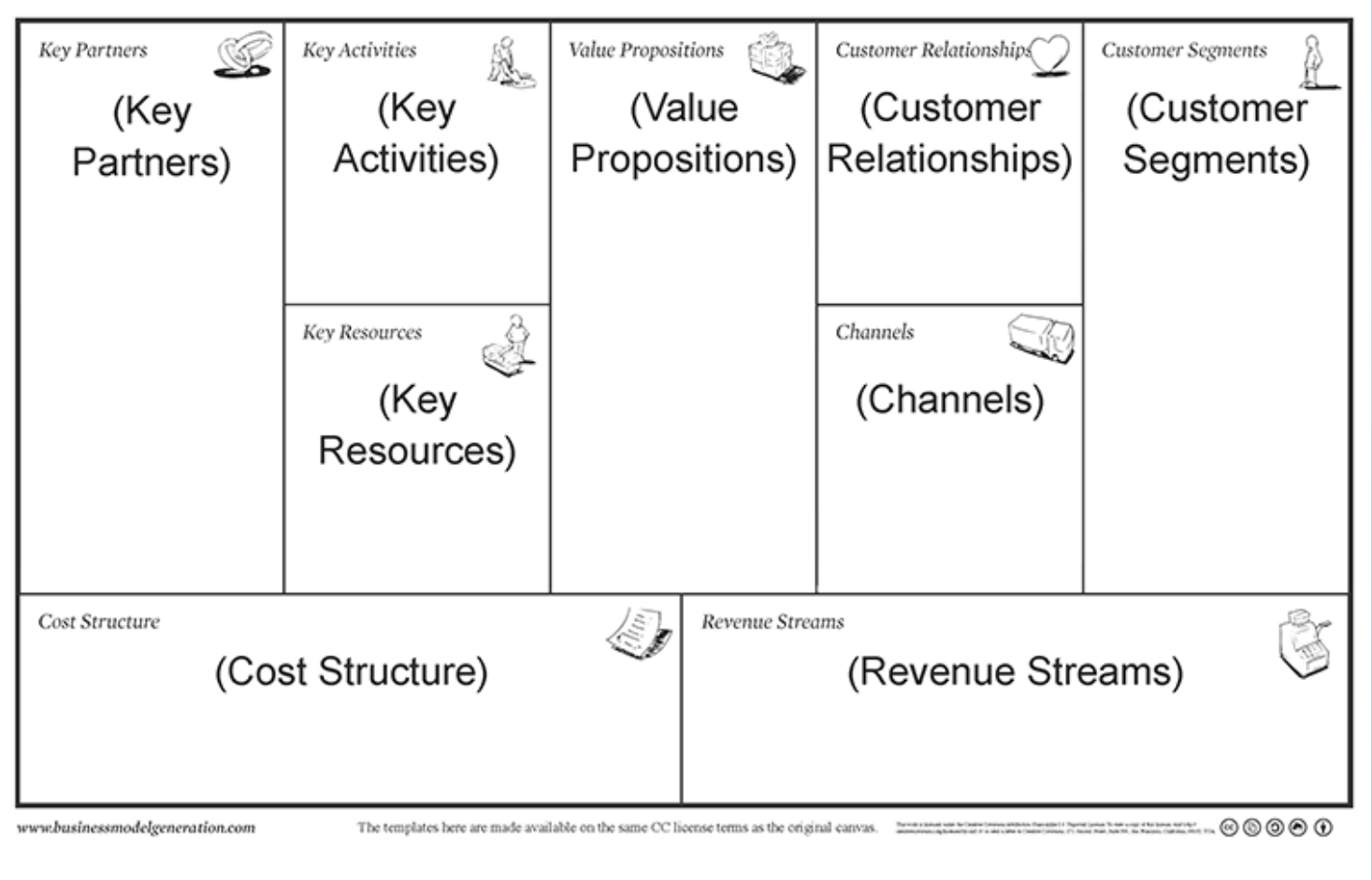
AI Business Models

Dr. Deepak Saxena, SME IIT Jodhpur

What is a Business Model?

- The business model depicts the **content**, **structure**, and **governance** of transactions designed so as to create **value** through the exploitation of business opportunities" (Amit and Zott, 2001: 511).
- A business model articulates the logic, the data and other evidence that support a **value proposition** for the customer, and a **viable structure of revenues and costs** for the enterprise delivering that value (Treece, 2010, p.179).

Business Model Canvas



(Big) Data-related Business Models

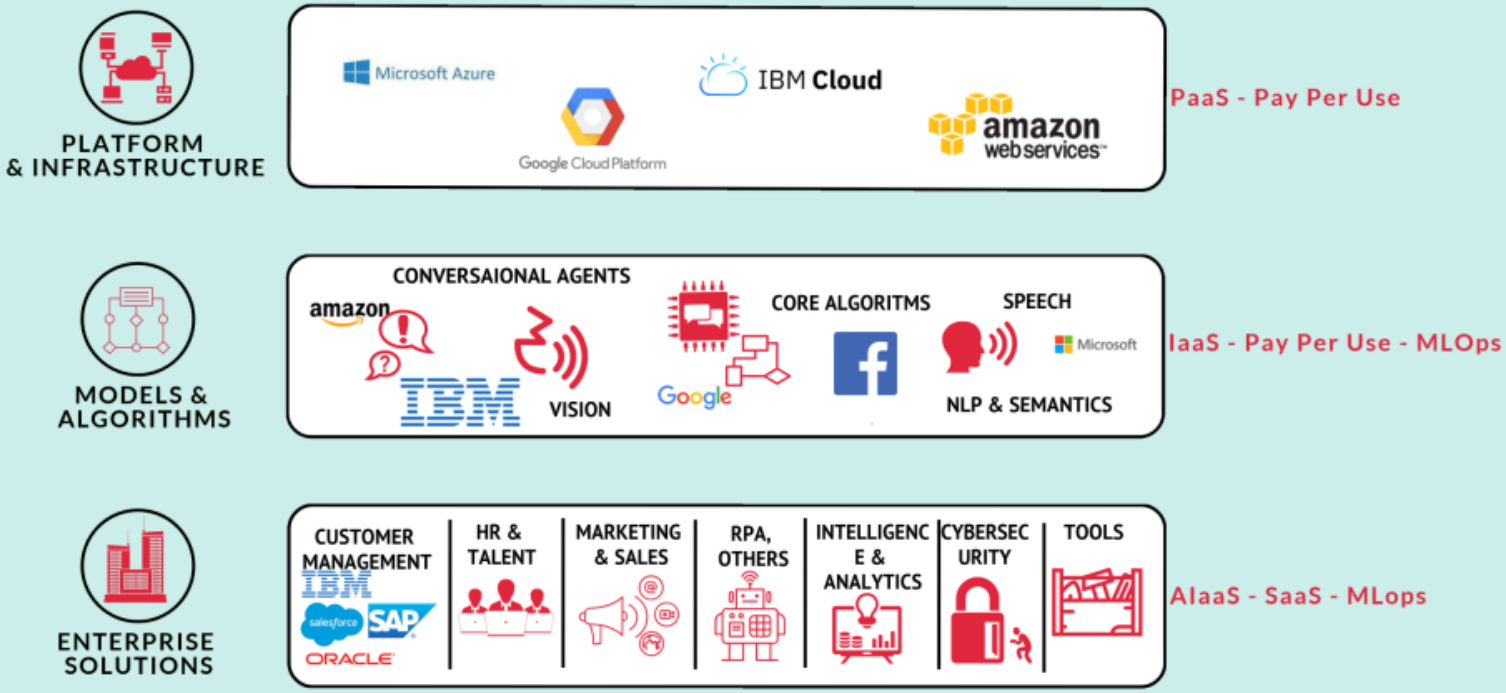
- *Data users* use big data to streamline their operations or to create new products or services.
- *Data suppliers* collect and sell data to other firms.
- *Data facilitators* enable other firms to use big data analytics, for example by providing the necessary infrastructure or analytics as a service.

AI-related Business Model

Pattern	Definition	Example startup
AI-charged Product/Service Provider	Provide products and services that have readily trained AI models embedded	*Alegion*: Provides an AI-charged service that supports manual data labelling
AI Development Facilitator	Facilitate AI development of customers with customizable solutions or technical interfaces	*BotXO*: Provides a platform to develop fully customized conversational AI solutions
Data Analytics Provider	Provide solutions that integrate and analyze various data sources for decision support	*Falkonry*: Provides a solution that analyzes sensor and machine data to predict machine operating states
Deep Tech Researcher	Research and develop basis AI technology for innovative niche problems	*Cerenion*: Researches and develops AI technology that interprets brain activity

AIaaS: The Business Model of AI as a Service

Artificial Intelligence as a Service (AIaaS) helps organizations incorporate artificial intelligence (AI) functionality without the associated expertise. Usually, AIaaS services are built upon cloud-based providers like Amazon AWS, Google Cloud, Microsoft Azure, and IMB Cloud, used as IaaS. The AI service, framework, and workflows built upon these infrastructures are offered to final customers for various use cases.



AI in Human Resource Management

What is HRM?

HRM Tasks

- Hiring/recruiting People
- Shortlisting, PI Performance, Deciding the interviewer
  - Hiring Vs Recruitment
    - Hiring happens when you need to fill a role. Recruiting is the process of attracting top talent to your organization
  - Diversity, and inclusion
    - Gender, geographic location, physically challenged etc.

HRM Tasks

- Allocating them the work
  - Assigning a task to machine is different than human
  - How we get the people right for the kind of job we are looking for?
  - Deciding on their pay over the time as the experience increase how it changes?

HRM Tasks

- Performance management
  - Deciding on compensations, recognition, and rewards

HRM Tasks

- Training people

HRM Tasks

- Reputation management
  - HR people also must think of how company's reputation is affected by people management issues such as Sexual harassment, Firing, Overloading, Unfair Behaviour, Conflicts among the employees
  - Sharing their experiences in glassdoor kind of virtual platforms, social media

HRM Tasks

- Predicting Churn
- Retaining people

We can say it is all about managing people

Why HR/Managing People is Critical

- It is a complicated task
- If you consider the cost of any organization fairly a large share is spend on it's employee.
- In a survey it was repeated that **roughly 66 percentage of the total cost was spend on employees and labours**
  - The employee expenditure may consist of salary, bonus, gifts, other wages such as medical, transportation and so on

Why HR/Managing People is Critical

- Competitive business environment
  - Companies do not only compete based on their competencies.
  - Rather how they manage people. How companies manage their people, it also affects the lives of the employees.
    - Managing people badly cause various serious issues such as stress and productivity issues ultimately it may make their life measurable.
    - If we can manage people well, we can make their lives a whole lot better.

Why HR/Managing People is Critical

- People get sick.
- People also get angry they react differently when they are angry.
  - If it persists for long time they quit
- If they feel ignored, they slow down the work.
  - Another strategy of slowing down the work may be following the manual line by line of word by word and finding out the ways to stop the work of common interest if their interest is not fulfilled.

Why HR/Managing People is Critical

- They also have different mindset.
  - Some people act towards the common goal, and some have their own growth on priority.

Evolution of AI

Decision Making

Human experts

Expert systems (Softwares)

ML Algorithms

Hiring

- Shortlisting: should we invite someone for PI
- Preparing overall performance Index

Listing important factors (specific to job and the organization plus some common factors) it needs domain knowledge

Selecting AI/ML tool

Human VS Algorithms (decision making)

Performance measurement

- Should we promote an employee?
- Bonus recommendation
  - Dependent Variable: Appraisal Score
  - Independent variables:

Churn/Attrition Prediction

Dependent Variable: Appraisal Score

Independent variables

Exit interviews (Textual information and Video)

DL models to learn about the reasons of their quit

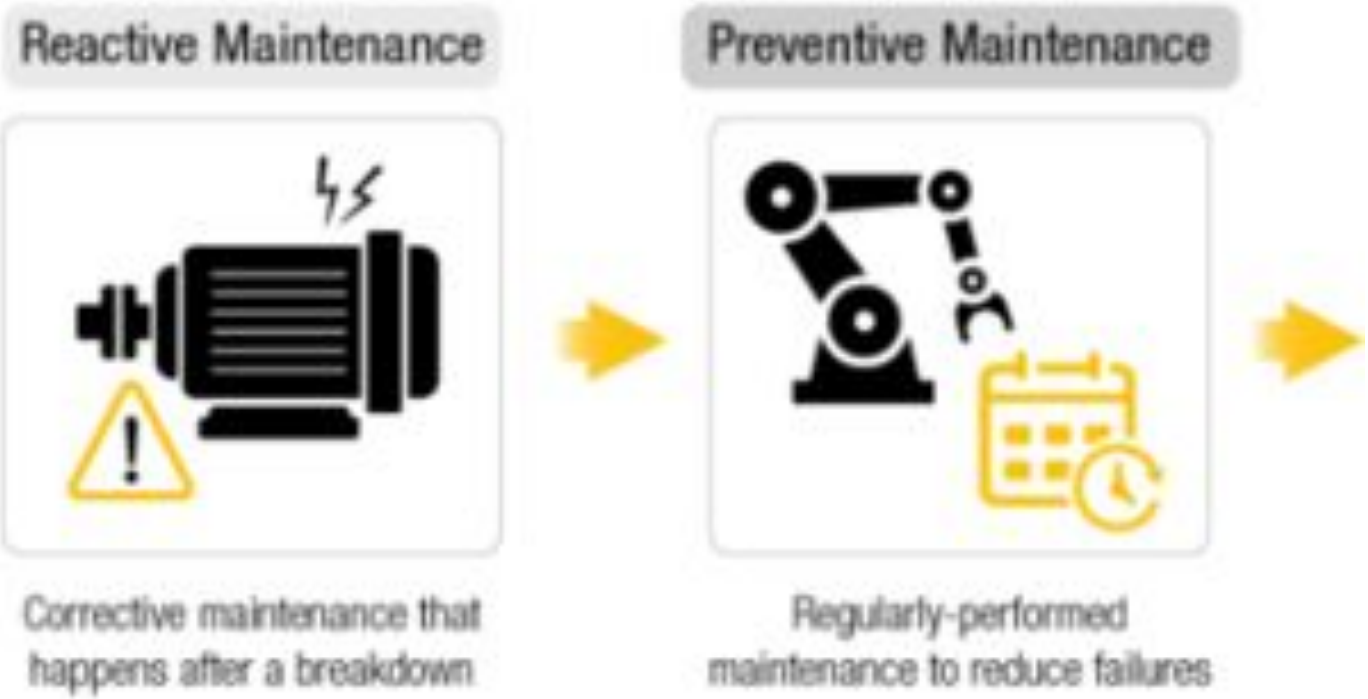
Probable solutions/retention strategies

AI in Maintenance

Checking, servicing, repairing or **replacing** of necessary **devices, equipment, machinery, building infrastructure, and supporting utilities**

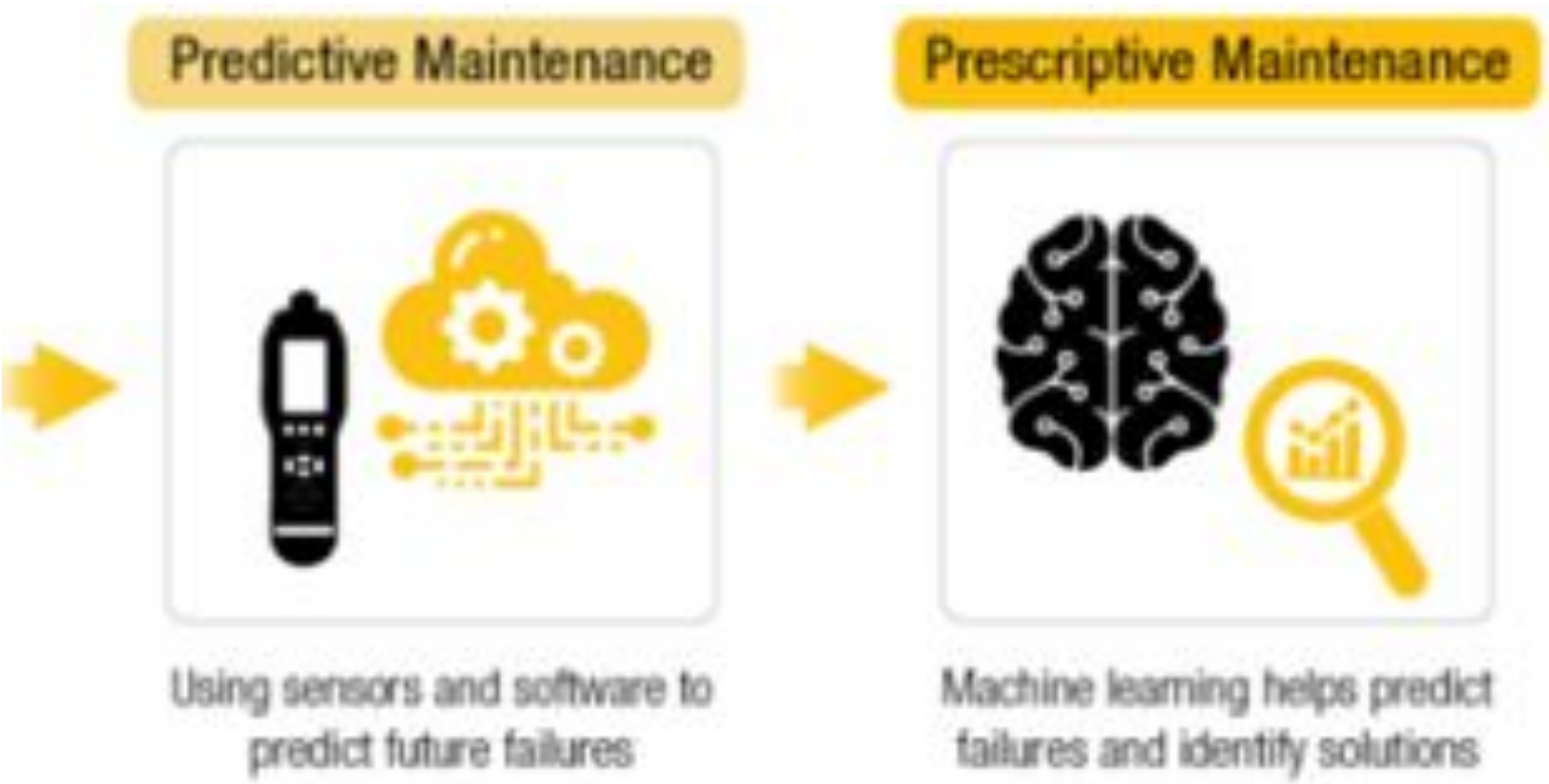
https://en.wikipedia.org/wiki/Maintenance_(technical)

Types of maintenance



https://www.emaint.com/what-is-a-cmms/predictive-maintenance-technologies/

Types of maintenance



https://www.emaint.com/what-is-a-cmms/predictive-maintenance-technologies/

Why Maintenance?

Consequences of failure

- Manufacturing equipment
- Cars
- Aeroplanes

18% failures are due to age and 82% are random

Role of AI

- Collect data from the equipment/machine, and analyse it
- Thanks to Internet of Things (IoT)

AI enabled predictive maintenance?

- Proactive data driven approach that keeps facility and equipments in good health and perform optimal
- AI helps in finding patterns to anticipate the randomness of the failures, prevent them. Hence, downtime is reduced and performance is optimised
- Sensors (IOT) and software to predicting future failures

AI enabled predictive maintenance

AI can help in Detecting

- Anomalies
- Patterns
- Trends in equipment behavior
- Potential faults and risks
- It suggests optimal timing and methods for repairs or replacements.

Benefits

- Lower breakdowns/disruptions
- Reduction in delays in maintenance activities
- Enhanced reliability and availability of assets
- Improved workstation safety
- Improved product/service quality (Reduced human error)
- Reduction in accidents, and defects

Benefits

- It helps in providing insights about **remaining useful life**
  - That helps you in scheduling maintenance if needed
- Reduction in downtime: Anticipation of failures and hence timely corrective actions reduce downtime
- Optimal utilization: Detection of any deviation from the expectations, hence timely corrective actions ensure optimal utilization
  - Optimizing maintenance schedules

https://towardsdatascience.com/how-to-implement-machine-learning-for-predictive-maintenance-4633cdbe4860

Benefits

- Maintain a safe work environment by ensuring that machines are working properly
- Increseard product quality
- Increase efficiency and productivity by preventing unplanned reactive maintenance and minimizing downtime
- Enhanced customer satisfaction.
- Increased life span of equipments and facility
- Optimize costs by removing the need for too many unnecessary checks or repairs of components
- Reduced waste
- Sustainability

Hands on

Steps

- Key variables/parameters which determine the health of the equipment
- Equip the **device/equipment/machine** with the sensors to collect data for the key parameters
- Load the data to cloud/server
- Data Cleaning
- Data analysis or pattern recognition
- Decision making

Decision Making

- **Regression approach -** models provide the information on how many days/cycles are left until the component's/product's life ends.

- **Classification approach -** models built according to this approach identify whether a component/product is likely to fail

Challenges

- Data collection
- Data Storage
- Integration of data
- Reliability and consistency of data from multiple sources
- Data quality
- Analysis and Interpretation (Skillset)
- Data Privacy and security
- Sensitivity and and confidentiality
- Protection from unauthorized access or misuse
- Effective communication, collaboration, and change management must be in place to ensure alignment of data-driven solutions among stakeholders and users.

Thank You

IIT Jodhpur

Excellence above all

SME

Technology • Innovation • Leadership

AI Challenges and Future

Dr. Deepak Saxena, SME IIT Jodhpur

Amazon Shut Down Recruiting AI for Sexist Results

After examining patterns from job applications over 10 years, most of which were from men, Amazon's system started penalizing women and ranking them lower.

UK ditches exam results generated by biased algorithm after student protests

Gender bias revealed in AI tools screening for liver disease

11 July 2022

A.I. Bias Caused 80% Of Black Mortgage Applicants To Be Denied

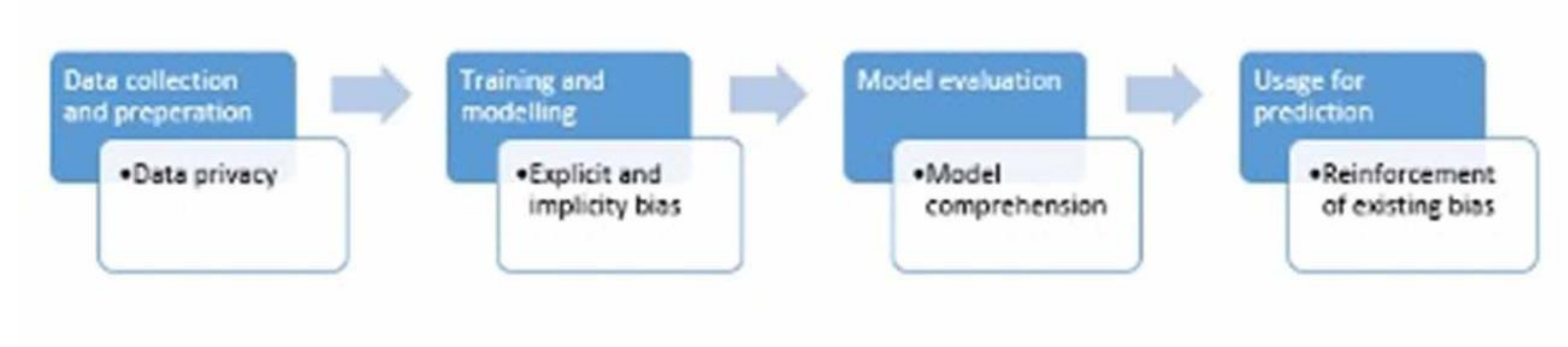
Google's solution to accidental algorithmic racism: ban gorillas

Google's 'immediate action' over AI labelling of black people as gorillas was simply to block the word, along with chimpanzee and monkey, reports suggest

Predictive policing algorithms are racist. They need to be dismantled.

Lack of transparency and biased training data mean these tools are not fit for purpose. If we can't fix them, we should ditch them.

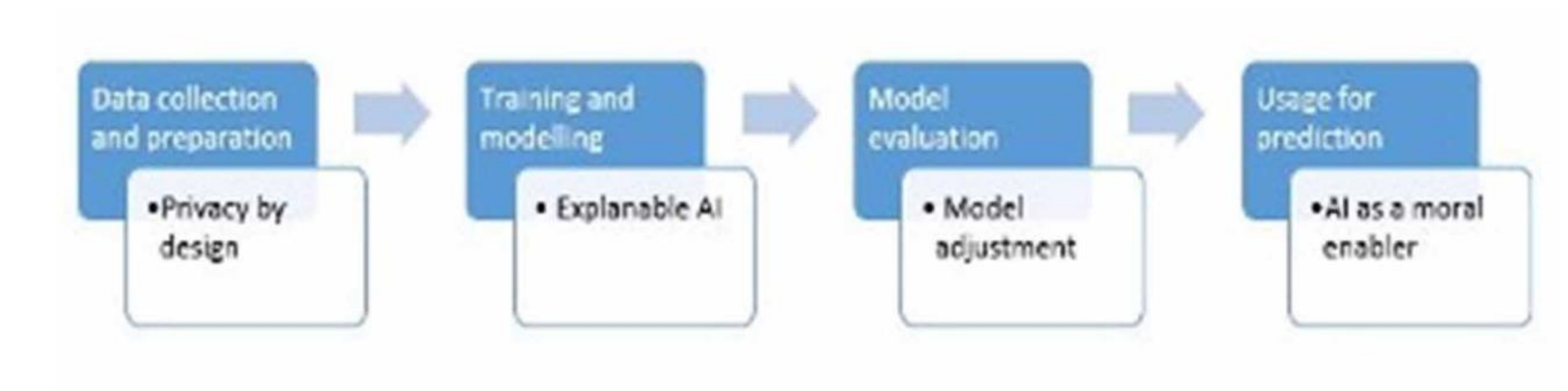
AI Learning Processes and Challenges



Inequality propagated by AI

- AI models are built on training data obtained from *our* world.
- Bias and inequality are inherently present in our societies.
- Hence they seep into our AI models.

Towards Responsible AI Learning



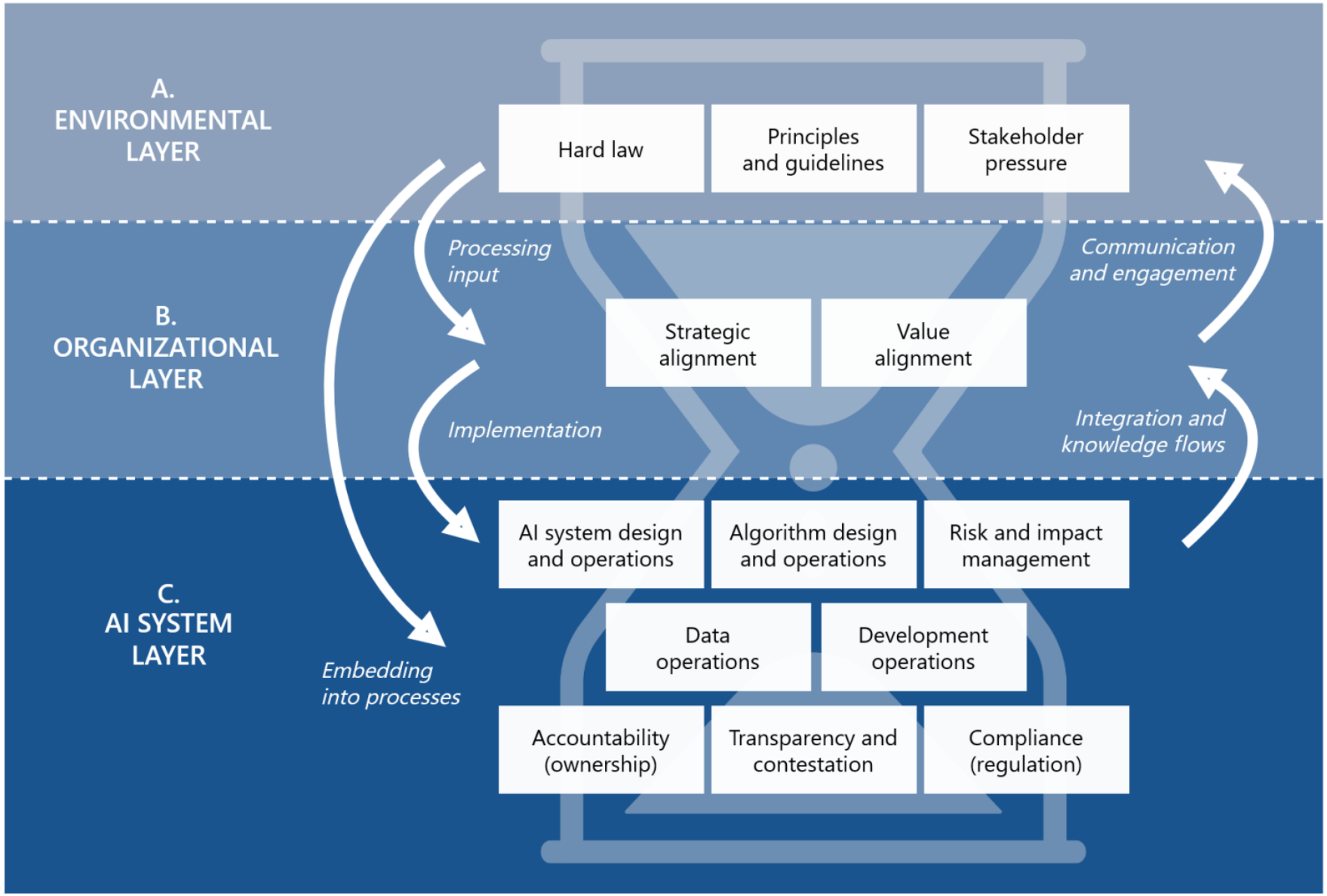
Actions for Responsible AI

Recommended Actions	Privacy by Design	Explainable AI	Model Adjustment	AI as a Moral Enabler
Action at the level of managers	• Determine the data and privacy protection policies. • Understand and explain the use of data to the employees.	• Those using the results from AI must roughly understand what goes inside the black box. • Determine which models/ constructs are to be used.	• Determine which existing biases are unwanted, and which affirmative biases are to be introduced.	• Reflect on the decision-making process and its impact.
Actions at the level of developers	• Design systems in a way that allows for further protection of privacy.	• Facilitate explainable AI.	• Make existing biases visible through explainable AI. • If existing biases are unwanted, exclude certain variables from the decision criteria. • Introduce affirmative biases in the system by changing the decision criteria.	• Introduce opportunities for reflection.

What the world is doing?

- EU: Proposal for an AI Act laying down harmonised rules on artificial intelligence
- USA: The US Algorithmic Accountability Act
- IEEE: Ethically Aligned Design
- ISO/IEC 23053:2022 - Framework for Artificial Intelligence (AI) Systems Using Machine Learning (ML).
- Almost all major companies now have a document related to Responsible/Ethical AI

The Hourglass Model of Organizational AI Governance



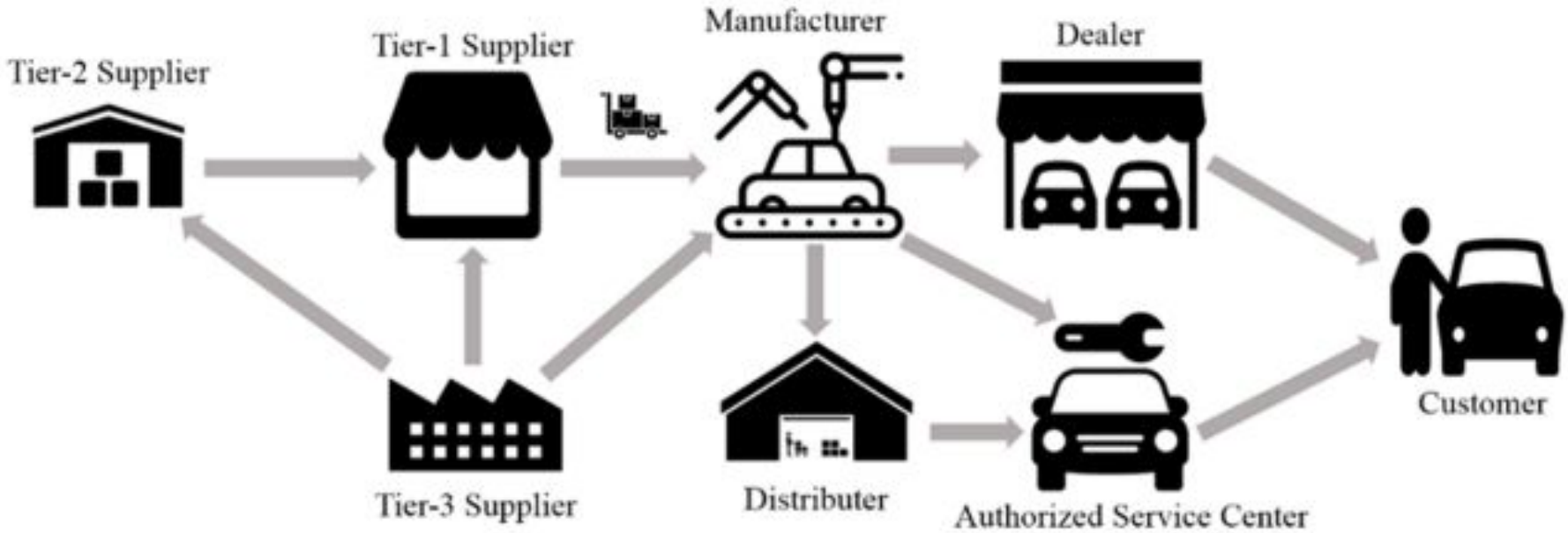
Mäntymäki, M., Minkkinen, M., Birkstedt, T., & Viljanen, M. (2022). *Putting AI Ethics into Practice: The Hourglass Model of Organizational AI Governance* (arXiv:2206.00335). arXiv. https://doi.org/10.48550/arXiv.2206.00335

Future of AI

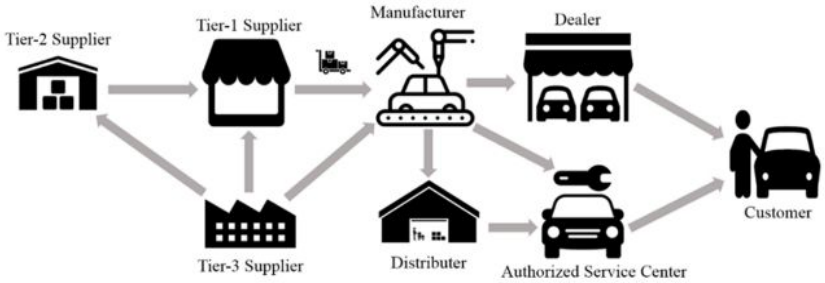
- Less data
  - Wilson, H. J., Daugherty, P. R., & Davenport, C. (2019). *The future of AI will be about less data, not more*. Harvard Business Review, 14.
  - Arsenault, B. (2018). *Why small data is the future of AI*. https://towardsdatascience.com/why-small-data-is-the-future-of-ai-cb7d705b7f0a
- Human-AI Hybrid / Collaborative Intelligence / Intelligence Augmentation
  - Wilson, H. J., & Daugherty, P. R. (2018). *Collaborative intelligence: Humans and AI are joining forces*. Harvard Business Review, *96*(4), 114-123.
  - Hassani, H., Silva, E. S., Unger, S., TajMazinani, M., & Mac Feely, S. (2020). *Artificial intelligence (AI) or intelligence augmentation (IA): what is the future?*. *AI*, *1*(2), 8.

AI in Supply Chain

Automobile Supply Chain



Where in SC



AI in monitoring suppliers

AI in shipment tracking

AI in operations

AI in dealer relationship and demand forecasting

AI in warehouse management

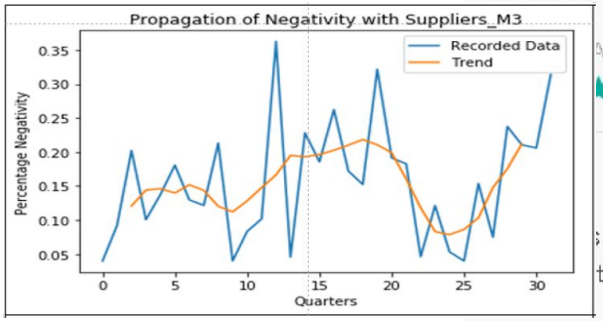
AI in Logistics

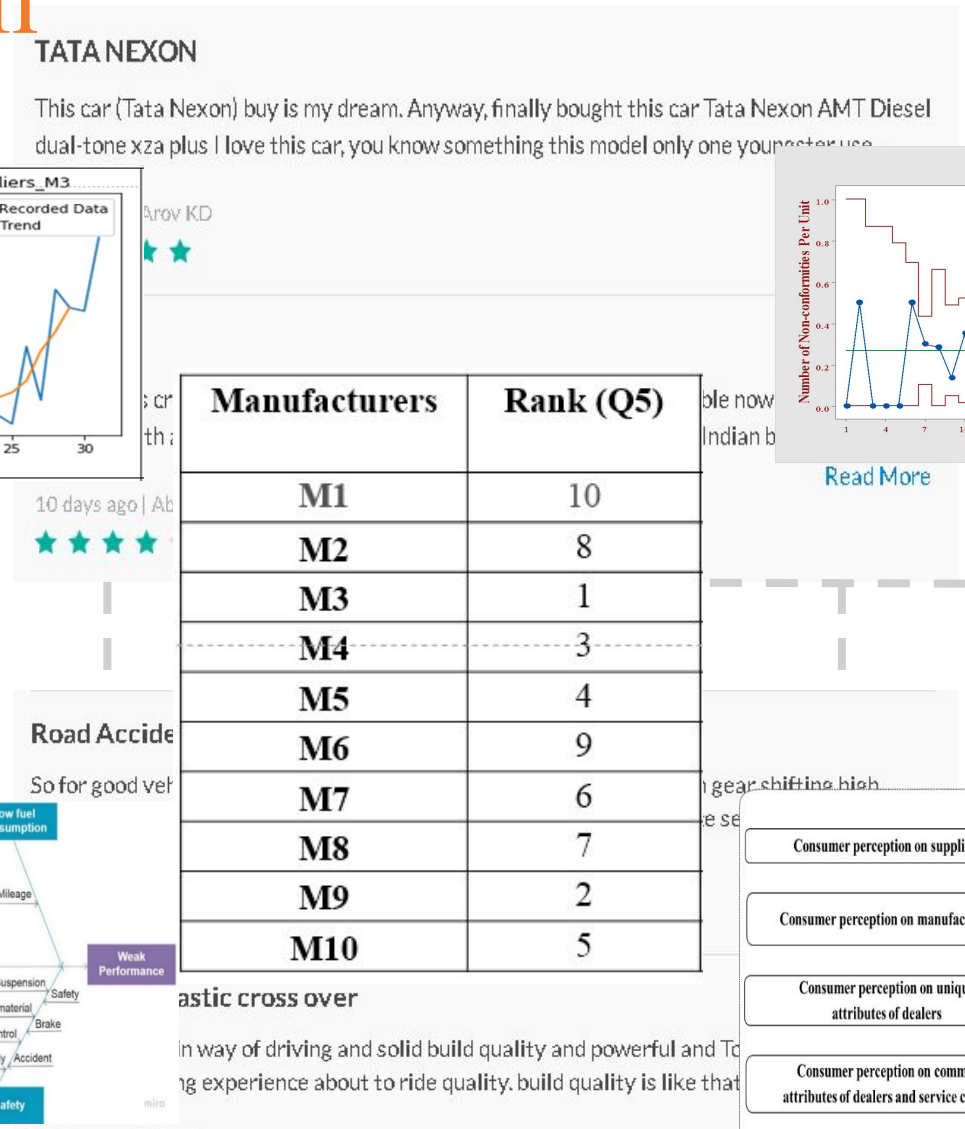
AI in monitoring service centers

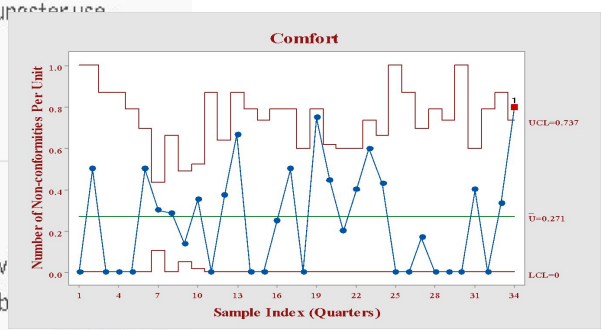
Analyzing the influence of consumer perceptions corresponding to SC-partners

Sentiment Analysis

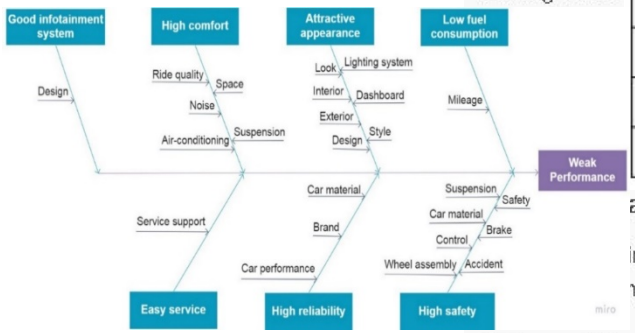
Motivation

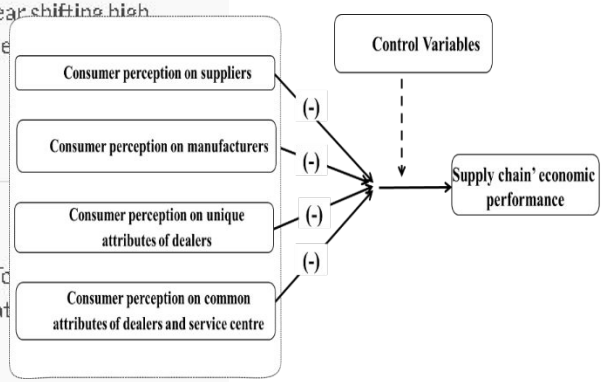






Manufacturers	Rank (Q5)
M1	10
M2	8
M3	1
M4	3
M5	4
M6	9
M7	6
M8	7
M9	2
M10	5





How to extract information/sentiments from reviews?

Steps:

- Extract/scrap online reviews from the website
- Using feature extraction methods such as Rapid Automatic Keywords Extraction extract features
- Prepare the list of features
- Split reviews into sentences
- Select each sentence one by one
- Search for the availability of features/keywords in the sentence
- Quantify sentiments into the sentences and assign the score to the feature in the sentence

Review: *The car has good mileage. its driving control is Pathetic. It has very good pickup. It has best class suspension.*

Mileage: 0.75

Pickup: 1.5

Driving Control: -0.75

Suspension: 1.6

Sentiment classification approaches

Review: *The car has good mileage. its driving control is Pathetic. It has very good pickup. It has best class suspension.*

- Binary classification

- Multi-level classification

Levels of Sentiment analysis

- Document level
- Sentence level
- Aspect (Attribute) level

Document level

Review: *The car has good mileage but bad comfort, style and driving control. It has very good pickup and best class suspension.*

Positive

Sentence level

Review: *The car has good mileage but bad comfort, style and driving control. It has very good pickup and best class suspension.*

The car has good mileage but bad comfort, style and driving control.

Neutral

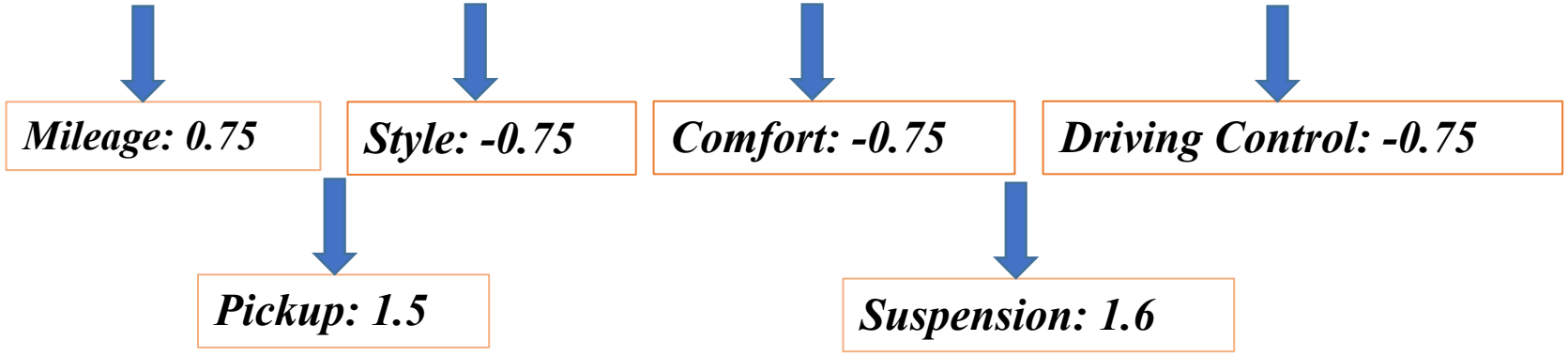
It has very good pickup and best class suspension.

Positive

Aspect (Attribute) level

Review: *The car has good mileage but bad comfort, style and driving control. It has very good pickup and best class suspension.*

*[[‘good mileage.’]; **[‘bad style.’]; [‘bad comfort.’]; [‘bad driving control’]]***
[[‘very good pickup’]; [‘best suspension’]]



The analysis method

- Classification/ML/DL based approach
- Dictionary based approach

good (.75)
bad (-.75)
very good (1.5)
Best (1.6)

ML Based Approach

Steps:

- Extract online reviews
- Split the reviews into sentences
- Manually scan each sentence and annotate it if it is a positive or negative review

The output should look like

Sentence	Class	Annotation
The food quality is amazing	Positive	1
The cleanliness is a bit compromised wastage of money	Negative	0

ML based Methods

Review	Sentiment
Wow... Loved this place.	1
A great touch.	1
Service was very prompt.	1
Would not go back.	0
Crust is 5766757657 !& && not good.	0
Not tasty and the texture was just nasty.	0
This place is not worth your time, let alone Vegas.	0
did not like at all.	0
The Burrittos Blah!	0
The food, amazing.	1
Service is also cute.	1
I could care less... The interior is just beautiful.	1
So they performed.	1
d by during the late May bank holiday off Rick Steve recommendation and	1
The selection on the menu was great and so were the prices.	1
I tried the Cape Cod ravoli, chicken, with cranberry...mmmm!	1

ML Based Approach

- Split the data into train and test sets
- Train the classification algorithms on training dataset
- Using the trained model, classify the sentences in testing set and evaluate the model
- Multiple classifiers can be tested and best one can be selected

- For new reviews and corresponding sentences quantify classify the sentiments
- Assign the score to the feature in the sentence

Lexicon based Methods

- Sentiment dictionaries

Steps

- Text extraction
  - Crawling
  - Scrapping
- Pre-processing
  - Markups, HTML tags
  - Duplicate removal
  - parts of speech tagging
  - Feature Extraction
  - Tokenization / Sentence Splitting
  - Stemming
  - Lemmatization

Removing the mark-up

'   The bentley mulsanne is the car that   one should just have its ext. is   just great.   It just looks like an searing eagle. It is a wonderful experience to have this car.

The bentley mulsanne is the car that one should just have its ext. is just great. It just looks like an searing eagle. It is a wonderful experience to have this car.

Stop words

Dictionary/lexicon Based Approach

Steps:

- Split the reviews into sentences
- Search for the availability of feature/keywords in the list of features and assign the feature to the sentence
- Select a sentiment dictionary
- Search each word in the sentence if it is available in the sentiment dictionary and extract its sentiment score; summate the sentiment scores of each word and assign the score to the feature
- Repeat it for each sentence in each review
- Hence, sentiments are extracted the extracted sentiment data will look like

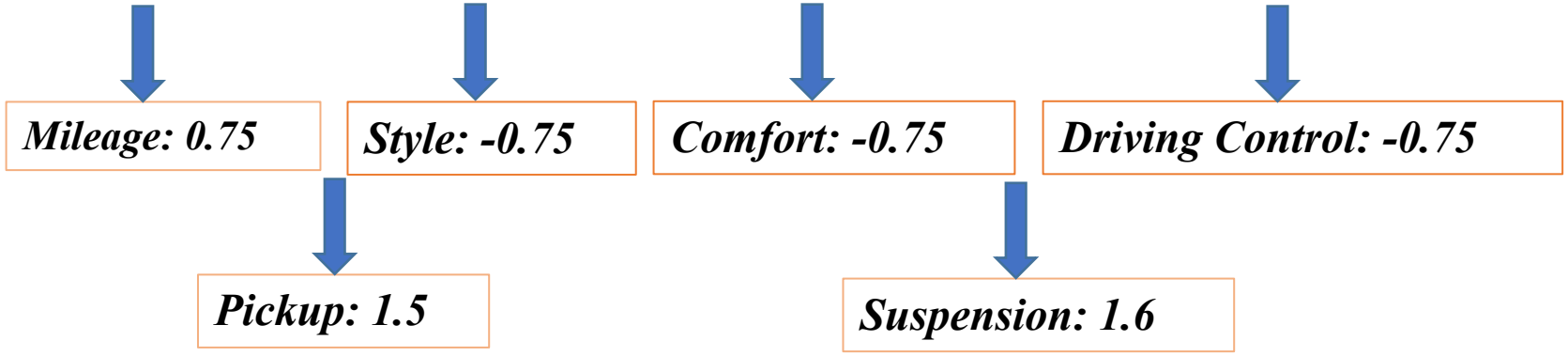
Data will look like

Reviews	Feature 1	Feature 2 ……	Feature n
Review 1	1.5	-.75	.95
Review 2 .. Review n	-.5	1.33	1.75

Aspect (Attribute) level

Review: *The car has good mileage but bad comfort, style and driving control. It has very good pickup and best class suspension.*

*[[‘good mileage.’]; **[‘bad style.’]; [‘bad comfort.’]; [‘bad driving control’]]***
[[‘very good pickup’]; [‘best suspension’]]



Can we extract sentiments on supply chain?

Table A2: Automobile aspects and corresponding attributes used in analysis

SC partner	Attributes
Suppliers	Body quality, car material, interior material, leather, lube oil, mobil oil, seat material, wheel material, window glass, vanity mirror, steering wheel, spares quality, sound system, power brakes, piston rings, headlamp, cd player, audio system, audio player, air filter, air purifier, rear view mirror, gear box gasket, front camera, clutch wire, clutch plate, clutch housing, clutch disc, clutch cover, brake holder, automatic transmission, battery, accessory, air conditioning, abs, bearing, accelerator, seatbelt, airbag, brake, armrest, camera, infotainment system, transmission, bluetooth, body, bonnet, bottle holder, seat, bumper, camshaft, car care kit, car cover, mat, compressor, countershaft, crankshaft, crdi shaft, cup holder, cylinder, dashboard, defogger, differential, display, door, door lock, driver utility set, earphone, fan belt, filter, flywheel, fog lamp,
Manufacturing and Assembly	Wheel design, sunscreen design, storage capacity, boot space, seat design, rim design, rear style, rearview, fuel economy, display design, dashboard design, mileage, km/liter, kmpl, km/ltr, kilometer per liter, gallon per miles, foot rest design, bottle holder design, inner space, exterior design, door design, brake horsepower, horse power, body strength, body quality, automatic parking, steering wheel design, steering adjustment space, automatic retracting orvm, brake force distribution, antilock brake system, electric power assisted steering, speed sensing power steering, sporty feature, quality, body roll, technology, abs, pickup, ebd, advertisement, aerodynamics, appearance, transmission, bhp, noise, brand, cabin, car
Dealers	Sales executive, dealer support, delivery experience, exchange benefit, resaling, reseller, sales support, showroom
Service Related Attributes	Service personnel, service manager, service issues, service cost, service center, music system, media player, dynamic player, repair, car care kit, technical support, ride quality, customer care service, maintenance, overhauling, post sales services, service support, workshop

Using Sentiment extraction algorithm, we can

- Quantify the sentiments for the key words mentioned in the previous slide
- Aggregate sentiments corresponding to a particular supply-chain partner and assign that to the partner. It is considered consumer perception of sentiment corresponding to that SC partner

Questions

Suppose you have consumer reviews and the algorithm for sentiment analysis with you

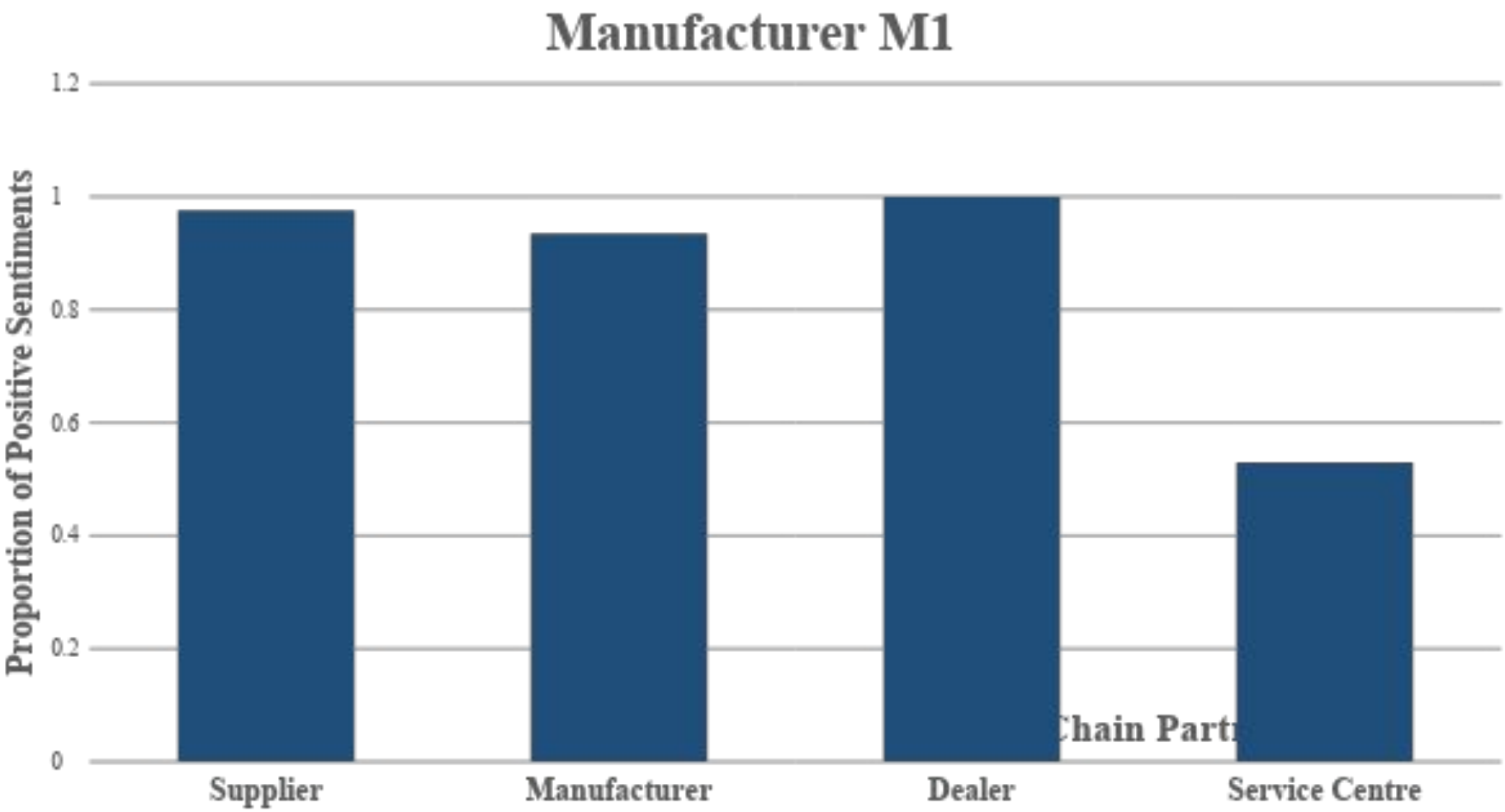
Q1) A manufacturer wants to see its weakest supply chain partner using online reviews? How can you help them as a consultant?

Q2) Suppose I am a manufacturer and got that my suppliers are not working well, I have the access to the reviews of my competitors, how can I use these in searching a new supplier?

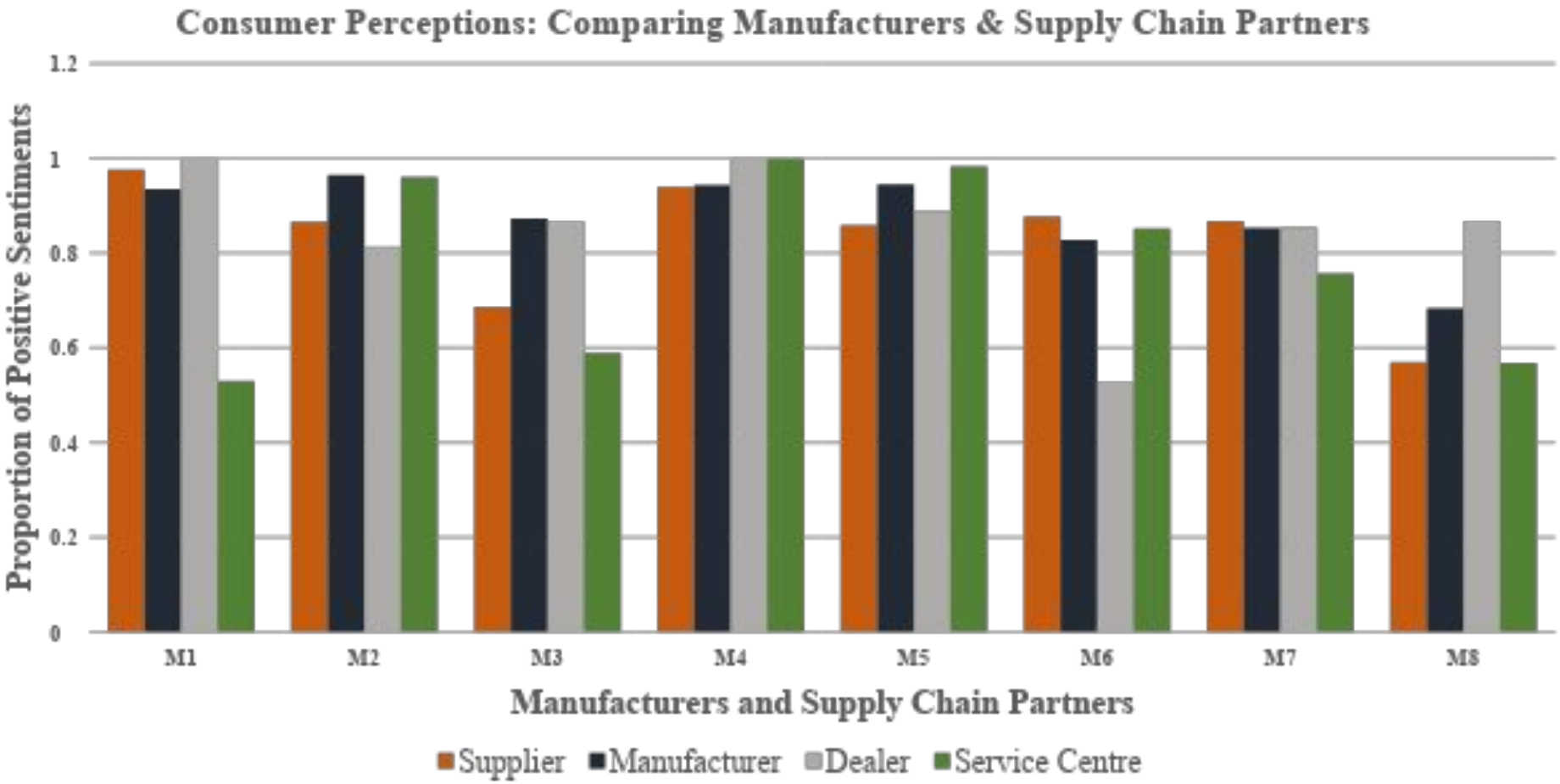
Q3) As a manufacturer, if I want to see which of my supply chain partner is out of control for years. How can I use online reviews and NLP here?

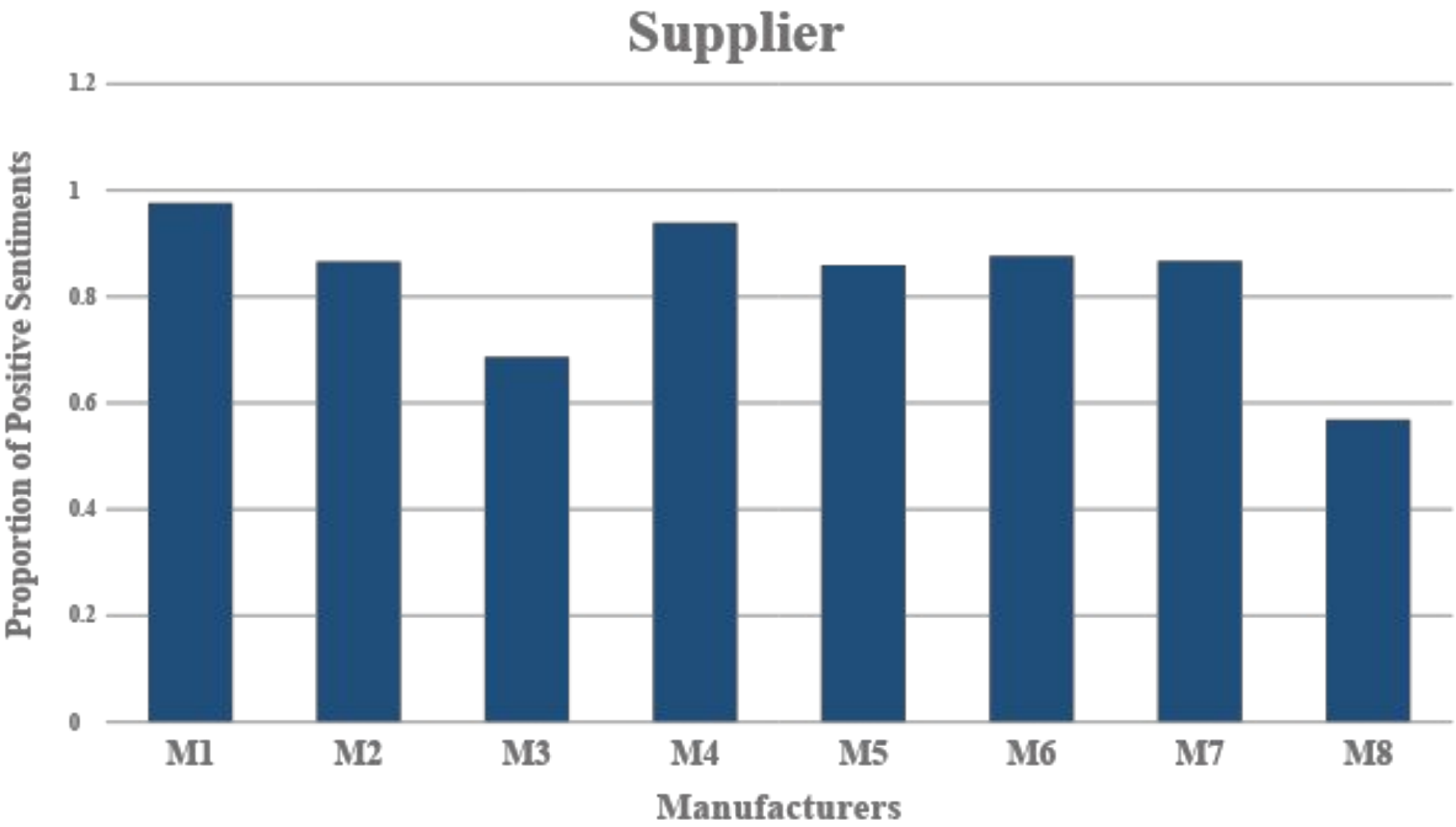
How sentiments are extracted?

Q1) A manufacturer wants to see its weakest supply chain partner using online reviews? How can you help them as a consultant?

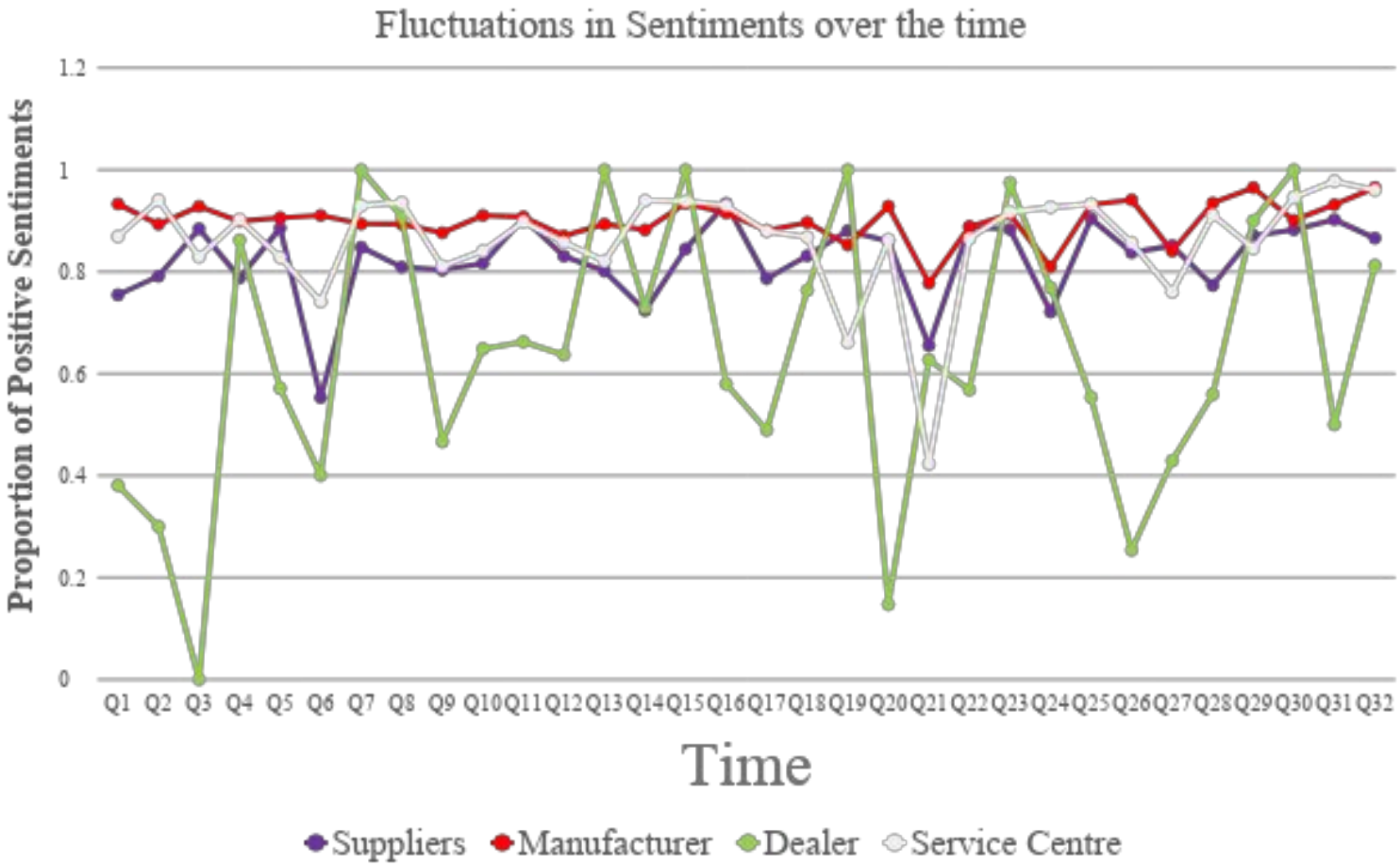


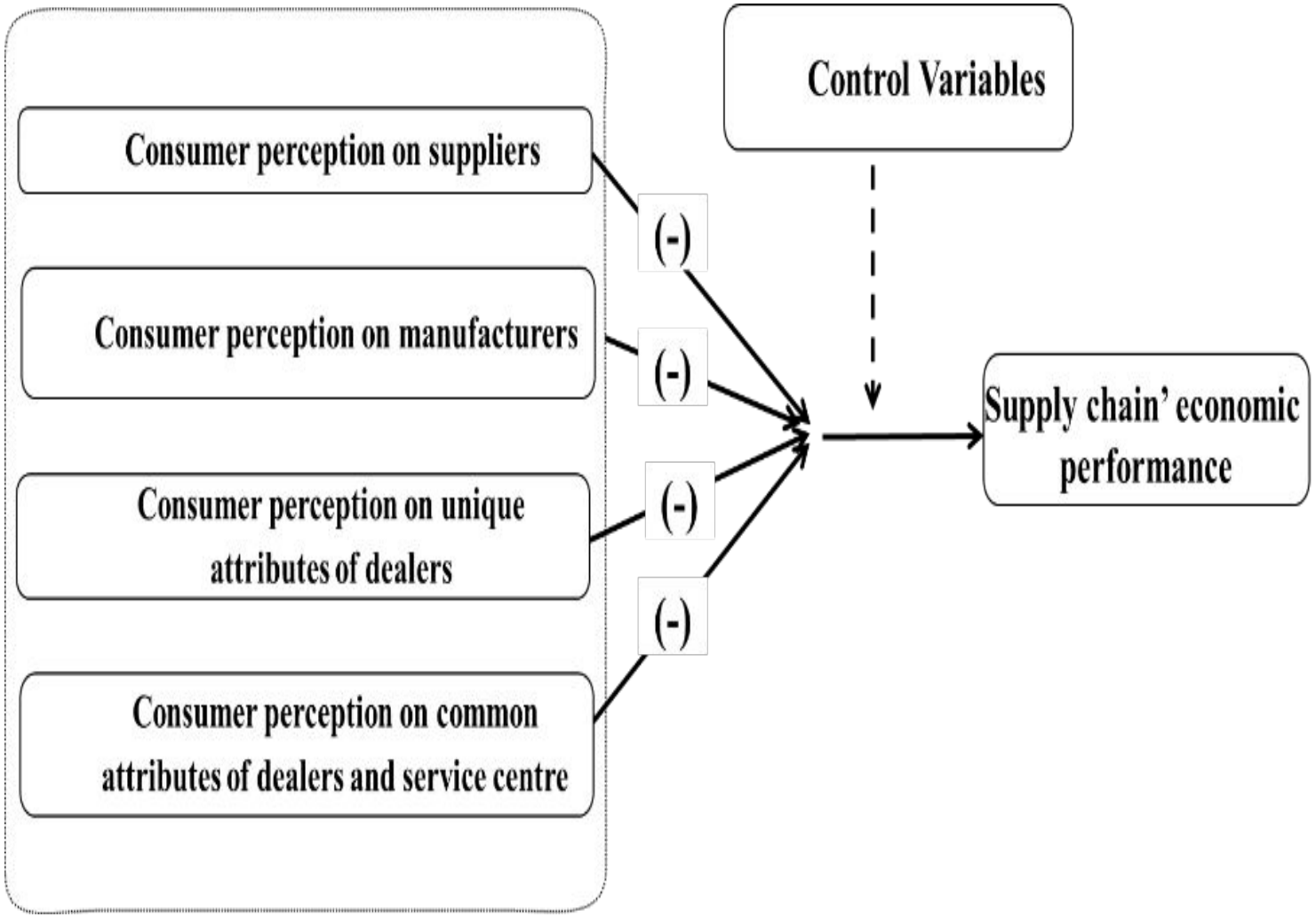
Q2) Suppose I am a manufacturer and got that my suppliers are not working well, I have the access to the reviews of my competitors, how can I use these in searching a new supplier?




Supplier
1.2
1
0.8
0.6
0.4
0.2
0
Proportion of Positive Sentiments
M1
M2
M3
M4
M5
M6
M7
M8
Manufacturers

Propagation of Sentiments




Control Variables
Consumer perception on suppliers
Consumer perception on manufacturers
Consumer perception on unique attributes of dealers
Consumer perception on common attributes of dealers and service centre
(-)
(-)
(-)
(-)
Supply chain' economic performance

- Feeding SC partner level sentiment data and the sales data to the above-mentioned model, we can run regression to quantify if the sentiments corresponding to SC partners influence sales
- Regression could be OLS or Panel data Regression etc.

Empirical Model for firms' sales performance evaluation

Model

$$CarSales_t = \alpha CarSales_{(t-1)} + \beta_0 + \beta_1 Variety + \beta_2 Firmage + \beta_3 GDP + \beta_4 ReviewVolume + \beta_5 AvgReviewLength + \beta_6 Supplier + \beta_7 Manufacturer + \beta_8 Dealers + \beta_9 ServiceProvider + \beta_{10} YearEffect + \varepsilon_i$$

Results from the Empirical Model

Variables	Model 1 (Actual Variables)	Model 2 (Z-transformed Variables)
L.Zsales	0.7170***	0.7170***
	(0.000)	(0.000)
Variety	1,051.4595	0.1267
	(0.202)	(0.202)
Firmage	-1,764.4194*	-4.1765*
	(0.079)	(0.079)
GDP	0.2115*	0.5353*
	(0.058)	(0.058)
Avg_RevL	-4.1281	-0.0332
	(0.539)	(0.538)
Rev_Vol	29.3857*	0.1145*
	(0.069)	(0.068)
Suppliers	-940.9284	-0.0096
	(0.846)	(0.846)
Manuf&Asmbl	5,484.3980	0.0355
	(0.523)	(0.523)
Unique_Dealers	-1,146.8709	-0.0416
	(0.363)	(0.363)
ServRel_CommDeal&ServCntrs	-1,525.1857	-0.0246
	(0.624)	(0.624)

Note: p-value in parentheses
*** p<0.01, ** p<0.05, * p<0.10 Adjusted R-squared for third model is 0.518

Thank You

Case on Text Mining

While purchasing a product or hiring a service (booking hotel) online, what kind of information we refer?

What about learning from previous customers?

What beyond average rating?

Online reviews

- Number of reviews
- Textual Information

How to extract information from online reviews?

- Text mining
- Sentiment analysis

- Data Cleaning

Term Frequency (TF)

Number of times a term appears in the document divided by the total words in that document

Inverse document frequency (IDF)

Log of total number of documents divided by number of documents in which that term appears

When a word occurs in all the documents– the TF-IDF rating will be lowest

When a word occurs many times in a small number of documents, it will be highest

- Sentiment Analysis

Evaluating products/services

Analysing textual data: Steps

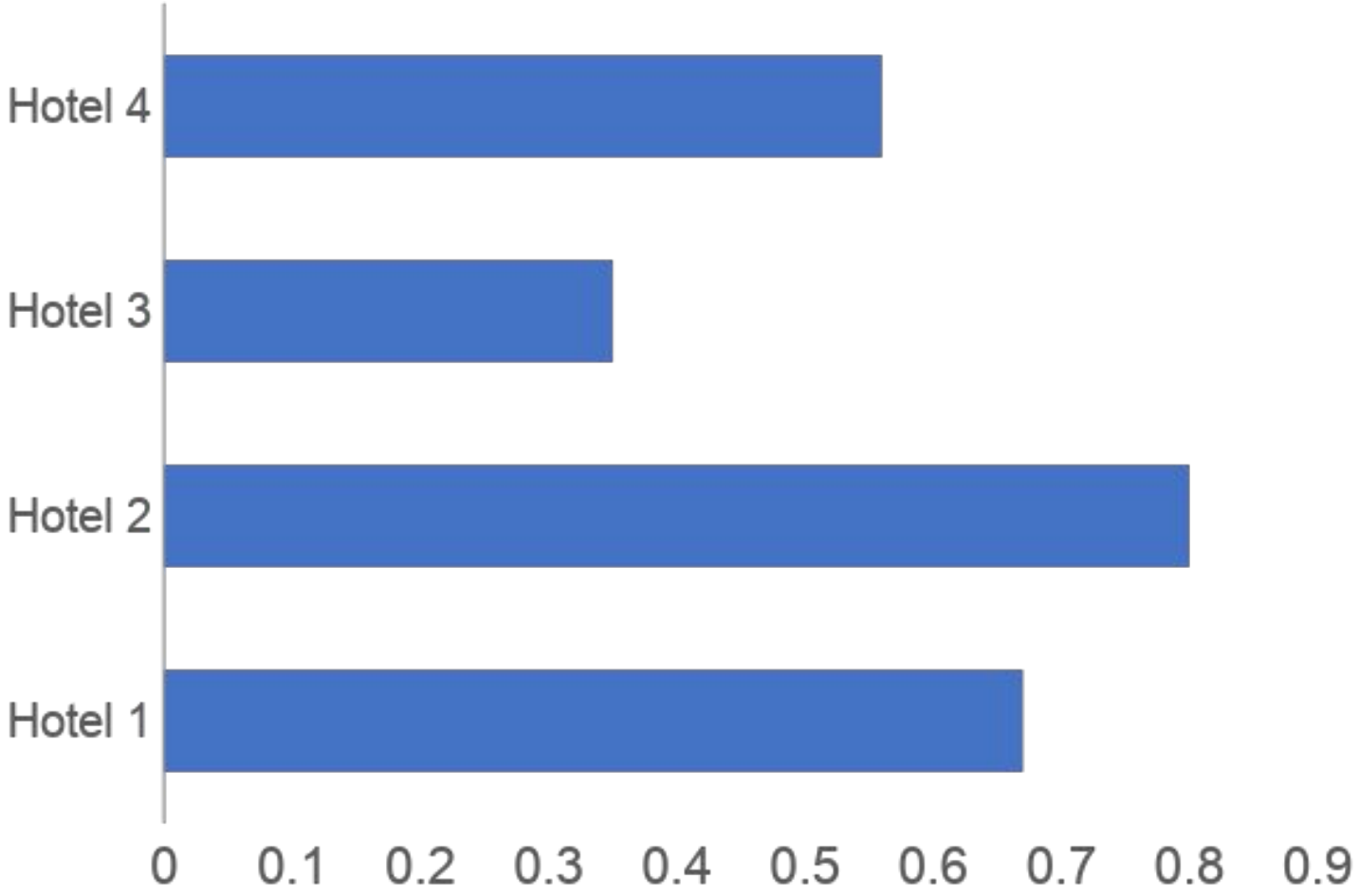
Based on the expenditure capacity, decide on the alternatives (Hotels)

Collect reviews

Extract information

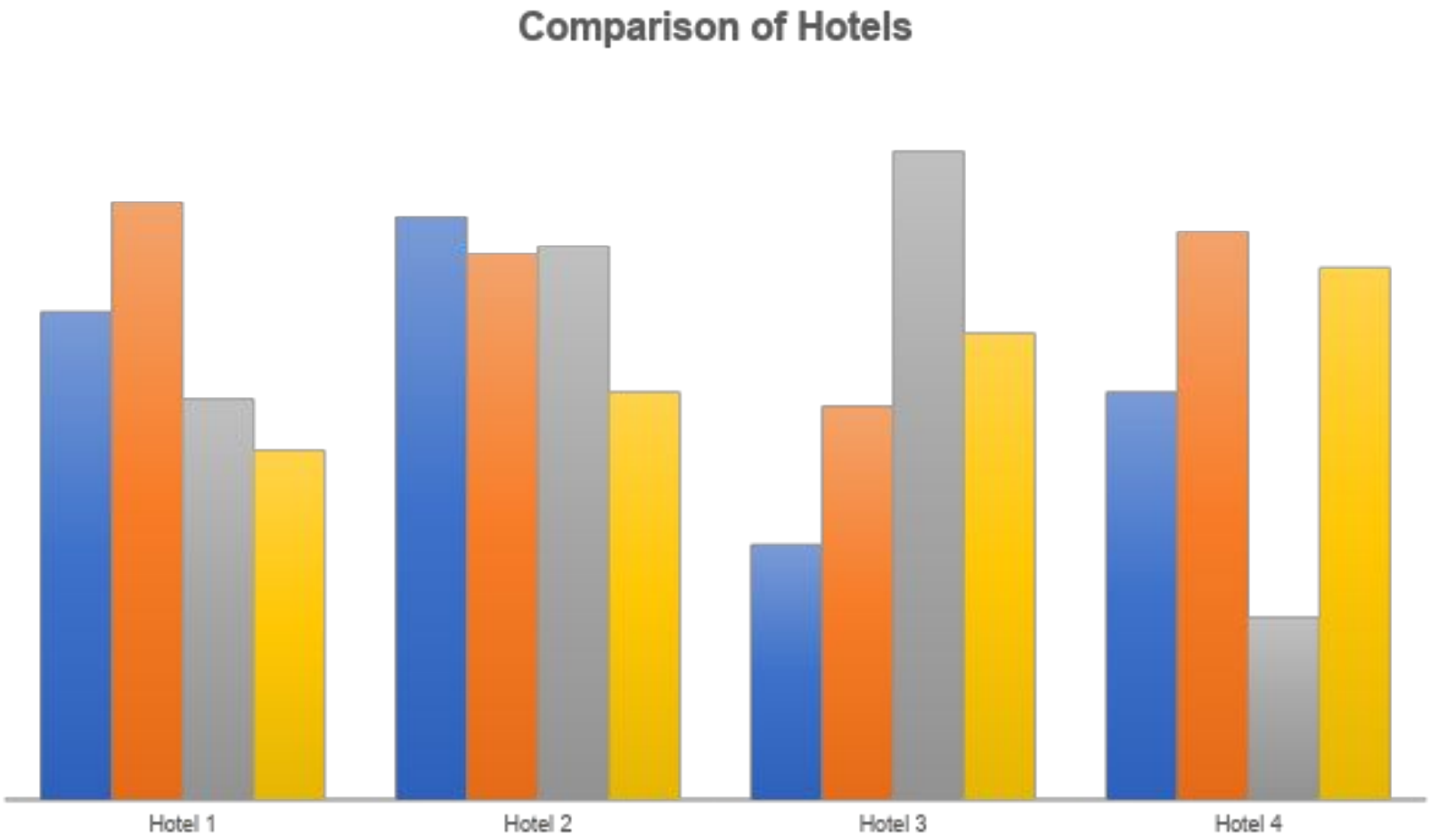
Analyse the data/information and evaluate the alternatives

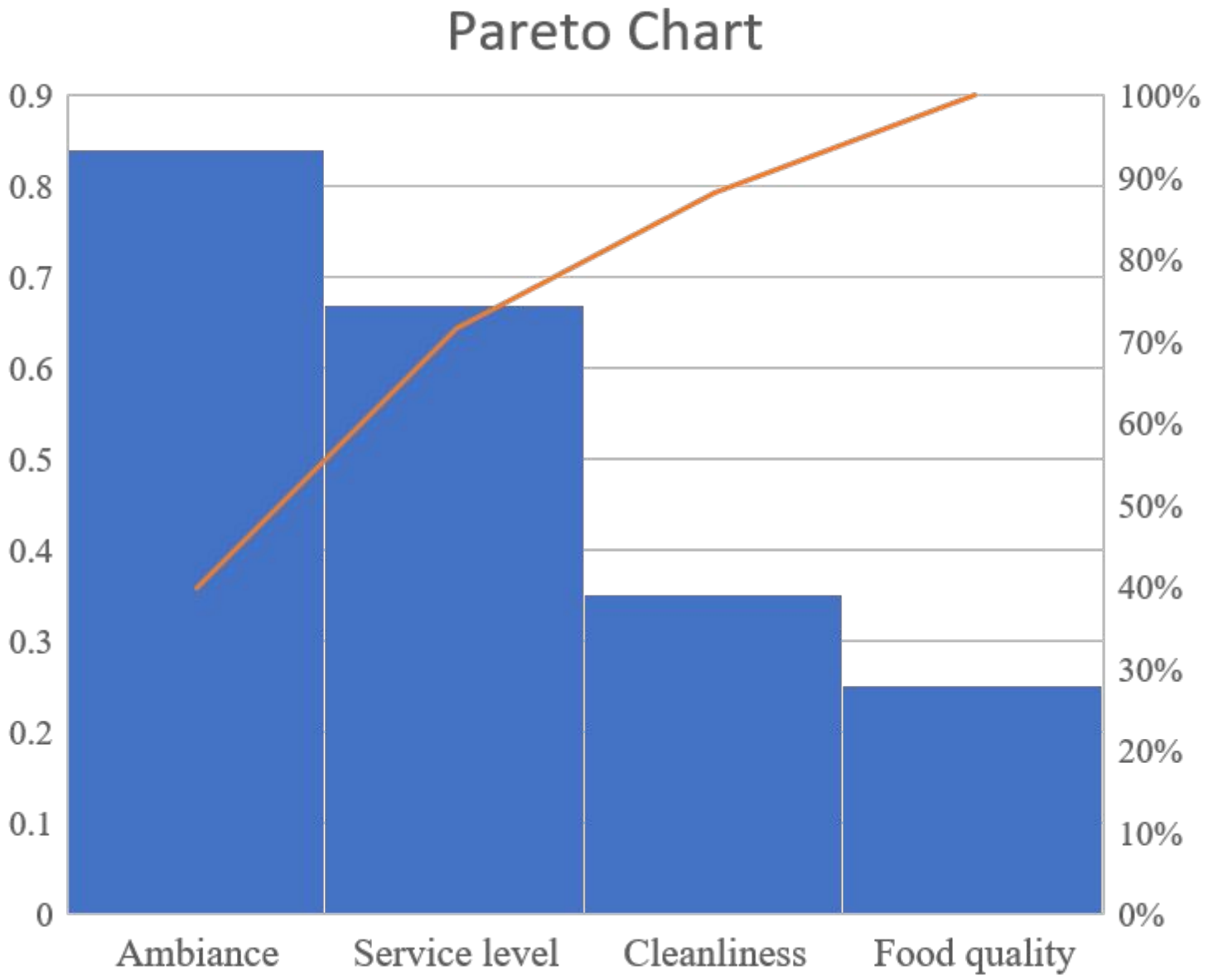
Select the best alternative


Hotel 4
Hotel 3
Hotel 2
Hotel 1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9

Suppose customers are interested in features such as

- Cleanliness
- Service level
- Ambiance
- Food quality


Comparison of Hotels
Hotel 1
Hotel 2
Hotel 3
Hotel 4


Pareto Chart
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Ambiance
Service level
Cleanliness
Food quality

Criterion	Hotel 1	Hotel 2	Hotel 3	Hotel 4
Food				
Cleanliness				
Ambiance				
Service				

TOPSIS Steps

- Obtaining Decision Matrix
- Normalization (Column-wise)
- Weights for the factor
- Weighted Normalized Matrix
- Positive Ideal solution
- Negative Ideal Solution
- Euclidean distance
- TOPSIS score

Thank You

Recommendation System

Recommendation system

Recommendation systems help business in predicting which product(s) best suit to a customer

- It uses data on user profile, past purchases, product rating and so on..

Why Recommender system?

- It helps users discover products and services they might otherwise have not found on their own
- Personalization of the products
- Decreased shopping time
- More engagement
- Enhanced satisfaction
- Higher revenue

When you start using any website, they request you for your profile

Why?

Approaches

- Content based
  - If a Item A and Item B are liked by a set of people. If a new customer has chosen Item A, Item B may also be recommended to him/her
  - In other words, if you are frequently watching horror movies, then may be next time NETFLIx
- Collaborative filtering
  - If two people have similar opinion on a set of items.. It is more likely that if person A has chosen and liked any product that may be liked by Person B as well
- Hybrid methods
  - Combination of content based and collaborative filtering

Entity Classes

- Users
- Items

- Users have preferences on certain features of the item. We need to extract these preferences

	Movie 1	Movie 2	Movie 3	Movie 4
User 1	4	?	?	5
User 2	?	?	2	?
User 3	5	3	?	4
User 4	3	?	4	1

Data

- Data is provided in form of utility matrix

	Item 1	Item 2	Item 3	Item 4
User 1	3			
User 2			4	
User 3				

- The value in the box highlighted in red is the preference of user 1 on item 1

Data

	Item 1	Item 2	Item 3	Item 4
User 1	3			
User 2			4	
User 3				

- The utility matrix is sparse… Means the preference of certain users on certain items is not available in the data

Examples

- Product recommendations through e-commerce platforms
- Movie recommendation in video streaming platforms
- Friend recommendation

Problems with content-based recommender system

- Very simple
- Only considers a few features
- What about latent/hidden features?

Collaborative filtering

Logic

- You have certain interest and will like similar type of products
- You may like products which are liked by other users which have similar interest as you

Obtaining

- User-Latent feature matrix
- Latent feature-Item matrix

Reading Material

1. https://www.youtube.com/watch?v=n3RKsY2H-NE
2. https://developers.google.com/machine-learning/recommendation/collaborative/basics
3. https://www.youtube.com/watch?v=1xtrIEwY_zY

Thank You

Content based

Users

Features

Items

Numerical

AI in Demand Forecasting

Time-series Demand Forecasting

Time Series Data

- Sequence of data where time is the index
  - Aggregated observations over periods of time
    - Monthly sales (Jan Sales. Feb Sales, …)
  - Specific observations at fixed time
    - Left out stock every week (Checked at 9PM every Friday)

Types of Time Series

- **Period**
  - Time taken in reaching next peak from the current peak
- **Frequency**
  - Number of cycles per unit time

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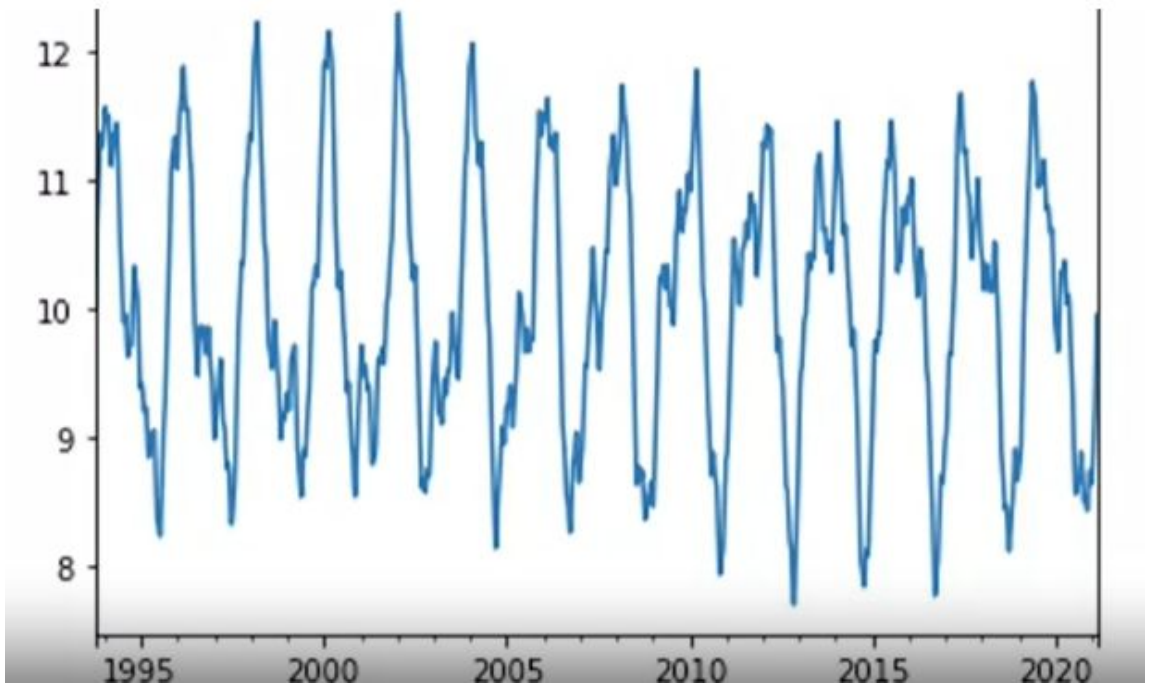
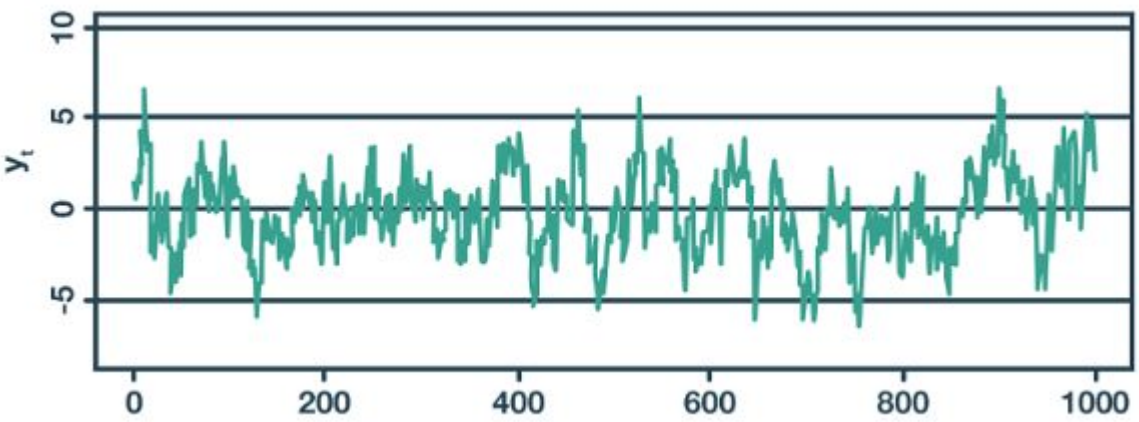
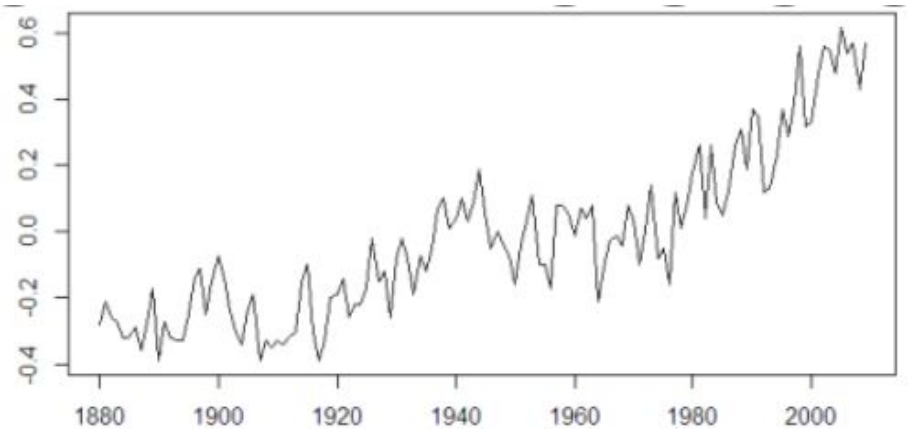


Types of Time Series

- **Stationary timeseries**
  - Mean and Variance does not significantly change over time



- **Non-stationary timeseries**
  - Mean and Variance significantly change over



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Data processing

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Chatbots

Chatbots help organizations in customer support services, they have increased the **consumer satisfaction by 24%**

They also help in **discovering** prospective customers, **engaging** them, and convincing them to use product/service

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The user information collected by chatbots can help in scoring the leads in a better fashion.
Artificial Intelligence can help understand which leads are more likely to convert. This can help improve forecasts and help sales reps concentrate on the right prospects.

Example

Product

- Digital cameras
- Camcorder

- Retail price on Amazon
- Sales rank of the product (Proxy for Sales)
- Product release date
- Reviews
  - Text posted by the reviewer
  - Numerical rating on a scale of one to five stars
  - The date the review was posted

- Trend
- Age
- Fraction of one-star reviews
- Fraction of five-star reviews
- Number of reviews
- Average Rating
- Standard deviation (Rating)

- Picture quality blurry
- Picture quality clear
- Picture quality good
- Picture quality very good
- Picture quality excellent
- Picture quality amazing
- Ease of use Simple

- Ease of use easy
- Ease of use easy to use
  Ease of use very easy
- Size small
- Size compact
- Size light
- Video quality great
- LCD large
- Design great
- Battery life good

Table 9 GMM and Dynamic GMM Estimation Results for Digital Camera Category with Inferred Polarity, Part A

	(1) Model 1 (GMM)	(2) Model 2 (GMM)	(3) Model 3 (DGMM)	(4) Model 4 (DGMM)
Price (unit = $100)	0.101***	0.0954***	0.0517***	0.0155
	(9.26)	(8.87)	(4.13)	(0.94)
Trend	−1.440***	−0.858***	−0.291***	−0.419***
	(−63.56)	(−32.43)	(−7.59)	(−4.38)
Age	0.00954***	0.00855***	0.00330***	0.00460***
	(135.75)	(123.57)	(15.53)	(8.18)
Isused	0.628***	0.560***	0.216***	0.340***
	(65.33)	(52.91)	(11.87)	(7.53)
Fraction of one-star reviews	−0.571***	−0.0234	0.103	0.234
	(−5.83)	(−0.23)	(0.80)	(0.89)
Fraction of five-star reviews	2.340***	0.175*	0.0146	0.405*
	(60.28)	(2.54)	(0.17)	(2.22)
Numreviews (unit = 10)	−0.358***	−0.213***	−0.0716***	−0.117***
	(−59.05)	(−33.87)	(−7.86)	(−4.98)
Rating	−1.040***	−0.279***	−0.0820*	−0.223*
	(−43.49)	(−9.93)	(−2.25)	(−2.57)
Reviewlength (unit = 10,000 words)	0.0397***	−0.0976***	−0.0486***	−0.0448***
	(5.69)	(−14.96)	(−6.16)	(−3.30)
Ratingstdev	−0.722***	−0.311***	−0.0947***	−0.240***
	(−46.46)	(−16.40)	(−3.81)	(−4.02)
Hasrating	2.542***	0.615***	0.206	0.392
	(30.97)	(7.01)	(1.80)	(1.44)
		...	...	...
		...	...	...

Table 10 GMM and Dynamic GMM Estimation Results for Digital Camera Category with Inferred Polarity, Part B

	(1) Model 1 (GMM)	(2) Model 2 (GMM)	(3) Model 3 (DGMM)	(4) Model 4 (DGMM)
Picturequalityblurry		−0.524***	−0.214**	−0.187
		(−8.95)	(−2.73)	(−1.11)
Picturequalityclear		−0.819***	−0.288**	−0.517**
		(−11.66)	(−3.17)	(−2.66)
Picturequalitygood		0.507***	0.232***	0.352**
		(12.67)	(4.41)	(2.90)
Picturequalityverygood		−0.654***	−0.366**	−0.863**
		(−7.73)	(−3.09)	(−2.84)
Picturequalitygreat		−3.043***	−1.186***	−1.634***
		(−68.58)	(−12.93)	(−6.62)
Picturequalitysharp		0.486***	0.169	0.535*
		(6.09)	(1.65)	(2.25)
Picturequalitycrisp		0.0846	0.0841	−0.375
		(0.87)	(0.69)	(−1.41)
Picturequalityexcellent		−1.755***	−0.692***	−0.934***
		(−23.40)	(−6.80)	(−4.26)
Picturequalityamazing		−4.901***	−1.921***	−2.194***
		(−39.32)	(−10.36)	(−5.79)
Easeofusesimple		−3.086***	−1.349***	−1.330***
		(−33.39)	(−9.57)	(−4.97)
Easeofuseeasy		−0.540***	−0.221***	−0.374**
		(−12.16)	(−3.80)	(−2.89)
Easeofuseeasytouse		1.706***	0.710***	0.550*
		(19.27)	(5.96)	(2.20)
Easeofuseveryeasy		2.208***	0.824***	1.470***
		(18.41)	(5.18)	(3.88)
Sizesmall		−0.699***	−0.237***	−0.321***
		(−24.28)	(−5.92)	(−3.41)
Sizecompact		−0.530***	−0.197**	−0.412**
		(−10.26)	(−3.03)	(−3.06)
Sizelight		0.0160	−0.00451	−0.155
		(0.24)	(−0.05)	(−0.84)

Thank You

AI in Sales/Demand Forecasting

Sales/demand forecasting

Estimates of the sales for specified future period

Importance?

- Manufacturers produce products in advance. If the forecast is not accurate, a proportion of the product may have to be scrapped. It imposes additional cost.

- Manufacturers have to plan for raw material in advance

- Decisions pertaining to operations planning, scheduling, production, inventories, logistics and supply chain, equipment requirements, manpower requirements are dependent on the forecast

- If it is done for the long term, it may help in deciding on expansion, automation, diversification of the product line etc.

Types

- Short term
- Long term

Short term

- It is done for relatively short period
- Depending on the nature of the product, it may be monthly or yearly

Long term

- It is done for relatively long period may be a number of years.
- When the investment for the equipment/infrastructure is quite high
- Examples:
  - Steel plants
  - petroleum refinery
  - paper mills

Types: Method

- Qualitative/survey-based method
  - Buyer expectations (survey from potential customers)
  - Sales force opinion (sales people)
  - Expert opinion
  - Delphi method (multiple round of questionnaire)
- Quantitative/statistical method
  - Time series models
  - Regression models
  - Econometric models

Time-series forecasting

Time Series Data

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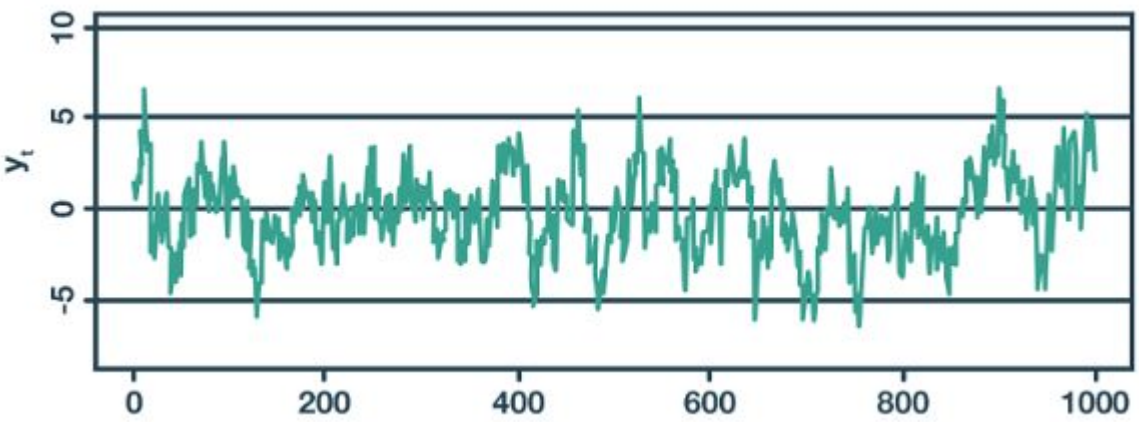

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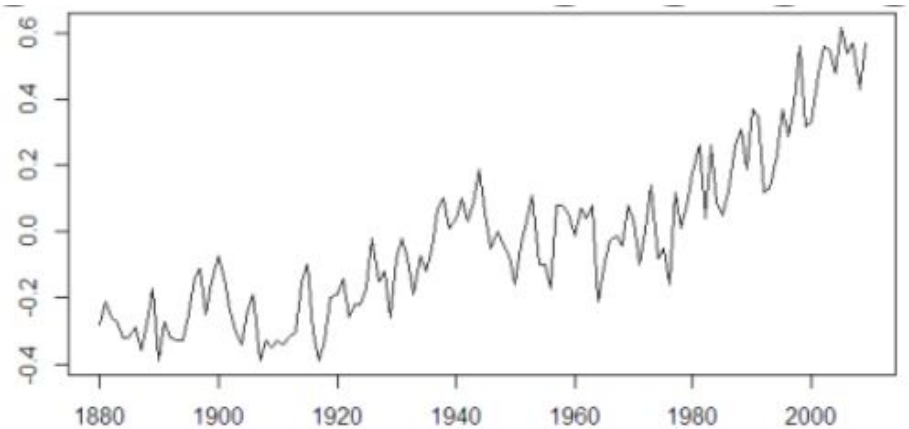

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Analysis of unstructured content

- Text analytics
- Image analytics
- Video analytics

Example

Example: Dairy farm

Existing VS New

Product

- Digital cameras
- Camcorder

Questions

- Which product features are evaluated in the product review?
  - Why not the features provided by the manufacturer in the brochure?
    - Intangible product features (ease of use, value for money, robustness)
- What evaluations are given to these attributes?
- What is the pragmatic and economic value of these evaluations?

- Retail price on Amazon
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  - Numerical rating on a scale of one to five stars
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		...	...	...
		...	...	...

Table 10 GMM and Dynamic GMM Estimation Results for Digital Camera Category with Inferred Polarity, Part B

	(1) Model 1 (GMM)	(2) Model 2 (GMM)	(3) Model 3 (DGMM)	(4) Model 4 (DGMM)
Picturequalityblurry		−0.524***	−0.214**	−0.187
		(−8.95)	(−2.73)	(−1.11)
Picturequalityclear		−0.819***	−0.288**	−0.517**
		(−11.66)	(−3.17)	(−2.66)
Picturequalitygood		0.507***	0.232***	0.352**
		(12.67)	(4.41)	(2.90)
Picturequalityverygood		−0.654***	−0.366**	−0.863**
		(−7.73)	(−3.09)	(−2.84)
Picturequalitygreat		−3.043***	−1.186***	−1.634***
		(−68.58)	(−12.93)	(−6.62)
Picturequalitysharp		0.486***	0.169	0.535*
		(6.09)	(1.65)	(2.25)
Picturequalitycrisp		0.0846	0.0841	−0.375
		(0.87)	(0.69)	(−1.41)
Picturequalityexcellent		−1.755***	−0.692***	−0.934***
		(−23.40)	(−6.80)	(−4.26)
Picturequalityamazing		−4.901***	−1.921***	−2.194***
		(−39.32)	(−10.36)	(−5.79)
Easeofusesimple		−3.086***	−1.349***	−1.330***
		(−33.39)	(−9.57)	(−4.97)
Easeofuseeasy		−0.540***	−0.221***	−0.374**
		(−12.16)	(−3.80)	(−2.89)
Easeofuseeasytouse		1.706***	0.710***	0.550*
		(19.27)	(5.96)	(2.20)
Easeofuseveryeasy		2.208***	0.824***	1.470***
		(18.41)	(5.18)	(3.88)
Sizesmall		−0.699***	−0.237***	−0.321***
		(−24.28)	(−5.92)	(−3.41)
Sizecompact		−0.530***	−0.197**	−0.412**
		(−10.26)	(−3.03)	(−3.06)
Sizelight		0.0160	−0.00451	−0.155
		(0.24)	(−0.05)	(−0.84)

Thank You

AI in Finance

Extracting information from transaction data

- Product code (product category)
- Store code (Location) / Missing information
- Country code
- Bank ID/UPI ID
- Amount

Store code (Location) / Missing information

Consumer Profiling

- Elderly people
- Children
- Sports
- Beauty products
- Tourists
- Student
- Etc.

Predicting the preferred brand

Predicting the preferred store

Predicting the preferred location

Predicting if a customer may switch to your competitor and so on

Credit Score prediction

Factors

- Payment history
- Amount of debt you owe
- How long you've been using credit
- New or recent credit
- Types of credit used

- Irresponsible Payment Behaviour
- High Credit Utilisation Ratio
- Outstanding Debt
- Paying only the Minimum Amount Due
- Making Multiple Credit Applications

Fraud

- Order size
- Multiple cards
- Same address, and different cards
- Same card, and multiple address
- Same IP address, different orders
- Same IP address, different cards
- Similar card numbers
- Quick shipping with large order
- International shipping
- No purchase history
- Fake email address

Thank You

AI in Finance

Extracting information from transaction data

- Product code (product category)
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Predicting the preferred brand

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Predicting the preferred location

Predicting if a customer may switch to your competitor and so on

Credit Score prediction

How do banks earn?

RS. 100

- Interest to depositors
- Salary and other expenses
- NPA
- Interest earned

To extend the ability of banks to issue loans, smart credit scoring solutions are evident.

Application of AI/ML has revolutionized the lending industry

- In the presence of vast amount of data, and advanced ML/DL algorithms have increased the accuracy in predicting credit risk
-

Factors

- Payment history
- Total income (per person)
- Transaction analysis
- Amount of debt you owe
- How long you've been using credit
- New or recent credit
- User Behaviour analysis (psychometrics to develop a behavioural and personality profile of applicants.)
- Types of credit used
- No of working members in a family
- Nos of dependents (children, parents)
- Health problems in the family
- No of years the employee is working
- Type of job (contract/permanent)
- Employment opportunities
- Potential ability to earn

Factors

- Irresponsible Payment Behaviour
- High Credit Utilisation Ratio
- Outstanding Debt
- Paying only the Minimum Amount Due
- Making Multiple Credit Applications

Other AI tools for credit scoring of a company

- Structured data
- Text
- Image
- Video

Benefits of AI based credit scoring

- Identifying hidden and non-obvious patterns
- Inclusion of hidden factors and their interactions
- Social network analysis
- Real time inclusion of data and inherent patterns
- Inclusion of the data from open sources, applying unsupervised learning methods to identify patterns in user behavior and detection of fraudulent behaviour

Fraud

- Order size
- Multiple cards
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- Same card, and multiple address
- Same IP address, different orders
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Other AI applications

- Analysis of news and microblogs
- Political news analysis
- Market Sentiment Analytics
- Analysis of financial market

Thank You