Taxonomy of AI |

Goals

Differentiate between ‘structured’ and ‘unstructured’ data

Define the terms ‘data’, ‘information’, ‘knowledge’, and ‘data-driven decision-making’

Explain the difference between ‘data-driven’ and ‘gut-feeling’ decision-making by providing an example for each

Describe the four types of data analysis methods: Descriptive, Diagnostic, Predictive, and Prescriptive

Provide an example for each of the four types of data analysis methods

Define the terms ‘Symbolic AI’, ‘Machine learning’, ‘Connectionist AI’, ‘Inference’, and ‘Expert system’

Explain the difference between ‘supervised’ and ‘unsupervised’ machine learning

Provide at least one advantage, and one disadvantage of applying a rule-based systems/Symbolic AI, and deep learning/Connectionist AI predictive modelling approach

**Structured data** > data that fits neatly into data tables and includes discrete data types such as numbers, short text, and dates.

**Unstructured data** > doesn’t fit neatly into a data table because its size or nature: for example, audio and video files and large text documents.

2b

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| --- | --- |
| Structured data | Unstructured data |
| A spreadsheet containing columns for name, age, and address | A collection of handwritten poems in a diary |
| An online event calendar with fields for event name, date, time, location, and description. | A group conversation from a messaging app |
| A database of bird sightings with columns for bird species, location, date, and time. |  |

**Quantitative data** > interpretation-based, descriptive, and relating to language. Tells us how many, how much, or how often in calculations. (fixed and universal)

**Qualitative data** > can help us to understand why, how, or what happened behind certain behaviours.

**Data driven decision making** > A structured approach that relies on factual data and insights collected through analysis. This approach involves collecting, analysing, and interpreting data to identify pattern, trends, and relationships that inform decision making.

**‘Gut feeling’ decision making** > non-conscious form of knowledge or understanding. It’s a quick reaction based on past experiences, emotions, and subconscious processing. While intuition can be valuable, it can also be susceptible to biases and limited by breadth of our experiences.

2.1a

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| --- | --- |
| Data-driven decision making | ‘Gut-feeling’ decision making |
| Choosing the location based on reviews from food critics combined with the food preferences from the party and price range. You could also consider walking distance or overall difficulty on how to there. | Going to a restaurant where you have had previous experiences and believe that everyone would enjoy. |
| Deciding which band to hire based reviews of previous festivals. Knowing the food preferences of the audience to hire the right food tents. Consider ticket sales from previous festivals. Choosing the right location and watching out for weather conditions | Hiring bands that you may have worked with before or hiring the same catering businesses that you always have. Holding the festival at a location that you thought was the right fit. Relies on their own music taste or their perception of trends. |
| Developing a new product based on reviews of previous buyers, or based on collected data about the audiences, compare pricing with competitors, collecting data with the help of surveys. Prototyping and testing | Senses a shift in the consumers behaviour based on cultural or societal changes. Feels like the competitor is missing out on an opportunity. Deciding a product is good based on experience without proper prototyping and testing |

DIKW

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| --- | --- |
| Data | Refers to raw, unprocessed facts and figures without context. It is the foundation for all subsequent layers but holds limited value in isolation. |
| Information | Is organized, structured, and contextualized data. Information is useful for answering basic question like, “who”, “what”,” where”, and “when” |
| Knowledge | Is the result of analysing and interpreting information to uncover patterns, trends, and relationships. It provides |
| Wisdom | Is the ability to make well-informed decisions and take effective action based on understanding of the underlying knowledge |

2.2a

|  |  |  |
| --- | --- | --- |
| Data | "Employee A worked 8 hours today" | 10,000 steps walked today |
| Information | "Employee A worked 40 hours this week, earning $800." | You walked 10,000 steps today, which meets the daily goal of 10,000 steps |
| Knowledge | "Employees who work more than 40 hours per week tend to experience burnout and decreased productivity." | Walking 10,000 steps per day consistently for the past week has improved your overall fitness level |
| Wisdom | "Implement flexible working hours or additional breaks to prevent employee burnout and maintain productivity." | To improve cardiovascular health, consider incorporating more cardio into your workout routine. |

3.1a

Retail clothing store

*Descriptive analysis* > (What happened) summarize historical data to show what has happened in the past

-What were our total sales in the last quarter

-Which store location has had the highest sales

-How did our online sales go compare to our in-store sales

*Diagnostic analysis* > (Why did it happen) Delves further into the data to find why something happened

-Why were the sales lower in this location

-What factor led to higher sales in this location

*Predictive analysis* > (What is most likely to happen) using historical data to predict what is most likely to happen in the future

-How much are we likely to sell next quarter

-Which store is expected to outperform the other

*Prescriptive analysis*> (What should we do) provides recommendations on what actions to take to achieve desired outcomes

-What should we do to boost sales in underperforming stores

-How can we maximize sales across all channels

3.1b

<https://learn.microsoft.com/en-us/power-bi/fundamentals/power-bi-overview>

<https://learn.microsoft.com/en-us/power-bi/fundamentals/desktop-getting-started>

<https://learn.microsoft.com/en-us/training/modules/get-data-power-bi/?tutorial-step=1>

3.1c

Tableau

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User friendly interface (drop-and-drag interface)

Advanced visualizations (offer wide variety of powerful, interactive, and visually appealing charts and graphs)

Real-time data analysis (Can connect to live data sources)

Strong collaboration features (allows for easy sharing and collaboration)

Tableau is public (offers a free version)

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Steeper learning curve for advanced features (mastering more complex features can be challenging for non-technical users)

High cost for enterprises (pricing can be prohibitive for small businesses or individual users)

Dependency on internet connectivity

No automatic updates for tableau public

Limited data preparation capabilities (although its built-in data cleaning features, it is not as strong in ETL (extract, transform, load) compared to tools like Alteryx or Power Bi

3.2a

Supervised learning > A type of machine learning where the model is trained on labeled data. This means that for each input, the correct output is provided, and the algorithm learns to predict the correct output for new, unseen data.

Unsupervised learning > A type of machine learning where the model is trained on unlabaled data. The algorithm tried to find patterns or structures in the data without any explicit guidance on what the output should be.

3.2b

Inference refers to the process of using a trained model to make predictions or decisions based on unseen data.

Expert system is a computer program that mimics the decision-making ability of a human expert, using a knowledge base.

3.2c

Neural networks and the human brain share several similarities in how they process information.

They are similar in:

Structure > neurons in the brain receive inputs, process them, and send signals to other neurons. Artificial neurons are made up of layers of nodes (artificial neurons), each node receives inputs, processes them, and passes outputs to other nodes.

Learning process > The brain learns through experiences, strengthening or weakening connections between neurons based on feedback. Neural networks learn from data by adjusting the weights between nodes using algorithms.

Parallel processing > The human brain can process multiple pieces of information through its network of neurons. Neural networks process information similar to how the brain handles multiple tasks at once.

Pattern recognition > The brain excels at recognizing patterns through repeated exposure. Neural networks are designed to recognize patterns in data, such as images, text, or sound, by learning from examples.

3.2d

ANN uses a connectionist approach to AI, they are modelled after the brain’s structure and function, where knowledge is stored and processed through connections between many simple units.

3.2e

Medical diagnosis systems use symbolic AI rather than a connectionist approach. They use symbolic AI to assist doctors in diagnosing diseases by analysing medical data and applying diagnostic rules. In these cases, transparency is critical. Using symbolic AI, using predefined rules and logic, allows doctors to see exactly how a diagnosis was reached.