Unraveling the data dilemma
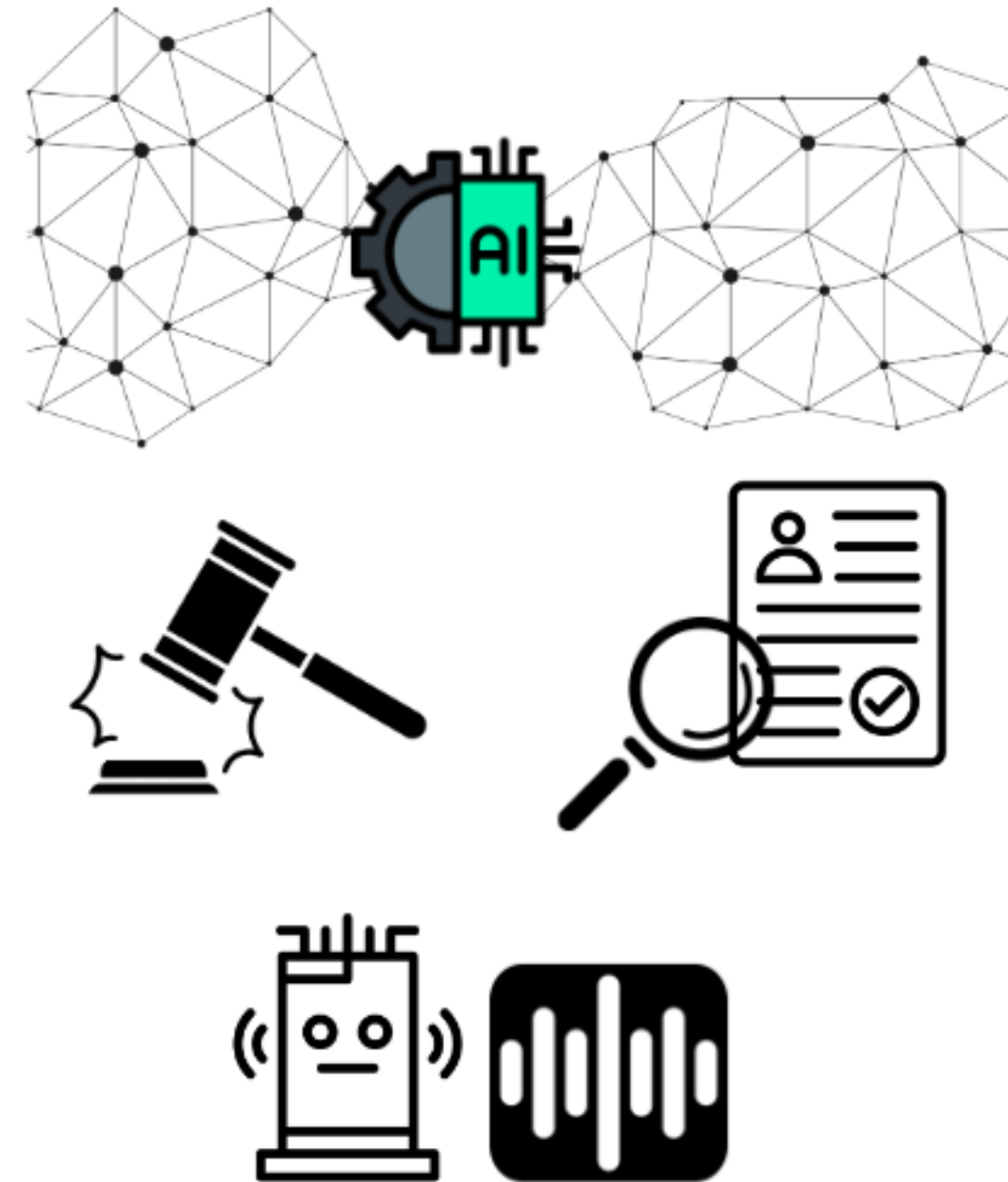
CONQUERING DATA BIAS

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Data driving decision-making

- **Data-driven decision-making** has revolutionized industries across the globe

- The adoption of **data and AI** has extended its reach into critical areas like:
  - Social justice
  - Employment screening
  - Interactive interfaces such as virtual assistants

The emergence of data bias

Alongside these advancements, concerns have emerged regarding the presence of **biases** within these solutions.
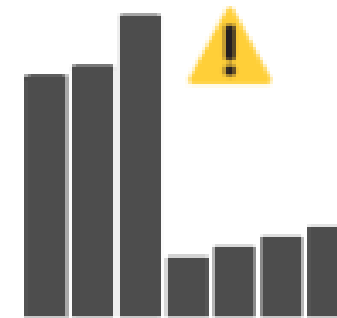

- Amazon shut down its model that scored **suitable candidates for employment** as it favored male candidates

What is data bias?

- It arises when data or information is limited, **painting an inaccurate or unfair picture** of the population

- It results from various factors such as:
  - Imbalances and underrepresentation
  - Historical prejudices
  - Cognitive tendencies

- It compromises the accuracy and reliability of data, hindering its **effectiveness** in informing decision-making processes
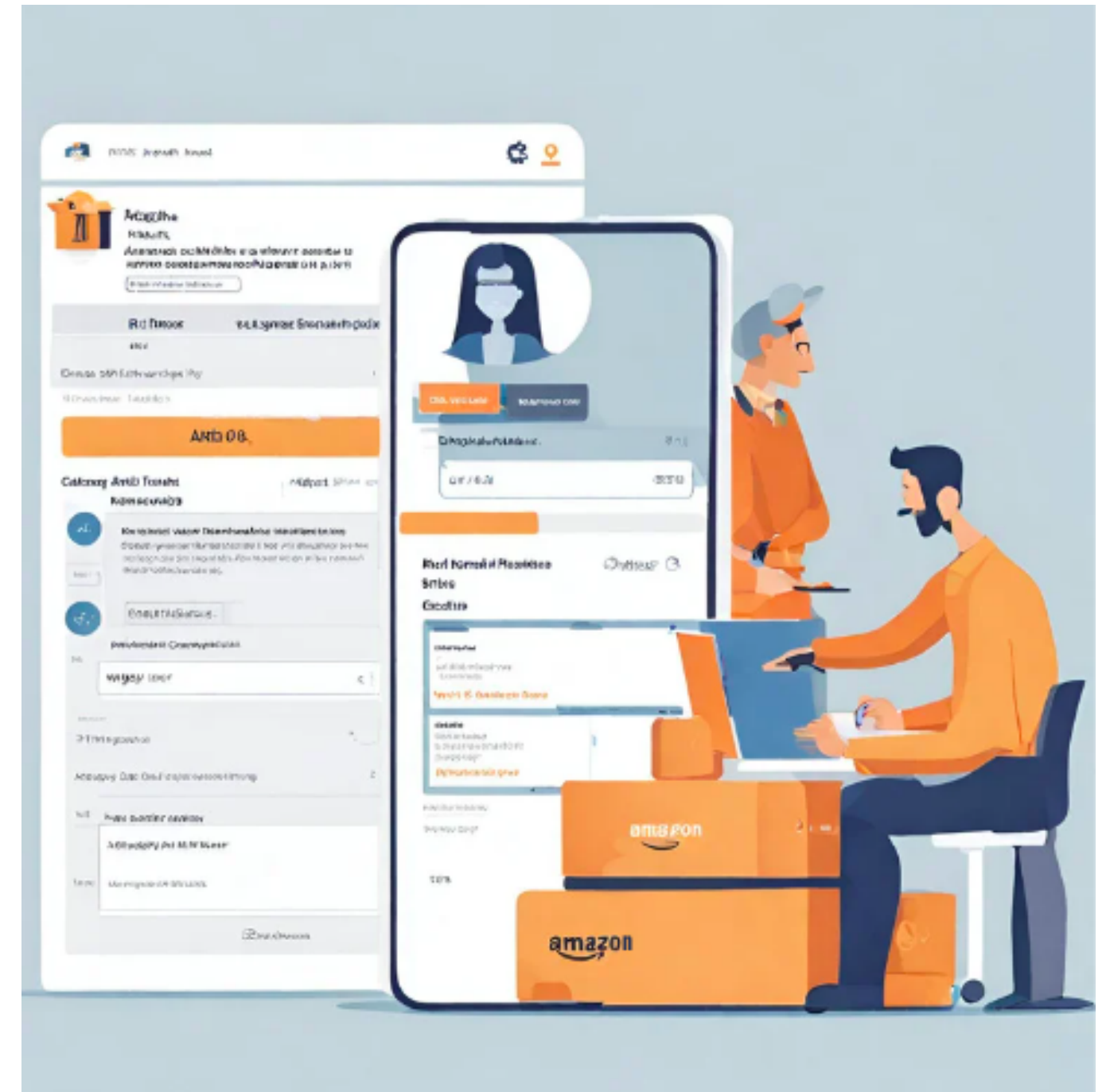
Imbalances and underrepresentation

Historical prejudices

Cognitive tendencies

The Amazon case

- Amazon's model was trained on resumes submitted over 10-years.

- During this time, male candidates were **disproportionately hired or favored by the hiring process.**

- The model was biased towards male candidates due to historical hiring patterns.

- Addressing data bias requires scrutiny of both the dataset quality and the human processes involved.

About the course

Chapter 1 - Learn about the impact of data bias on decision-making and why it is important to take data bias into consideration when working with data.

Chapter 2 - Learn the various types of data bias in data collection and discover how to implement techniques to minimize it.

Chapter 3 - Learn the data bias types commonly present during data analysis and when sharing analysis results. We will dive into how to identify bias and how to mitigate it.

Let's practice!

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Impact of data bias on decision-making

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Bias and data ethics

- Decisions are only as reliable as the data behind them

- When data is not aligned with the intended objectives, it can become a matter of **data ethics**

- It covers the **ethical** and **moral** obligations of collecting, analyzing, and using data

- It tackles issues such as **discrimination**, **privacy**, **transparency**, and **accountability**.

Unfair treatment and discrimination

- Data bias can lead to **unfair treatment** of certain individuals or groups

- Biased data can result in **discriminatory outcomes**

- For instance:
  - Biased sampling of customer purchase data may inadvertently disadvantage certain demographics

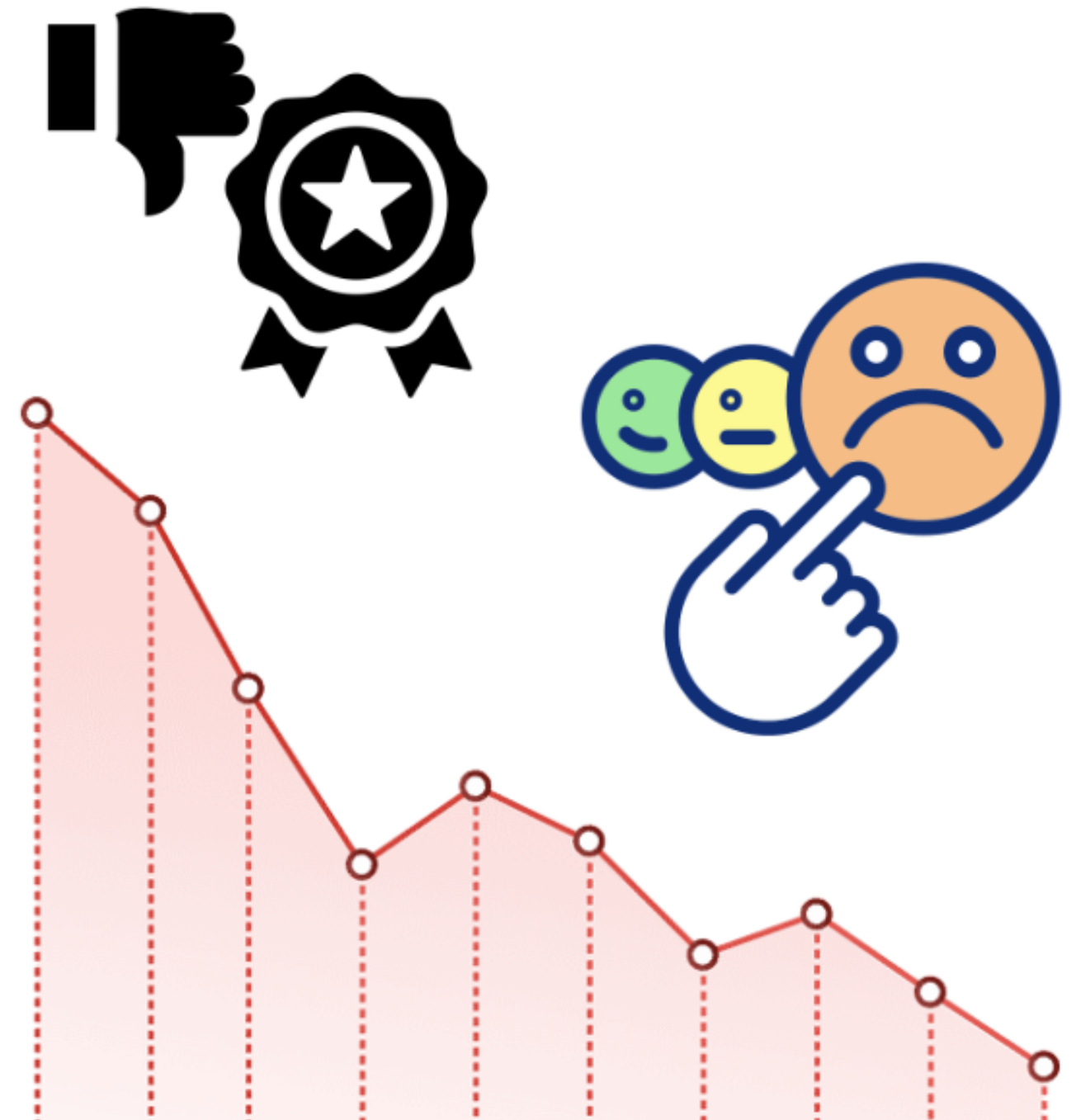 - Resulting in biased marketing strategies

Reinforcement of stereotypes

- Models trained on biased data may learn and reinforce **existing societal biases**

- Suppose the training data of a recommendation algorithm predominantly features content from a **specific political ideology**

- The algorithm, might recommend content that aligns with the dominant political ideology

Loss of trust and legal issues

- When biased decision-making becomes known, it **erodes trust in the data**

- In worst cases, it leads to **legal and ethical challenges**

- It can result in **legal action** and **damage to an organization's reputation**

Hindering performance and innovation

- Bias can lead to suboptimal decision-making and hinder **performance** and **innovation**

- For instance:
  - Lower utilization rates of a particular team occur due to bias
  - This leads to **misguided performance evaluations**
  - Impacting **resource allocation, process efficiency and innovation**

The feedback loop of bias

- Biases can create a **feedback loop** where historical biases are **reinforced** and **perpetuated** over time

- As biased decisions are made, they contribute to new biased data, which further influences future decisions

Let's practice!

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Types of data bias

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The dynamics of decision making

Adults make approximately **35,000** conscious decisions each day

> "What career path should I pursue?"
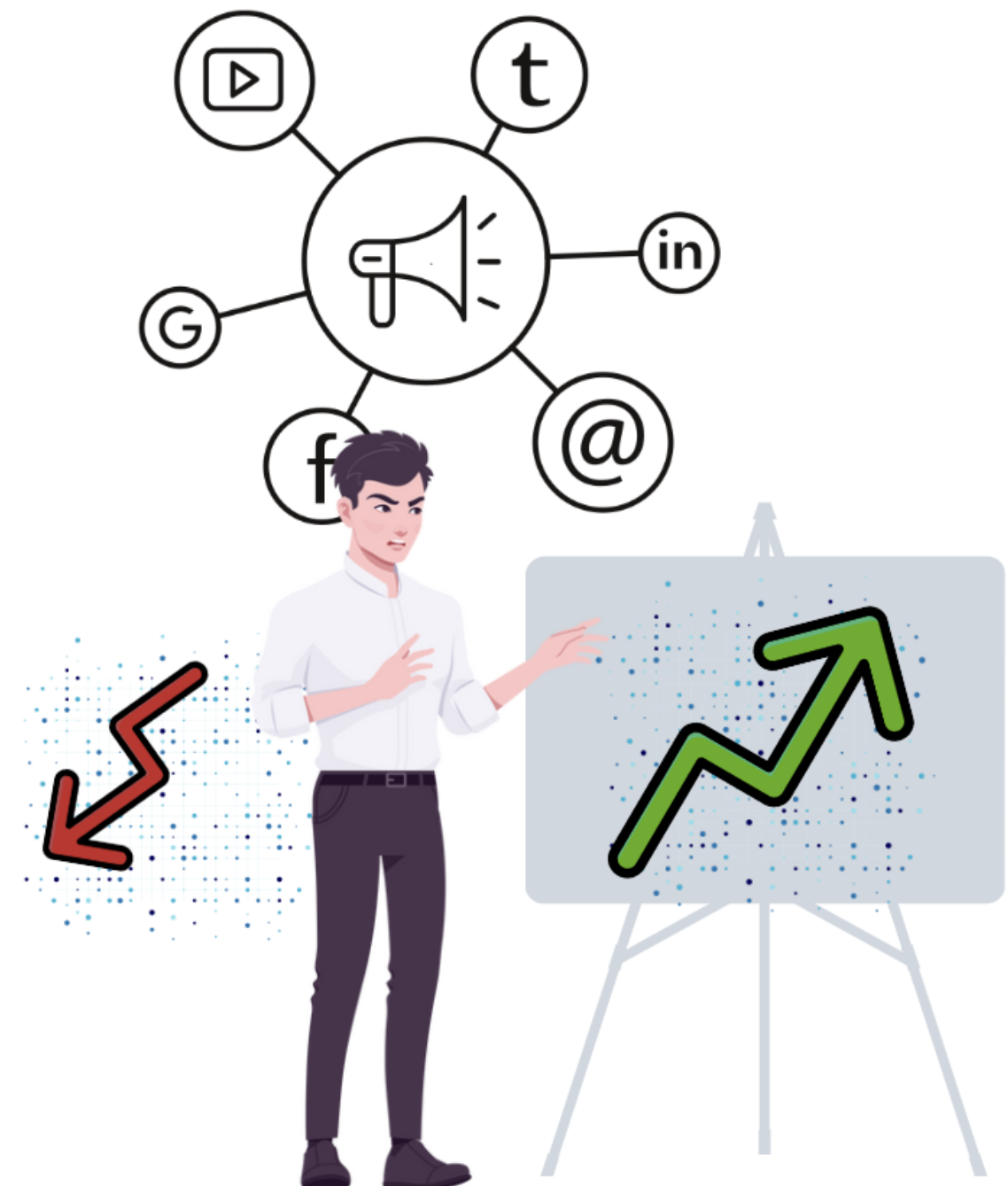
> "What should I eat for dinner?"

- **Heuristics** help our brains simplify information processing and reach decisions faster

- BUT heuristics can cause... **cognitive biases**

[1] https://hbr.org/2023/12/a-simple-way-to-make-better-decisions

Cognitive biases

Systematic patterns of deviation from norm or rationality in judgment and decision-making processes

- Data bias can be a result of those cognitive biases

- For example: an analyst **unconsciously favoring positive data** while analyzing a recent marketing campaign
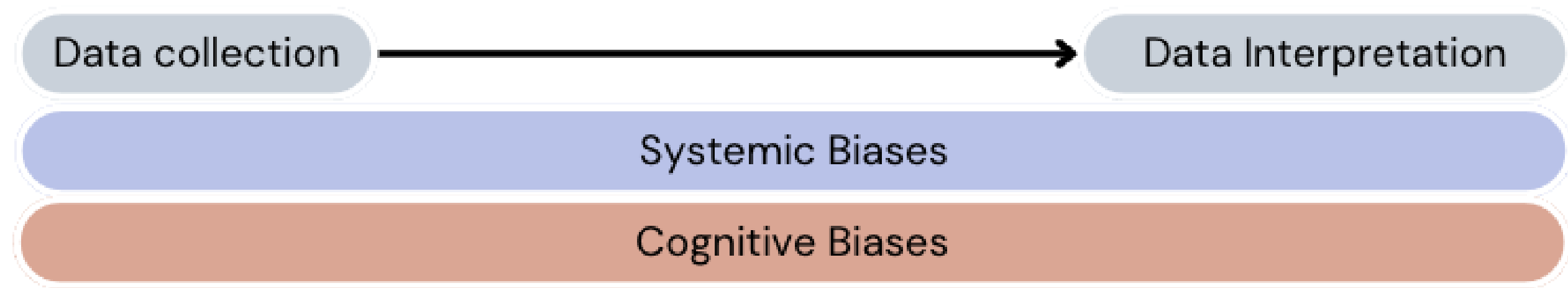
Systemic biases

- While cognitive biases pertain to individual decision-making processes, **systemic biases** highlight broader issues guiding data-related activities

- These are biases that are inherent in the **processes, structures, or systems** used to collect, analyze, and interpret data

- They originate due to various reasons such as biased data collection methods and algorithmic design
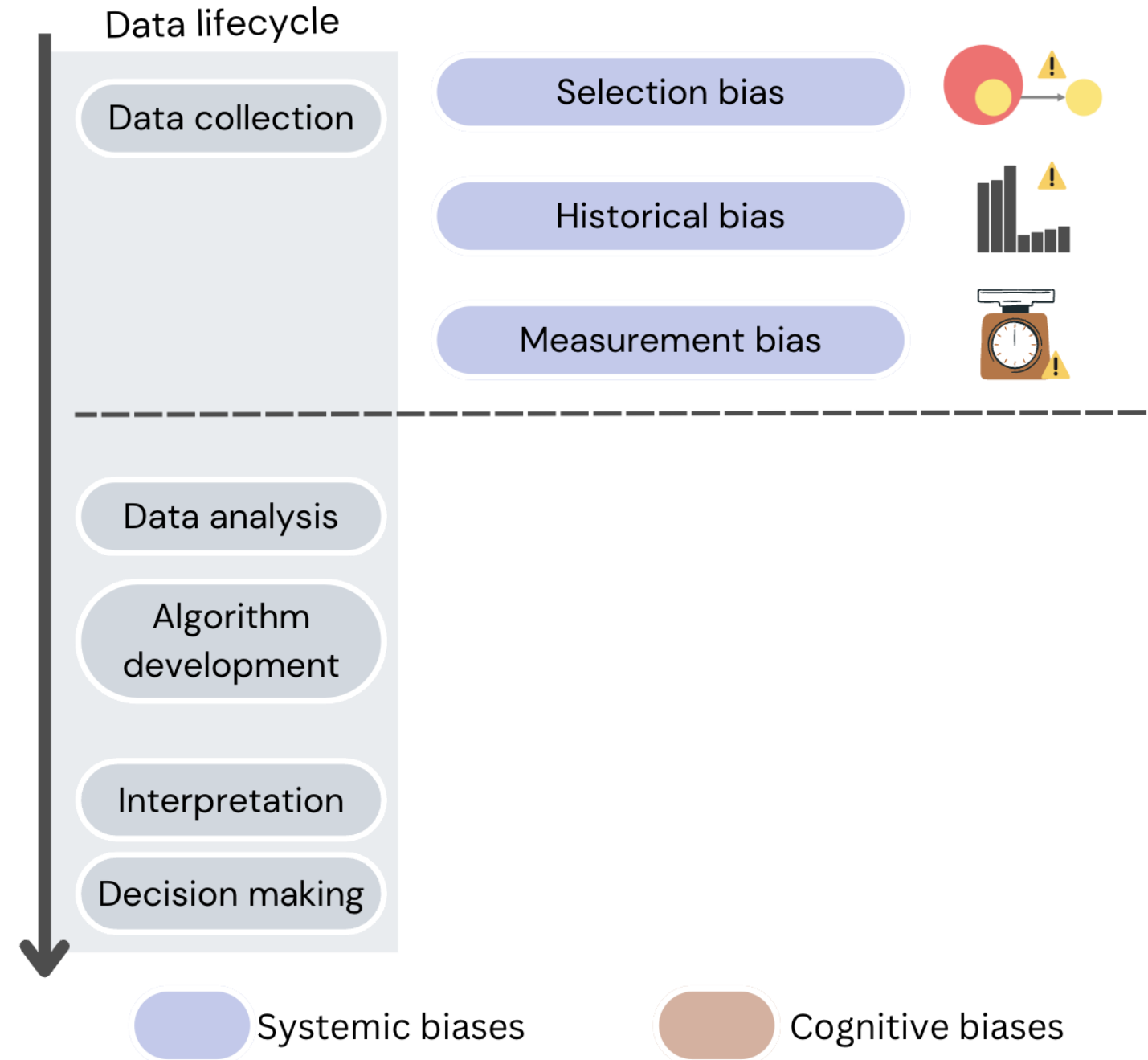
Bias in the data lifecycle

Data collection → Data Interpretation

Systemic Biases

Cognitive Biases

- Systemic and cognitive biases represent the origins of data bias

- Understanding the various types of data bias is the first step toward building a robust defense against their impact
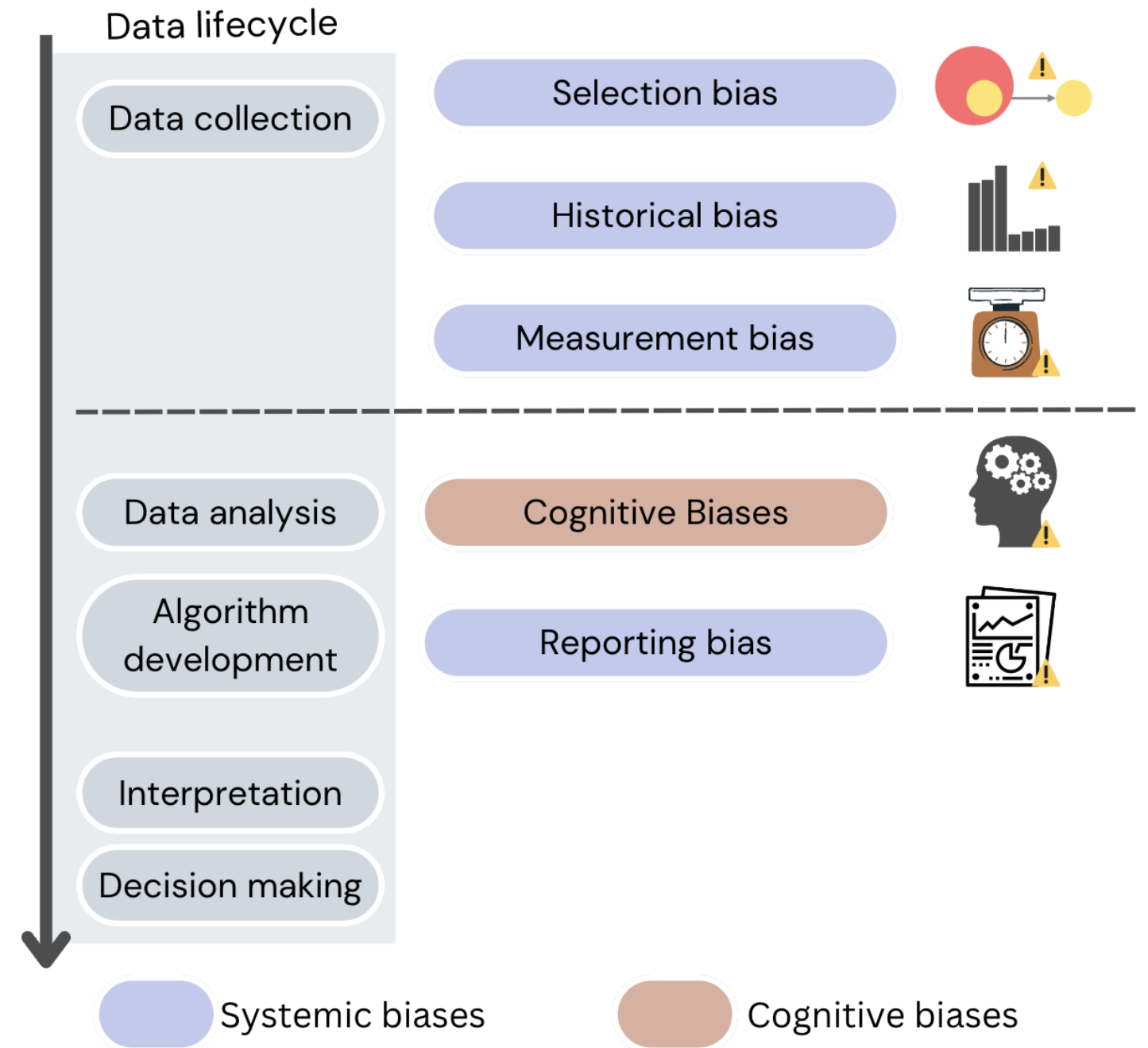
Unveiling data collection biases

- Selection bias
  - The collection process favors certain groups or characteristics over others

- Historical bias
  - Historical data reflecting past inequalities or systemic issues

- Measurement bias
  - Instruments or methodologies systematically misrepresent certain attributes
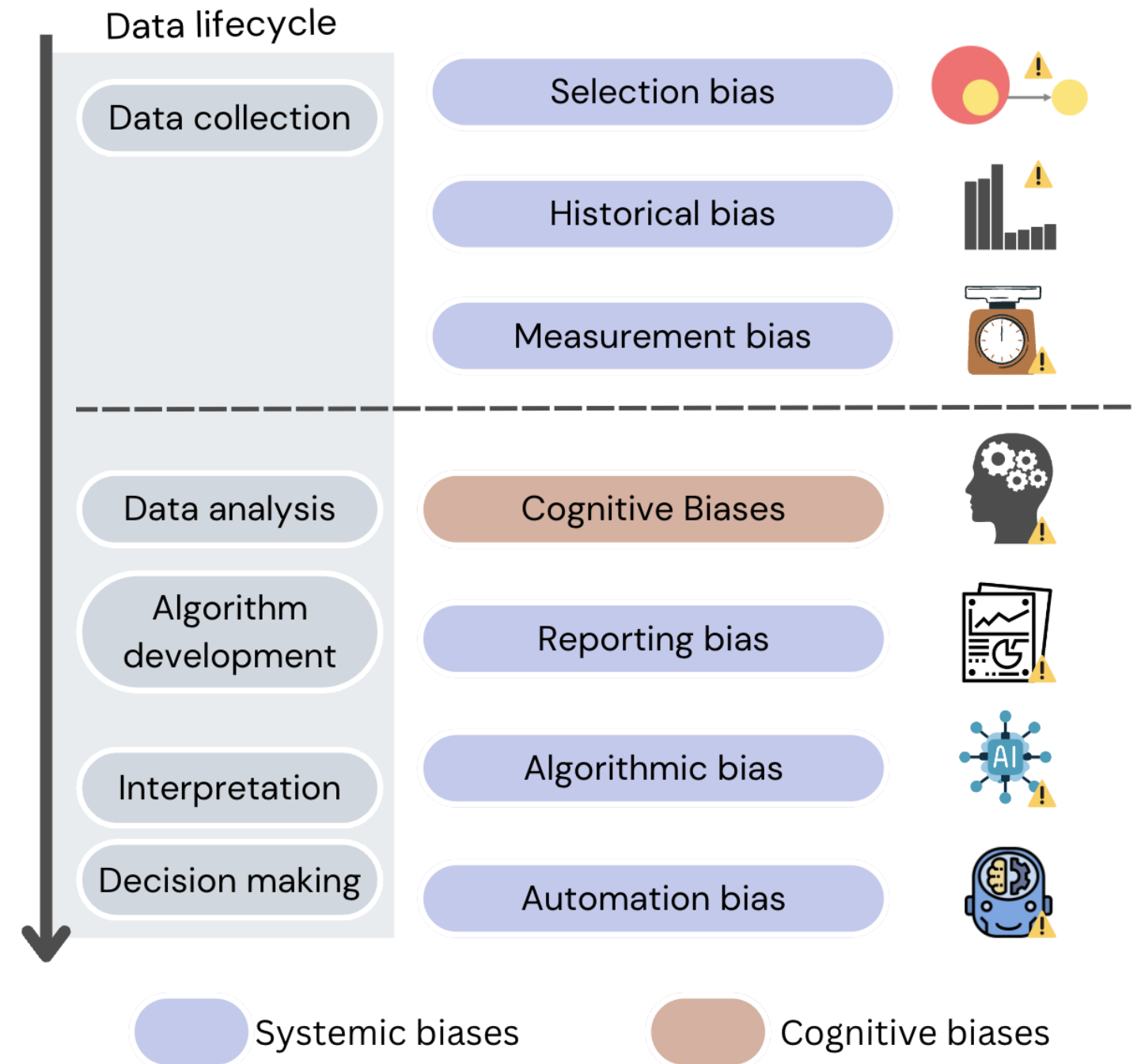
Unveiling bias in data analysis

- Cognitive bias
  - Confirmation bias is one prominent type
  - It refers to tendency to seek and interpret information that confirms pre-existing beliefs

- Reporting bias
  - Occurs when certain findings are highlighted or suppressed, shaping the narrative around the data

Bias in model development

- Algorithmic bias
  - Occurs when machine learning models reflect the biases present in the training data

- Automation bias
  - Emphasizes the importance of human oversight as automated processes may unwittingly perpetuate or amplify existing biases

Let's practice!

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