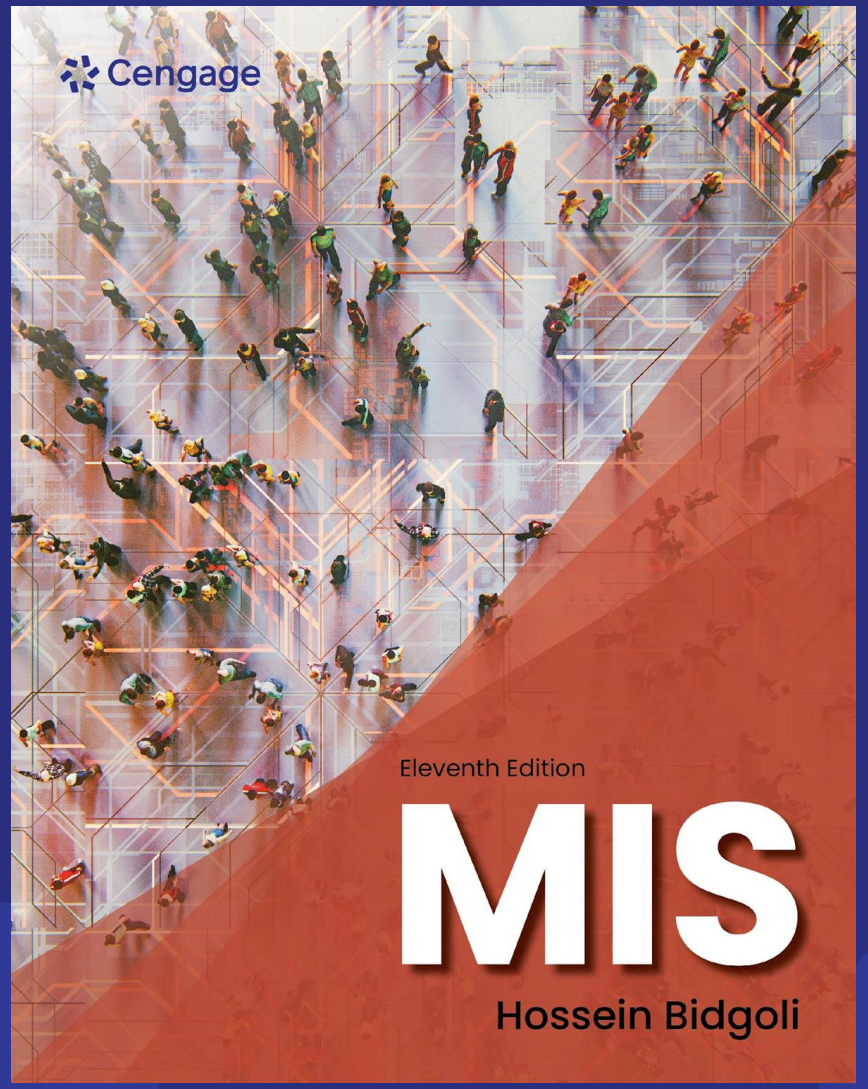


MIS, 11e

Module 13: AI and Automation

Module Objectives

By the end of this module, you should be able to:

13.1 Define artificial intelligence and explain how AI technologies support decision making

13.2 Describe an expert system, its applications, and its components

13.3 Describe case-based reasoning, including the four Rs involved in its design and implementation

13.4 Summarize each of the four types of intelligent agents and how they are used

13.5 Describe fuzzy logic and its uses

13.6 Explain machine learning and artificial neural networks

13.7 Describe how genetic algorithms are used

13.8 Explain natural-language processing and its major categories

13.9 Describe the five benefits of integrating AI technologies into decision support systems

13.10 Explain contextual computing

13.11 Explain the AI impacts on automation

13.12 Describe the ethical issues of AI

What is Artificial Intelligence?

- Related technologies that try to simulate and reproduce human thought behavior
  - Artificial intelligence (AI) technologies
    - Apply computers to areas that require knowledge, perception, reasoning, understanding, and cognitive abilities
    - Concerned with generating and displaying knowledge and facts

- Watch: https://www.youtube.com/watch?v=ad79nYk2keg

Table 13.1 Applications of AI

TABLE 13.1 APPLICATIONS OF AI TECHNOLOGIES

Field	Organization	Application
Energy	Arco and Tenneco Oil Company	Neural networks used to help pinpoint oil and gas deposits
Government	Internal Revenue Service	Software used to read tax returns and spot fraud
Human services	Merced County, California	Expert systems used to decide if applicants should receive welfare benefits
Marketing	Spiegel	Neural networks used to determine most likely buyers from a long list
Telecommunications	BT Group	Heuristic search used for a scheduling application that provides work schedules for more than 20,000 engineers
Transportation	American Airlines	Expert systems used to schedule the routine maintenance of airplanes
Inventory/forecasting	Hyundai Motors	Neural networks and expert systems used to reduce delivery time by 20 percent and increase inventory turnover from 3 to 3.4
Inventory/forecasting	SCI Systems	Neural networks and expert systems used to reduce on-hand inventory by 15 percent, resulting in $180 million in annual savings
Inventory/forecasting	Reynolds Aluminum	Neural networks and expert systems used to reduce forecasting errors by 2 percent, resulting in an inventory reduction of 1 million pounds
Inventory/forecasting	Unilever	Neural networks and expert systems used to reduce forecasting errors from 40 to 25 percent, resulting in a multimillion-dollar savings

Robots

- Most successful application of AI
  - Excel at performing simple, repetitive tasks
  - Free workers from tedious or hazardous jobs

- Personal robots have limited mobility, vision, and speech capabilities
  - Often used as prototypes to test certain services
- Advantages of robots in the workplace
  - No interpersonal or personnel issues
  - Consistency
  - Can function in dangerous environments

- Watch: https://www.youtube.com/watch?v=QdQL11uWWcI
- Watch: https://www.youtube.com/watch?v=wGWVKkYEHBE
- Watch: https://www.youtube.com/watch?v=8_lfxPI5ObM
- Watch: https://www.youtube.com/watch?v=fn3KWM1kuAw
- Watch: https://www.youtube.com/watch?v=EezdinoG4mk

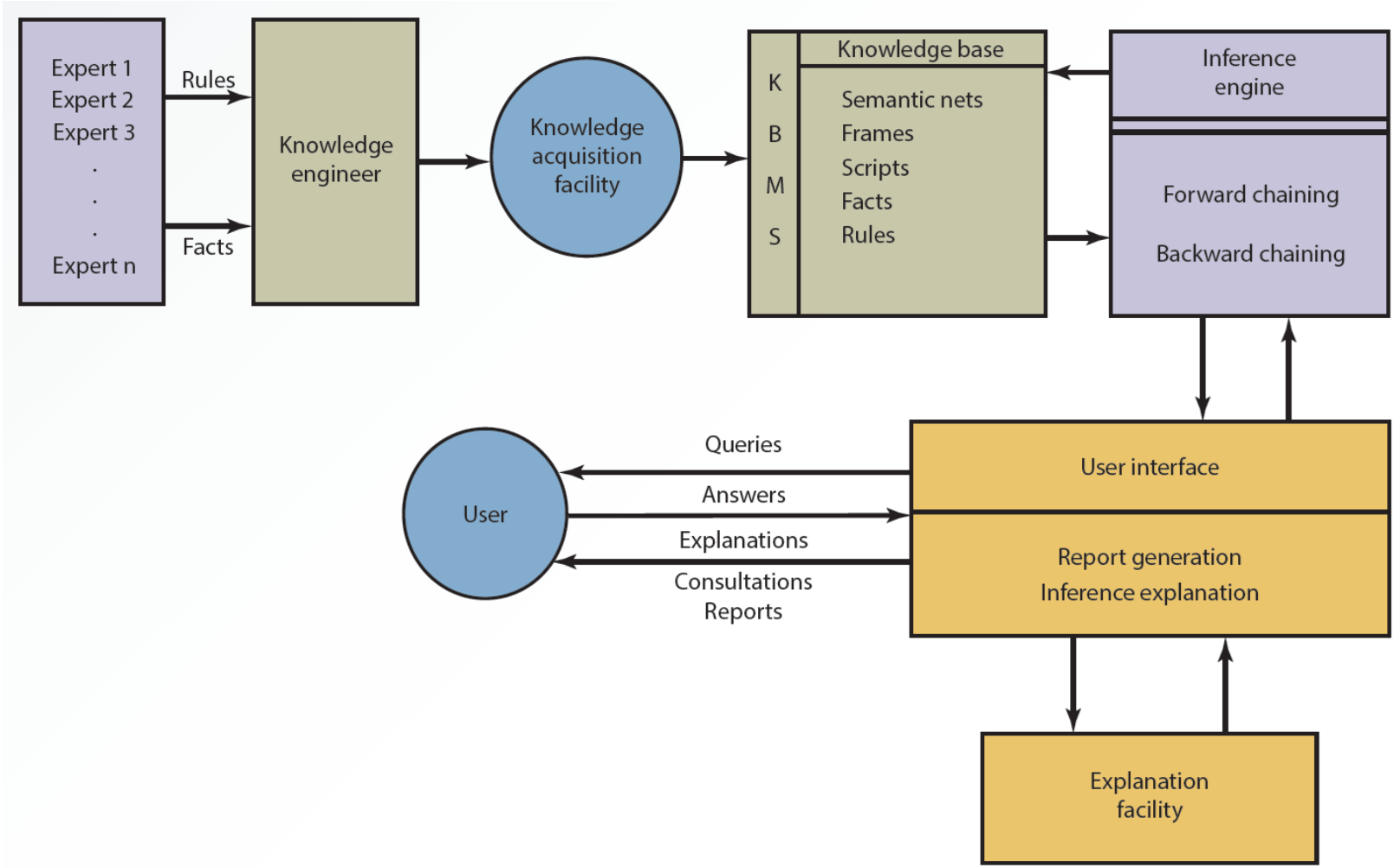
Expert Systems

- Programs that mimic human expertise in a specific area human experts have solved successfully
- To be successful, must be applied to tasks that human experts have already handled
  - Tasks in medicine, geology, education, and oil exploration
- Also used in search engines to better understand users' queries

- Work with heuristic data
  - Heuristic data encourages applying knowledge based on experience to find a solution to a problem

- Airline industry
- Forensics lab work
- Banking and finance
- Education
- Agriculture and food industry
- Personnel management
- Security and U.S. government

Exhibit 13.1 An Expert System Configuration



Components of an Expert System (1 of 4)

- Knowledge acquisition facility
  - Software package with manual or automated methods for acquiring and incorporating new rules and facts
  - Enables growth of an expert system
- Knowledge base
  - Similar to a database
  - In addition to storing facts and figures, keeps track of associated rules and explanations
    - Factual knowledge
    - Heuristic knowledge
    - Meta-knowledge

Components of an Expert System (2 of 2)

- Knowledge base management system (KBMS)
  - Similar to a DBMS
  - Used to keep the knowledge base updated, with changes to facts, figures, and rules
- User interface
  - Provides user-friendly access to the expert system
- Explanation facility
  - Explains to end users how recommendations are derived
- Inference engine
  - Similar to the model base component
  - Uses techniques such as forward and backward chaining to manipulate a series of rules
    - Forward chaining: series of “if-then-else” condition pairs is performed
    - Backward chaining: starts with the goal and backtracks to find the right solution

Case-Based Reasoning

- Case-based reasoning (CBR) is a problem-solving technique
  - Matches a new case with a previously solved case and its solution
    - Both stored in a database
  - Offers a solution after searching for a match
  - A human expert is required to solve the problem if CBR fails to find a match

Intelligent Agents

- Software capable of reasoning and following rule-based processes
  - Popular in e-commerce
- Other names
  - Bots
  - Virtual agents (VAs)
  - Intelligent virtual agents (IVAs)

Applications of intelligent agents

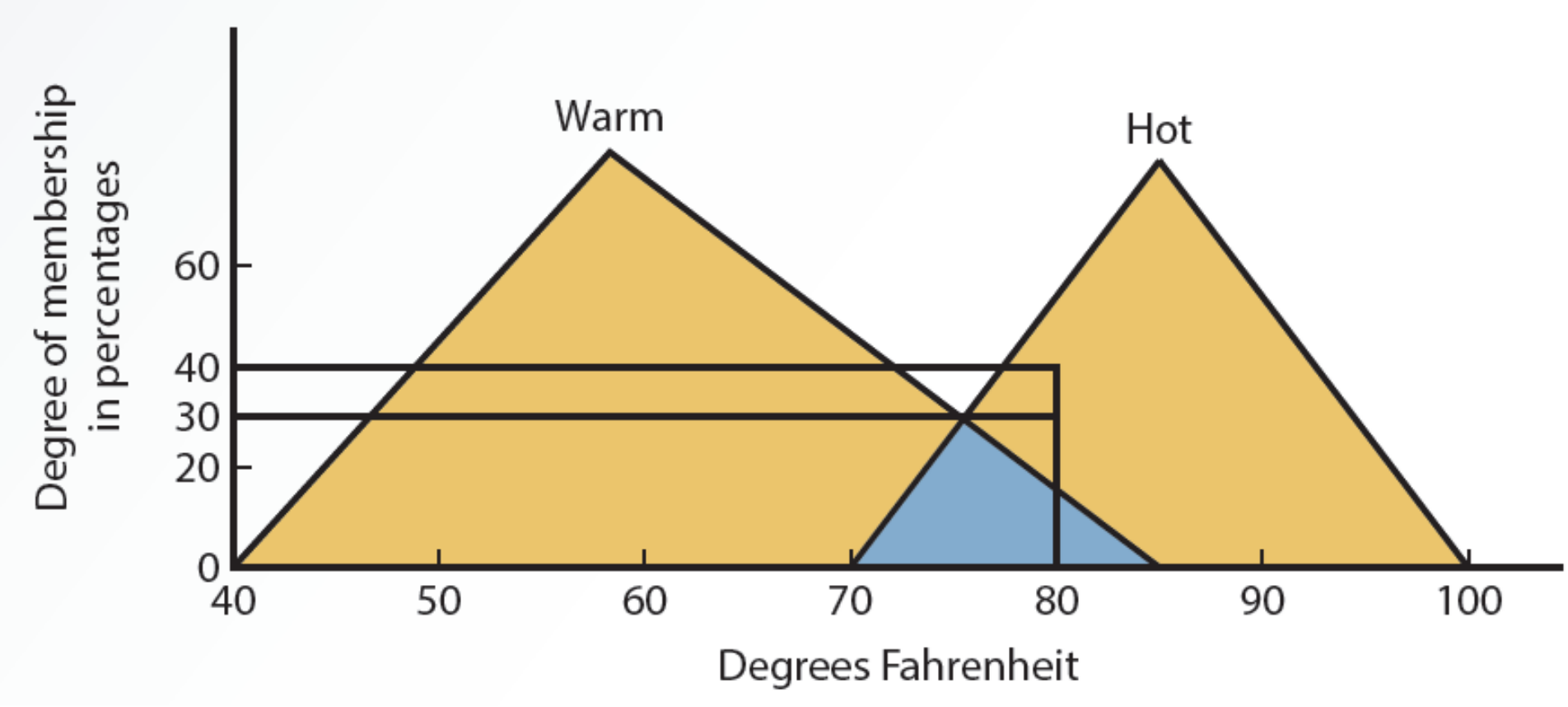
- Web marketing
  - Collect information about customers and use it to better market products and services
- Shopping and information agents
  - Help users navigate through vast resources available on the Web and provide better results in finding information
  - Serve as search engines, site reminders, or personal surfing assistants
- Personal agents
  - Perform specific tasks for a user, such as remembering information for filling out Web forms
- Data mining agents
  - Work with a data warehouse
  - Detect trends and discover information and relationships among data items that were not readily apparent
- Monitoring and surveillance agents
  - Track and report on computer equipment and network systems to predict when a system crash or failure might occur

Fuzzy Logic

- Allows a smooth, gradual transition between human and computer vocabularies
  - Deals with variations in linguistic terms by using a degree of membership in a set
  - Designed to help computers simulate vagueness and uncertainty in common situations
  - Allows computers to reason similarly to humans

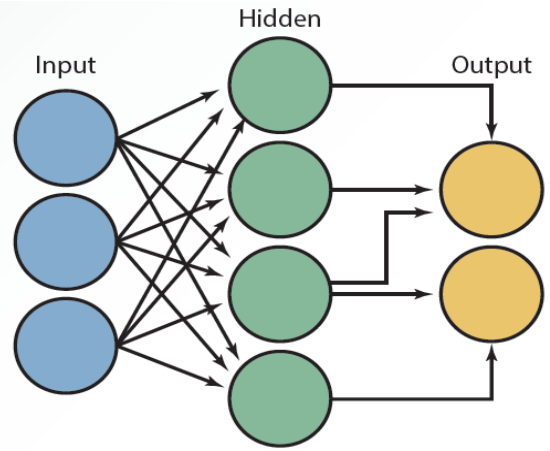
- Watch: https://www.youtube.com/watch?v=__0nZuG4sTw

Exhibit 13.3 Degree of Membership in a Fuzzy System



Machine Learning

- Process and procedure by which knowledge is gained through experience
  - Several applications
    - Social media and identifying faces in photos
    - Recognizing commands spoken into smartphones
    - Designing intelligent robots
    - Artificial neural networks (ANNs)



- Artificial neural networks (ANNs)
  - Learn and are capable of performing tasks difficult with conventional computers
  - Used for poorly structured problems
  - Cannot supply an explanation for the solution
    - Use patterns instead of the if-then-else rules used by expert systems
  - Create a model based on input and output

Genetic Algorithms

- Form of AI mainly used to find solutions to optimization and search problems
- Algorithms that mimic the process of natural evolution
  - Generate solutions to optimization
    - Find the combination of inputs that generates the most desirable outputs
  - Examine search problems using mutation, selection, crossover, and chromosome techniques

Watch: https://www.youtube.com/watch?v=uQj5UNhCPuo

Natural-Language Processing

- Developed so that users can communicate with computers in human language
  - Provides a question-and-answer setting that is natural and easier for people to use
    - Useful with databases
- Disadvantage
  - Complexity of the human language renders the development of NLP systems difficult

  - Watch: https://www.youtube.com/watch?v=fOvTtapxa9c

Computer Vision

- a field of artificial intelligence that trains computers to interpret and understand the visual world
  - Watch: https://www.youtube.com/watch?v=-4E2-0sxVUM

AI and Automation

- Robotic process automation (RPA) refers to the process of automated machines taking over everyday human tasks, such as cooking and checking inventory.
- As RPA grows, corresponding human jobs are eliminated leading to unemployment concerns.
- However, the resulting economic growth from RPA is expected to provide new employment opportunities for workers who are displaced by RPA.

- Watch: https://www.youtube.com/watch?v=9URSbTOE4YI

Ethical Issues of AI

- Before implementing an AI system, organizations should establish an ethical framework
  - Define the AI goals
  - Define the complexity of the problem
  - Define the environment as being stable or variable
  - Define and guard against bias
  - Define the level of human involvement
- Five major issues
  - AI bias
  - AI mistakes
  - Wealth inequality
  - Impact on humanity
  - Impact on unemployment

Knowledge Check Activity 1-1

Which of the following is an application of artificial intelligence?

a. Predicting sales at a future date

b. Training employees to operate a crane in practice

c. Harvesting farm produce

d. Authorizing paychecks to employees

Knowledge Check Activity 1-1: Answer

Which of the following is an application of artificial intelligence?

Answer: a. Predicting sales at a future date

Artificial intelligence is capable of accepting a large volumes of data and creating forecasting models to predict the outcome on a given point in time.

Polling Activity 1-1

It’s time to take a poll! Get your devices ready and open your [Kahoot] app. You can join the poll using this link/PIN: [enter link or PIN]

An adaptive cruise control system in a vehicle adjusts the vehicle speed based on traffic speed immediately ahead. Which component of an expert system primarily controls its operation?

a. Knowledge base
b. User interface
c. Forward chaining
d. Backward chaining

Polling Activity 1-1: Answer

An adaptive cruise control system in a vehicle adjusts the vehicle speed based on traffic speed immediately ahead. Which component of an expert system primarily controls its operation?

Answer: c. Forward chaining

Forward chaining determines the output signals using predefined conditions. An adaptive cruise control needs to adjust the vehicle speed based on conditions related to traffic speed.

Discussion Activity 1-1

You are setting up a movie rating system, where the average ratings (out of 10) of a movie is used to classify the movie as “good”, “ok”, or “bad”.

Discuss with your classmates a possible scheme and methodology that you can apply to this system.

Discussion Activity 1-1: Answer

You are setting up a movie rating system, where the average ratings (out of 10) of a movie is used to classify the movie as “good”, “ok”, or “bad”.

Answer: Classify based on rating value using fuzzy logic

Explanation: Fuzzy logic prevents sudden jumps from one category to another (e.g. “ok” to “good”) at small increments of the rating, and instead considers the weight of each category on the rating to determine the output category.

Self Assessment

At your local library, the management is trying to predict the flow of people in and out at certain times over the year. The flow can vary over the year and are not usually repetitive every week. The management wants to employ artificial intelligence to make these predictions.

Discuss the steps involved in generating a prediction. What data needs to be collected? What technique should be used to extract predictions using the data?

Summary (1 of 2)

Now that the lesson has ended, you should be able to:

13.1 Define artificial intelligence and explain how AI technologies support decision making

13.2 Describe an expert system, its applications, and its components

13.3 Describe case-based reasoning, including the four Rs involved in its design and implementation

13.4 Summarize each of the four types of intelligent agents and how they are used

13.5 Describe fuzzy logic and its uses

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Summary (2 of 2)

Now that the lesson has ended, you should be able to:

13.7 Describe how genetic algorithms are used

13.8 Explain natural-language processing and its major categories

13.9 Describe the five benefits of integrating AI technologies into decision support systems

13.10 Explain contextual computing

13.11 Explain the AI impacts on automation

13.12 Describe the ethical issues of AI