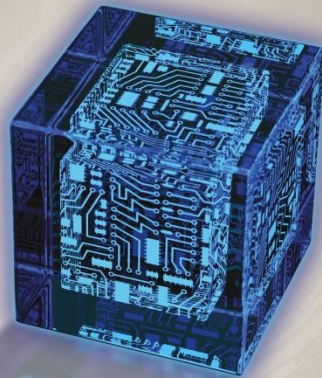


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MANAGEMENT INFORMATION SYSTEMS



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13

Intelligent Information Systems

Learning Objectives (1 of 2)

- Define artificial intelligence, and explain how AI technologies support decision making
- Describe an expert system, its applications, and its components
- Describe case-based reasoning
- Summarize the types of intelligent agents and how they are used

Learning Objectives (2 of 2)

- Describe fuzzy logic and its uses
- Explain artificial neural networks
- Describe how genetic algorithms are used
- Explain natural-language processing and its advantages and disadvantages
- Summarize the advantages of integrating AI technologies into decision support systems
- Explain contextual computing

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

AI Technologies Supporting Decision Making

- Decision makers use information technologies in decision-making analyses
 - What-is: used in transaction-processing systems and management information systems
 - What-if: used in decision support systems and to answer questions such as why, what it means, what should be done, and when should it be done

Field	Organization	Applications
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

Field	Organization	Applications
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 percent to 25 percent, resulting in a multimillion-dollar savings

Robots (1 of 3)

- Most successful application of AI
 - Excel at performing simple, repetitive tasks
 - Used to free workers from tedious or hazardous jobs
 - Have limited mobility and some have limited vision
 - Controlled by a computer program that includes commands

Robots (2 of 3)

- Programming languages
 - Variable Assembly Language (VAL)
 - Functional Robotics (FROB)
 - A Manufacturing Language (AML)
- Personal robots have limited mobility, vision, and speech capabilities
 - Currently used as prototypes to test certain services

Robots (3 of 3)

- Soft robots: simpler to make and cost less
 - Applications
 - High-speed food handling
 - Precise pick and place
 - Adaptive grasping
 - Warehouse logistics
 - Advanced assembly
 - Medical field

Expert Systems (1 of 2)

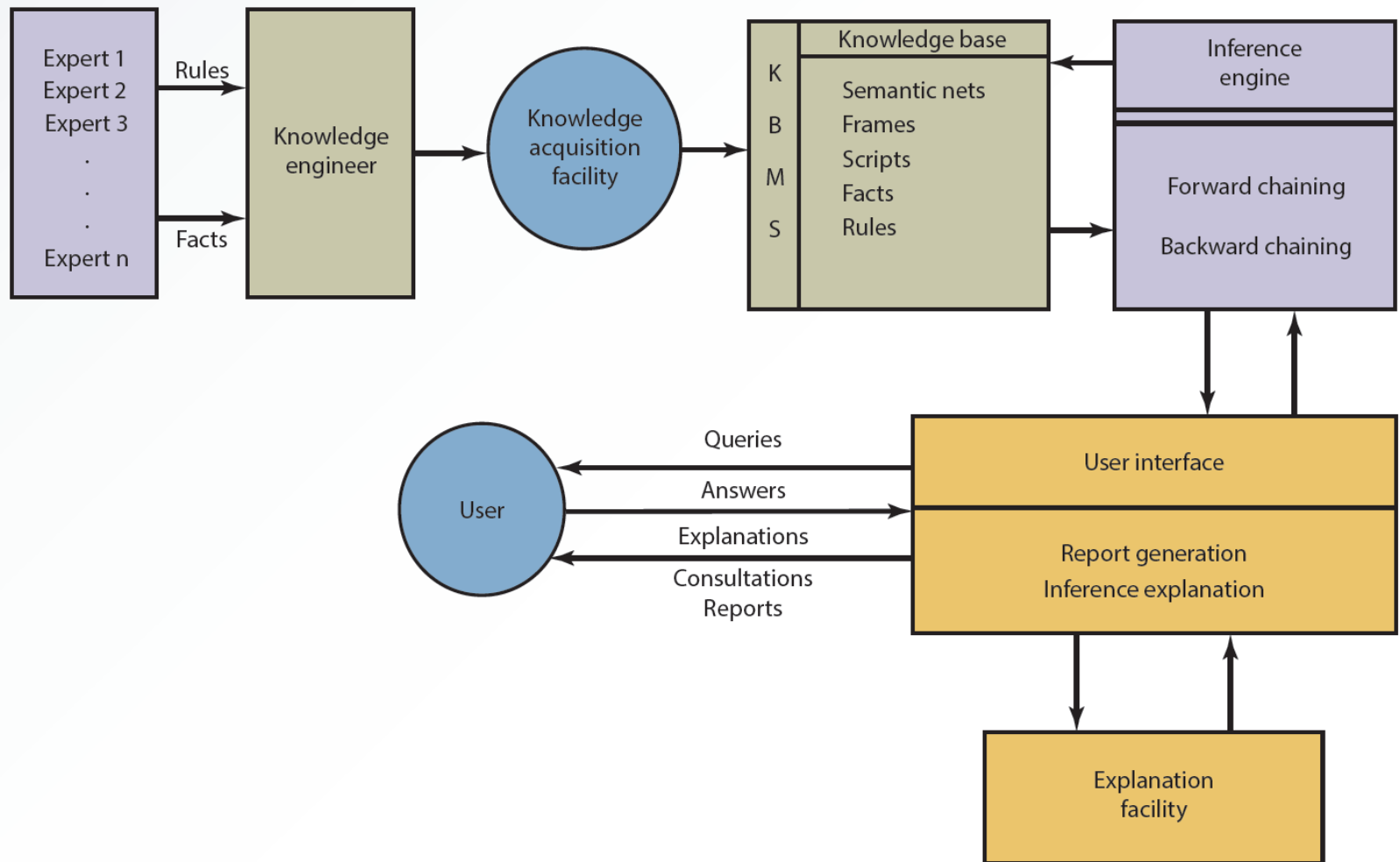
- Mimic human expertise in a field to solve a problem in a well-defined area
 - Must be applied to activities that human experts have already handled to be successful
 - Used in search engines to better understand users' queries

Expert Systems (2 of 2)

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

Exhibit

13.1 An Expert System Configuration



Components of an Expert System (1 of 5)

- Knowledge acquisition facility
 - Software package with manual or automated methods for acquiring and incorporating new rules and facts
 - Enables growth of an expert system

Components of an Expert System (2 of 5)

- Knowledge base
 - Similar to a database
 - Keeps track of rules and explanations associated with facts in addition to storing facts
 - Factual knowledge
 - Heuristic knowledge
 - Meta-knowledge

Components of an Expert System (3 of 5)

- 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

Components of an Expert System (4 of 5)

- Explanation facility
 - Performs tasks similar to what a human expert does by explaining to end users how recommendations are derived
- Inference engine
 - Similar to the model base component
 - Uses different techniques (e.g., forward and backward chaining) to manipulate a series of rules

Components of an Expert System (5 of 5)

- Forward chaining
 - Series of “if-then-else” condition pairs is performed
 - “If” condition is evaluated first, then the corresponding “then-else” action is executed
- Backward chaining
 - Expert system starts with the goal and backtracks to find the right solution

Uses of Expert Systems

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

Criteria for Using Expert Systems

- Extensive human expertise is needed
 - Can be represented as rules or heuristics
- Decision or task has already been handled successfully by human experts
 - Requires consistency and standardization
 - Involves many rules and complex logic
- Subject domain is limited
 - Experts in the organization are scarce

Criteria for Not Using Expert Systems

- Presence of few rules or too many rules
- Involvement of well-structured numerical problems and broad range of topics but not many rules
- Disagreement among experts
- Requirement for human expertise

Advantages of Expert Systems

- Never become distracted, forgetful, or tired
- Duplicate and preserve expertise of scarce experts
- Preserve expertise of employees who are retiring or leaving
- Create consistency in decision making
- Improve decision-making skills of nonexperts

Case-Based Reasoning (1 of 2)

- 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

Case-Based Reasoning (2 of 2)

- Design and implementation involves four Rs
 - Retrieve
 - Reuse
 - Revise
 - Retain

Intelligent Agents (1 of 6)

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

Intelligent Agents (2 of 6)

- Characteristics of intelligent agents
 - Adaptability
 - Autonomy
 - Collaborative behavior
 - Humanlike interface
 - Mobility
 - Reactivity

Intelligent Agents (3 of 6)

- Applications of intelligent agents
 - Web marketing
 - Collect information about customers and use it to better market products and services
 - Virtual catalogs
 - Smart or interactive catalogs
 - Display product descriptions based on customers' previous experiences and preferences

Intelligent Agents (4 of 6)

- 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

Intelligent Agents (5 of 6)

- Personal agents
 - Perform specific tasks for a user, such as remembering information for filling out Web forms

Intelligent Agents (6 of 6)

- 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

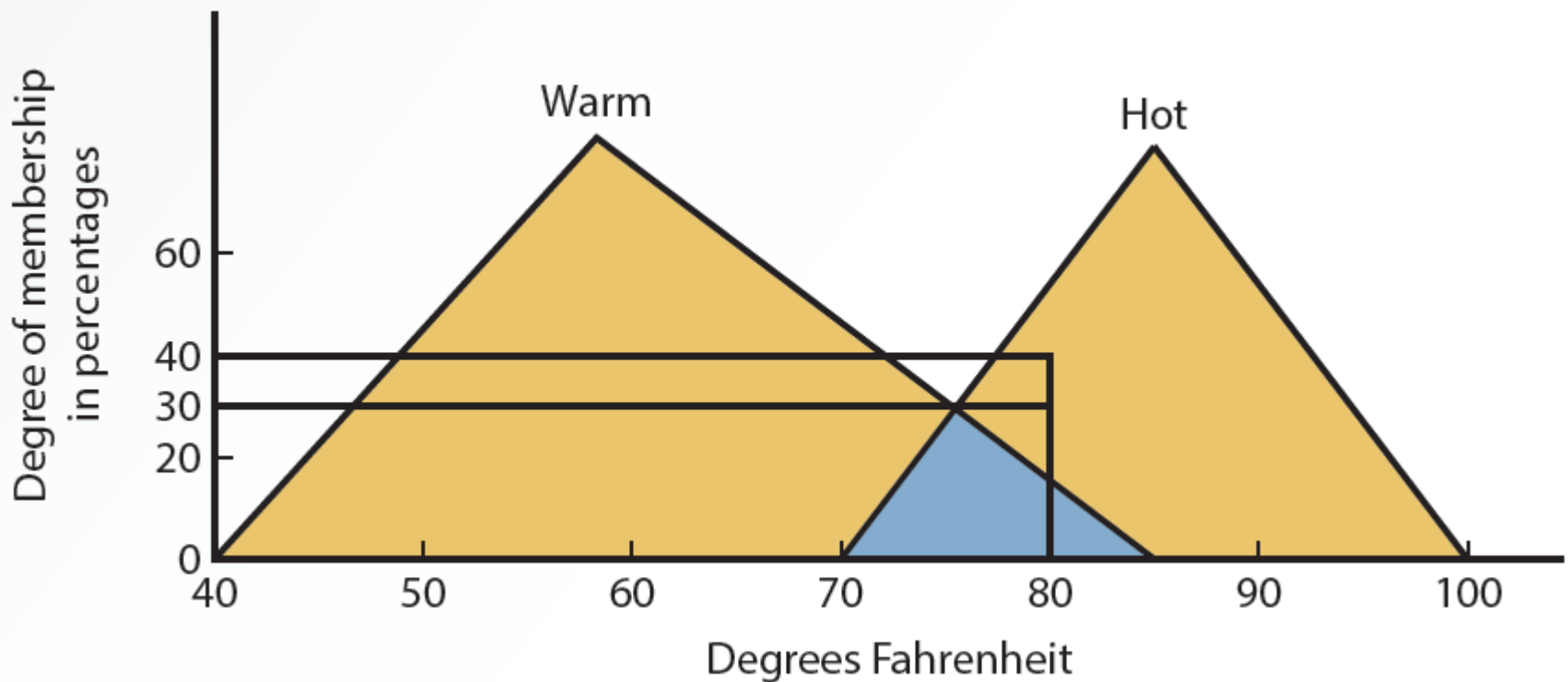
- Allows a smooth, gradual transition between human and computer vocabularies
 - Deals with variations in linguistic terms by using a degree of membership in a set
 - Designed to help computers simulate vagueness and uncertainty in common situations
 - Allows computers to reason similar to humans

Uses of Fuzzy Logic

- Used in several areas
 - Search engines
 - Chip design
 - Database management systems
 - Software development
 - Appliances

Exhibit

13.3 Degree of Membership in a Fuzzy System



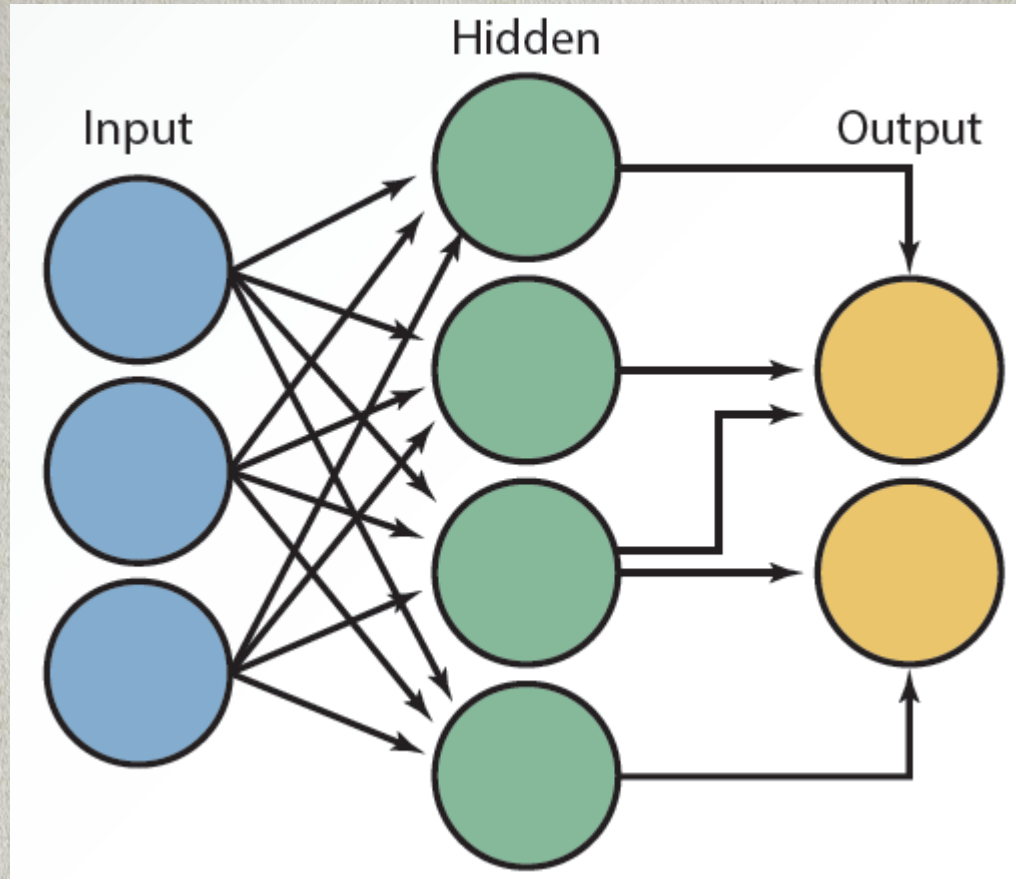
Machine Learning (1 of 3)

- 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)

Machine Learning (2 of 3)

- Artificial neural networks (ANNs)
 - Learn and are capable of performing tasks that are 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

13.4 Artificial Neural Network Configuration



Machine Learning (3 of 3)

- Tasks that involve the use of ANNs
 - Bankruptcy prediction
 - Credit rating
 - Investment analysis
 - Oil and gas exploration
 - Target marketing
 - Computer and network security

Genetic Algorithms

- Search algorithms that mimic the process of natural evolution
 - Generate solutions to optimization
 - Find the combination of inputs that generates the most desirable outputs
 - Search problems using mutation, selection, crossover, and chromosome techniques

Natural-Language Processing (1 of 3)

- 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

Natural-Language Processing (2 of 3)

- Categories
 - Interface to databases
 - Machine translation
 - Text scanning and intelligent indexing programs
 - Generating text for automated production of standard documents
 - Speech systems for voice interaction with computers

Natural-Language Processing (3 of 3)

- Activities performed
 - Interfacing
 - Accepting human language as input
 - Carrying out the corresponding command
 - Generating the necessary output
 - Knowledge acquisition
 - Using the computer to read large amounts of text, understand the information, and summarize important points

Integrating AI Technologies into Decision Support Systems (1 of 2)

- AI-related technologies can improve the quality of decision support systems (DSSs)
 - Result in integrated or intelligent DSSs (IDSSs)
 - Add explanation capabilities by integrating expert systems
 - Add learning capabilities by integrating ANNs
 - Create a user-friendly interface by integrating an NLP system

Integrating AI Technologies into Decision Support Systems (2 of 2)

- Benefits of integrating expert systems into the database component of a DSS
 - Adding deductive reasoning to traditional DBMS functions
 - Improving access speed and database creation and maintenance
 - Adding capability to handle uncertainty and fuzzy data
 - Simplifying query operations

Contextual Computing: Making Mobile Devices Smarter

- Computing environment that is always present
 - Capable of feeling surroundings and offering recommendations based on who we are, where we are, and whom we are with
 - Based on the principle that computers can both sense and react to their environments

Summary

- Artificial intelligence technologies
 - Apply computers to areas that require knowledge, perception, reasoning, understanding, and cognitive abilities
 - Robotics, expert systems, fuzzy logic systems, intelligent agents, artificial neural networks, natural-language processing, etc.
- Context-aware applications
 - Include smartphones and Facebook

