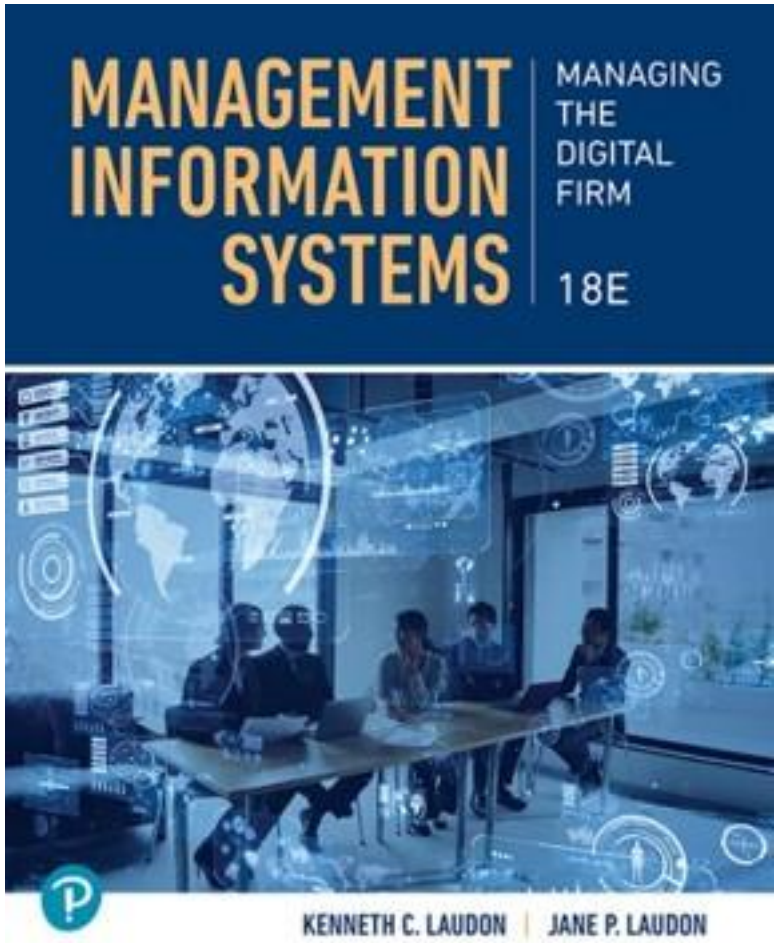
Management Information Systems: Managing the Digital Firm

Eighteenth Edition



Chapter 11

Artificial Intelligence

Learning Objectives (1 of 2)

11.1 Understand artificial intelligence.

11.2 Describe machine learning.

11.3 Describe neural networks and deep learning.

11.4 Discuss generative AI.

11.5 Discuss intelligent agents.

11.6 Understand natural language processing.

11.7 Understand computer vision systems.

Learning Objectives (2 of 2)

11.8 Describe robots.

11.9 Discuss genetic algorithms.

11.10 Discuss expert systems.

11.11 Describe fuzzy logic systems.

11.12 Understand the challenges of AI.

11.13 Understand how the information in this chapter can help your career.

Understand Artificial Intelligence
(1 of 2)

- Artificial intelligence (AI) systems have made great strides in their ability to perform tasks normally requiring human intelligence, such as
  - Speech recognition
  - Visual perception
  - Recognizing patterns
  - Making predictions
  - Writing essays
  - Learning from past experience

Understand Artificial Intelligence
(2 of 2)

- AI and human intelligence differ in their ability to adapt to new situations
  - AI systems are designed to perform specific tasks and are optimized for those tasks
    - Can learn to perform new tasks but require significant amount of training to do so
- AI systems have made significant strides in natural language processing technology that gives computers the ability to interpret, manipulate, and comprehend human language
  - Still struggle to understand the nuances of human language and the context in which itis used

Major Types of AI Technologies

- Major branches of AI
  - Machine learning
  - Neural networks and deep learning
  - Genetic algorithms
  - Natural language processing
  - Computer vision systems
  - Robotics
  - Intelligent agents
  - Expert systems
  - Fuzzy logic

Describe Machine Learning (1 of 2)

- Machine learning
  - Uses mathematical models that help a computer learn from large quantities of data and make statistical inferences without much explicit instruction
  - Enables a computer system to continue learning and improving on its own
  - Trained on large sets of data

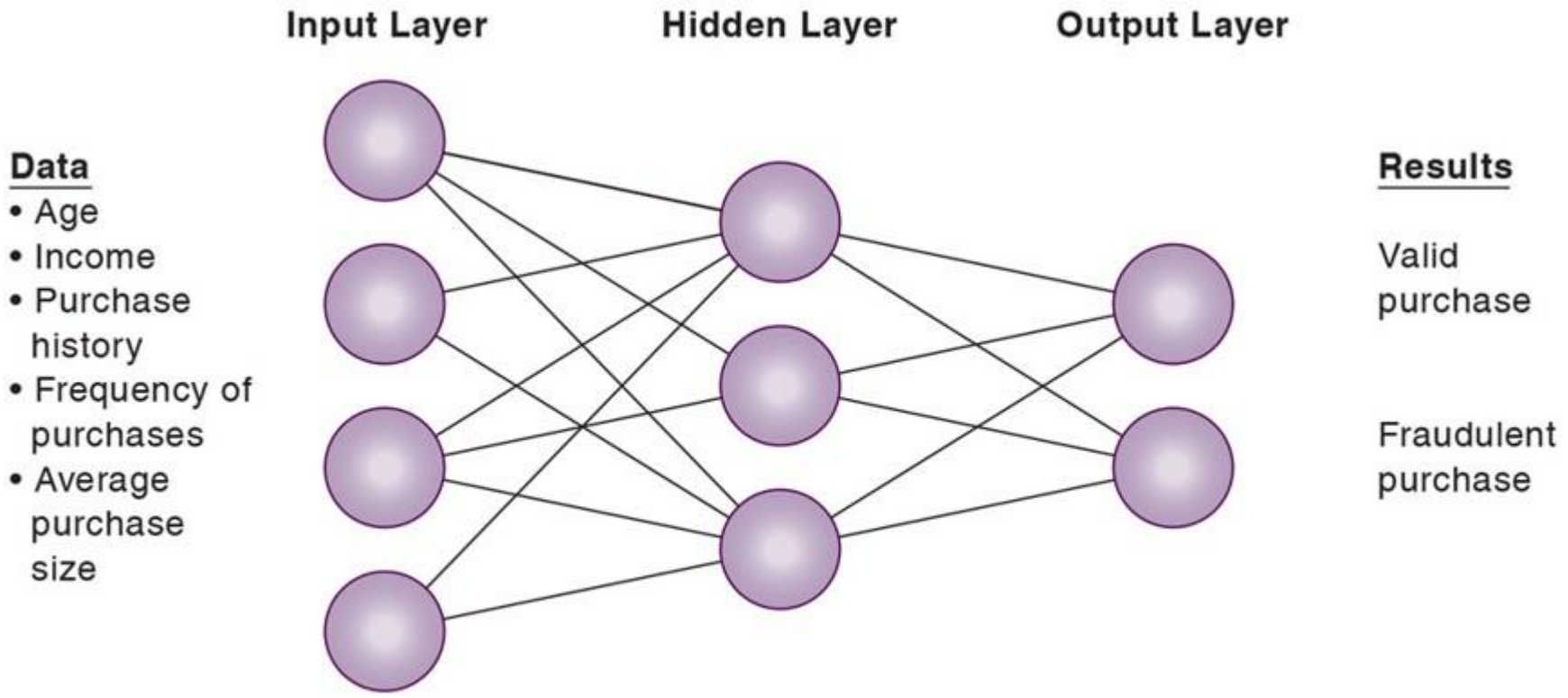
Describe Machine Learning (2 of 2)

- Supervised learning
  - System “trained” by providing examples of desired inputs and outputs identified by humans in advanced
  - One technique used to develop autonomous vehicles
- Unsupervised learning
  - Same procedures as used with supervised learning, but humans do not provide examples

Describe Neural Networks and Deep Learning (1 of 3)

- Neural networks
  - Find patterns and relationships in massive amounts of data too complicated for humans to analyze
  - Learn patterns by searching for relationships, building models, and correcting over and over again
  - Humans “train” network by feeding it data inputs for which outputs are known, to help neural network learn solution by example from human experts
  - Used in medicine, science, and business for problems in pattern classification, prediction, financial analysis, and control and optimization

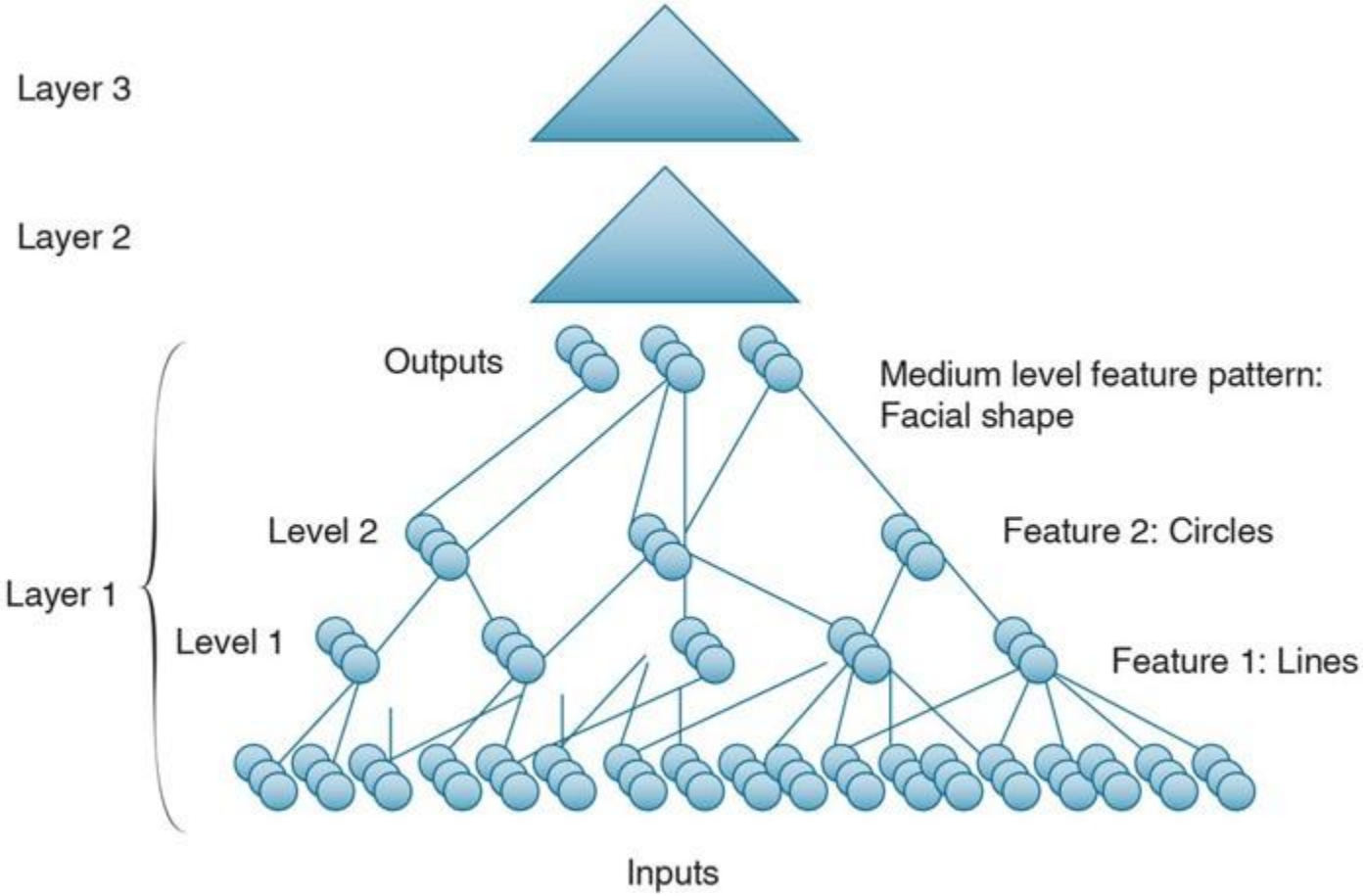
Figure 11.1 How a Neural Network Works



Describe Neural Networks and Deep Learning (2 of 3)

- Deep learning neural network
  - More complex, with many layers of transformations of input data to produce target output
  - Used almost exclusively for pattern detection on unlabeled data (unsupervised learning)
  - Deep learning algorithms are powering many GenAI models

Figure 11.2 A Deep Learning Neural Network



Describe Neural Networks and Deep Learning (3 of 3)

- Examples of neural networks and deep learning applications include
  - Computer vision
  - Speech recognition
  - Machine controls, diagnostics
  - Language translation
  - Transaction analysis
  - Targeted online ads

Discuss Generative AI

- Generative AI (GenAI)
  - A machine learning model that is trained to generate content
  - Can identify patterns and structures within existing data to produce new and original content
  - GenAI starts with a prompt that could be in the form of text, an image, a video, a design, musical notes, or any input that the AI system can process
    - Various AI algorithms then return new content in response to the prompt.

Foundation Models, Large Language Models, and Transformers (1 of 3)

- Foundation model
  - Underlying model that enables GenAI to work
  - Uses powerful neural networks designed to mimic the human brain; “learns” by finding patterns in existing data sets
- Large language models (LLM)
  - a foundation model trained on immense amounts of unstructured data covering many topics

Foundation Models, Large Language Models, and Transformers (2 of 3)

- Transformer
  - A transformer is a key component of foundation models
    - For instance, GPT in ChatGPT stands for generative pre-trained transformer
  - Transformers are a type of neural network architecture that transforms or changes an input sequence into an output sequence

Foundation Models, Large Language Models, and Transformers (3 of 3)

- GenAI tools
  - ChatGPT
  - Microsoft Copilot
  - Google Gemini
  - DALL-E

Discuss Intelligent Agents

- Intelligent agent
  - Software program that works in the background without direct human intervention
  - Carries out specific tasks for an individual user, business process, or software application
    - Smart thermostats
    - Driverless cars
    - Virtual assistants
    - Chatbots
    - Spam filters

Understand Natural Language Processing

- Natural language processing (NLP)
  - Makes it possible for a computer to analyze natural language—language that humans instinctively use
    - Can process voice or text command using natural human language
  - Examples: Google search; spam filtering systems; text mining sentiment analysis; customer call center interactions

Understand Computer Vision Systems

- Computer vision system
  - Uses machine learning and deep learning neural networks to emulate the human visual system to view and extract information from real-world images
  - Autonomous vehicles (drones and self-driving cars)
  - Industrial machine vision systems (e.g., inspecting bottles)
  - Military applications
  - Robotic tools

Robotics (1 of 2)

- Robotics
  - Deals with the design, construction, and operation of movable machines to substitute for humans
  - Control, sensory feedback, and information processing
- Robotic applications
  - Commercially available applications include the use of AIto enable robots to sense and respond to their environment
  - Most widespread use of robotic technology has been in manufacturing and logistics

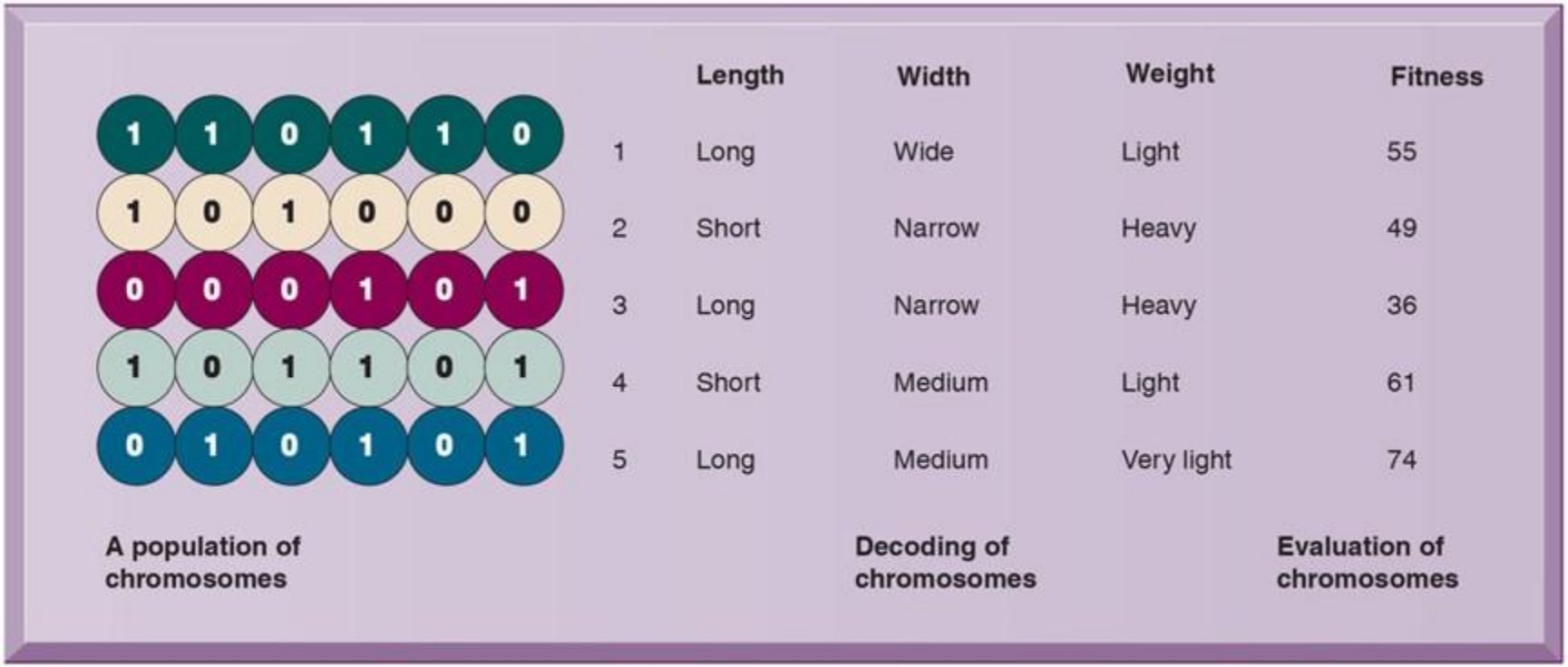
Robotics (2 of 2)

- Types of robots
  - Industrial robots
  - Collaborative robots (cobots)
  - Service robots
  - Humanoid robots
  - Medical robots
  - Drones
  - Autonomous cars

Discuss Genetic Algorithms

- Genetic algorithm
  - Another form of machine learning
  - Useful for finding the optimal solution for a specific problem
    - By examining a very large number of alternative solutions to that problem
  - Works by searching a population of randomly generated strings of binary digits to identify the string representing the best possible solution for the problem

Figure 11.3 The Components of a Genetic Algorithm



	Length	Width	Weight	Fitness
1	Long	Wide	Light	55
2	Short	Narrow	Heavy	49
3	Long	Narrow	Heavy	36
4	Short	Medium	Light	61
5	Long	Medium	Very light	74

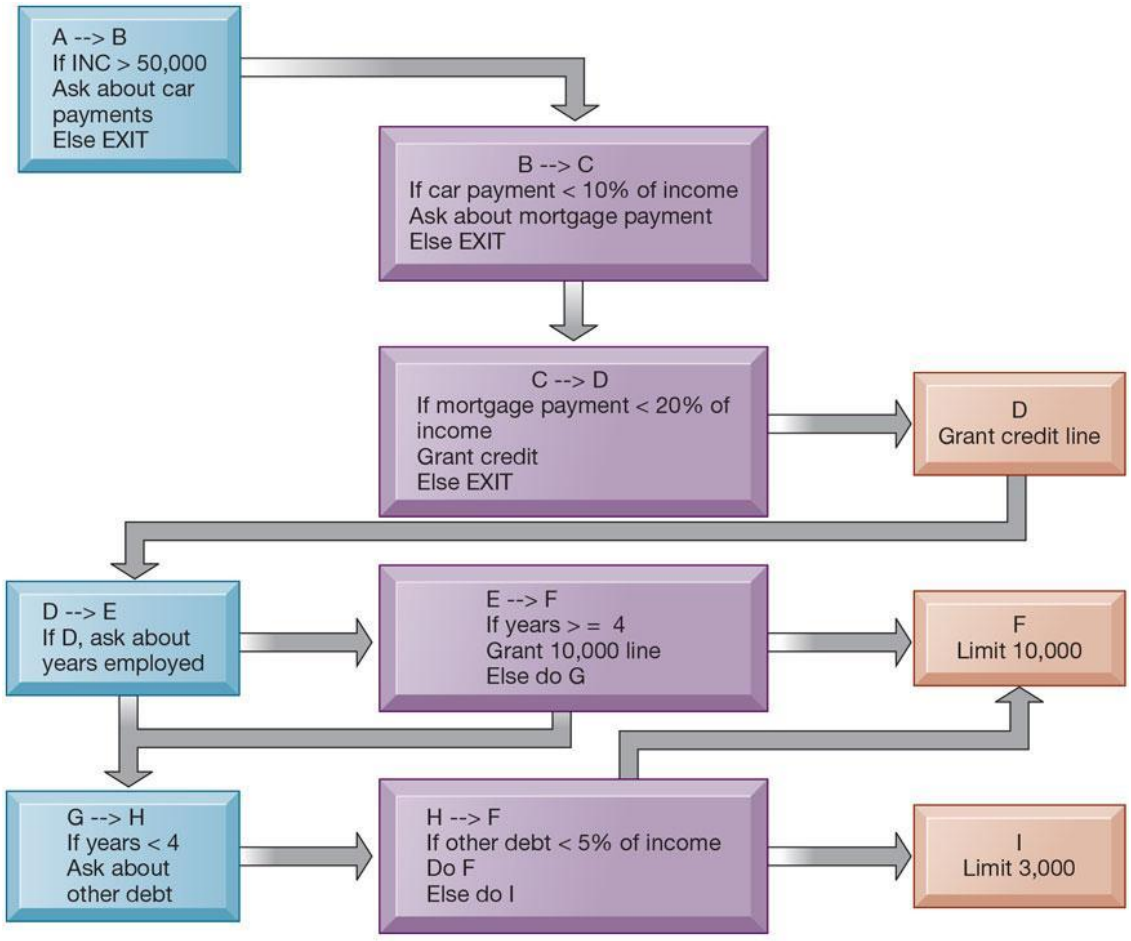
Decoding of chromosomes

Evaluation of chromosomes

Discuss Expert Systems

- Expert system
  - Captures the knowledge of individual experts in an organization and represents that knowledge as sets of rules
  - Often used when human expertise is critical and rules are well-understood

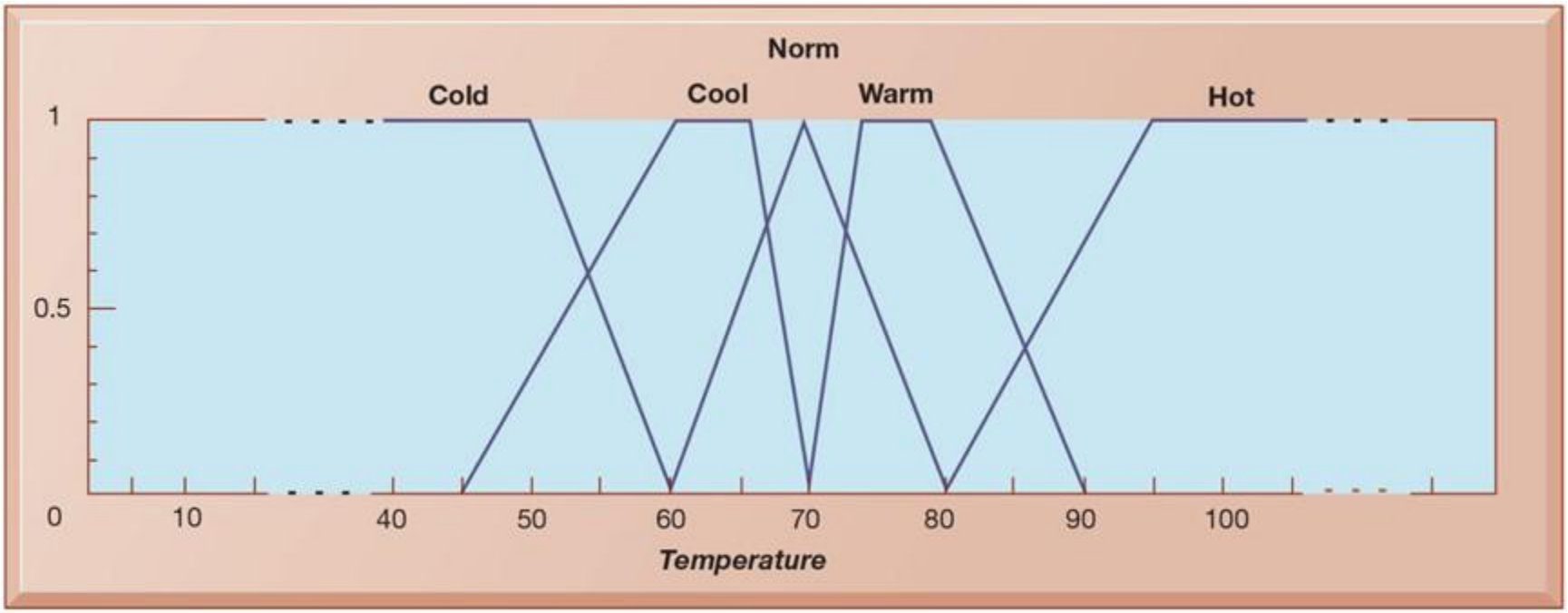
Figure 11.4 Rules in an Expert System



Describe Fuzzy Logic Systems

- Fuzzy logic
  - A form of AI that imitates human reasoning and cognition
  - Can describe a particular phenomenon or process linguistically and then represent that description in a small number of flexible rules

Figure 11.5 Fuzzy Logic for Temperature Control



Understand the Challenges of AI
(1 of 2)

- Hallucination
- Lack of transparency
- AI bias
- Cybersecurity problems
- Job loss and inequality

Understand the Challenges of AI
(2 of 2)

- Environmental impact
- Misinformation and disinformation
- Loss of privacy

Copyright and Intellectual Property Challenges

- The development of GenAI challenges the current copyright regimen for protecting intellectual property
  - A primary challenge is defining the level of human involvement required for AI-generated works to qualify for copyright protection
  - Web scraping
    - Often used by AI developers and vendors to “scrape,” or extract, content from publicly available sources on the Internet

Responsible AI

- Responsible AI is a set of practices to ensure that AI is designed, deployed, and used in an ethical and legal way
- These practices lead toward more beneficial and equitable outcomes

Copyright