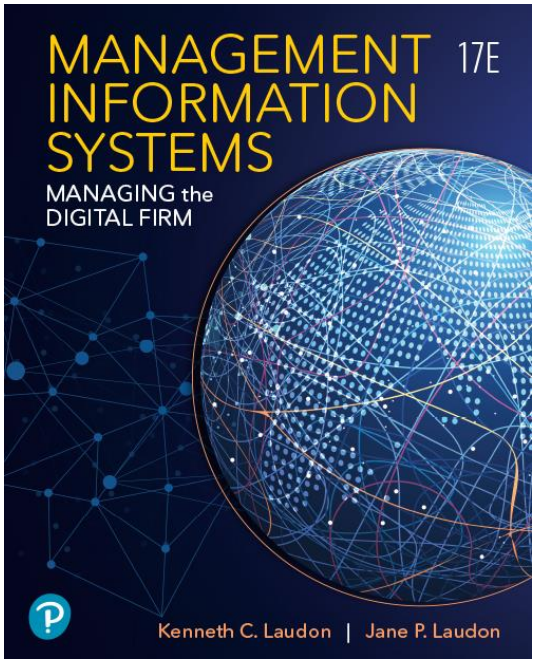
Management Information Systems: Managing the Digital Firm

Seventeenth Edition



Chapter 11

Managing Knowledge and Artificial Intelligence

Learning Objectives

11.1 What is the role of knowledge management systems in business?

11,2 What are artificial intelligence (AI) and machine learning? How do businesses use AI?

11.3 What types of systems are used for enterprise-wide knowledge management, and how do they provide value for businesses?

11.4 What are the major types of knowledge work systems, and how do they provide value for firms?

11.5 How will MIS help my career?

Video Cases

- Case 1: How IBM's Watson Became a Jeopardy Champion
- Case 2: Alfresco: Open Source Document Management and Collaboration

Artificial Intelligence Beats Radiologists in Reading Mammograms (1 of 2)

- Problem
  - High level of information inaccuracy
  - Opportunities from new technology
- Solutions
  - Monitor accuracy and costs
  - Evaluate study results
  - Collect mammograms for system training and testing
  - Train pattern recognition system
  - Compare AI system and human radiologist findings
  - AI pattern recognition system

Artificial Intelligence Beats Radiologist in Reading Mammograms (2 of 2)

- Demonstrates how organizational performance can benefit from using technology such as artificial intelligence to facilitate acquisition and application of knowledge
- Illustrates the ability of AI pattern recognition systems to achieve higher level of accuracy than human radiologists

What is the Role of Knowledge Management Systems in Business?

- Knowledge management systems among fastest growing areas of software investment
- Information economy: production and distribution of information and knowledge a major source of wealth and prosperity
- Substantial part of a firm's stock market value is related to intangible assets: knowledge, brands, reputations, and unique business processes
- Well-executed knowledge-based projects can produce extraordinary ROI

Important Dimensions of Knowledge (1 of 2)

- Data, information, knowledge, and wisdom
- Tacit knowledge and explicit knowledge
- Important dimensions of knowledge
  - Knowledge is a firm asset
  - Knowledge has different forms
  - Knowledge has a location
  - Knowledge is situational

Important Dimensions of Knowledge (2 of 2)

- Knowledge-based core competencies
  - Key organizational assets
- Knowing how to do things effectively and efficiently in ways others cannot duplicate is a prime source of profit and competitive advantage
  - Example: Having a unique build-to-order production system
- Organizational learning
  - Process in which organizations gain experience through collection of data, measurement, trial and error, and feedback

The Knowledge Management Value Chain (1 of 3)

- Knowledge management
  - Set of business processes developed in an organization to create, store, transfer, and apply knowledge
- Knowledge management value chain
  - Each stage adds value to raw data and information as they are transformed into usable knowledge
    - Knowledge acquisition
    - Knowledge storage
    - Knowledge dissemination
    - Knowledge application

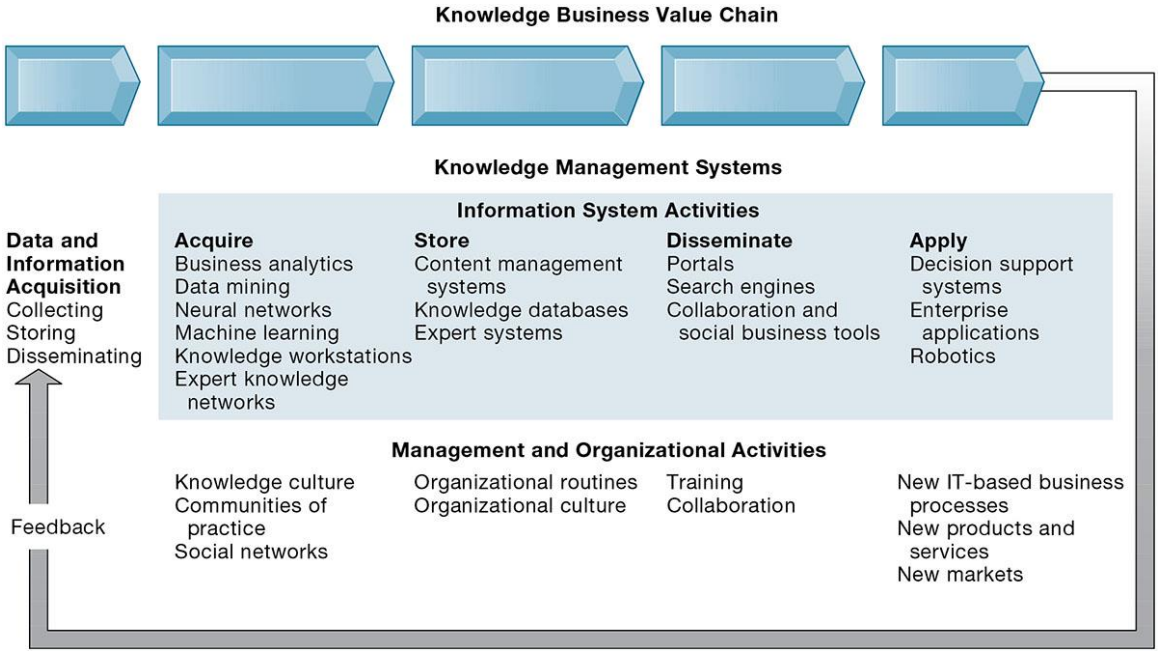
The Knowledge Management Value Chain (2 of 3)

- Knowledge acquisition
  - Documenting tacit and explicit knowledge
    - Storing documents, reports, presentations, best practices
    - Unstructured documents (e.g., e-mails)
    - Developing online expert networks
  - Creating knowledge
  - Tracking data from TPS and external sources
- Knowledge storage
  - Databases
  - Document management systems
  - Role of management

The Knowledge Management Value Chain (3 of 3)

- Knowledge dissemination
  - Portals, wikis
  - E-mail, instant messaging
  - Search engines, collaboration tools
  - A deluge of information
    - Training programs, informal networks, and shared management experience help managers focus attention on important information.
- Knowledge application
  - New business practices
  - New products and services
  - New markets

Figure 11.1 The Knowledge Management Value Chain



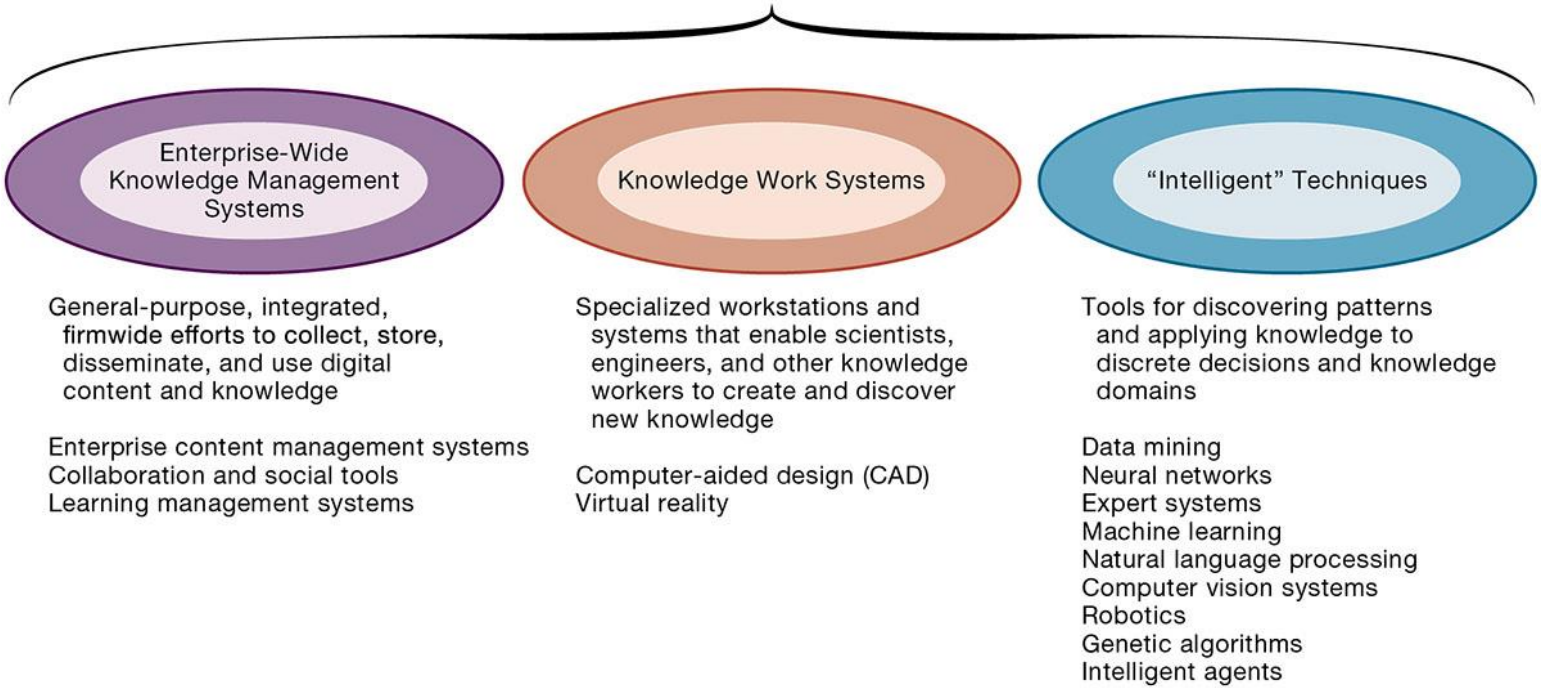
Building Organizational and Management Capital: Collaboration, Communities of Practice, and Office Environments

- Developing new organizational roles and responsibilities for the acquisition of knowledge
- Chief knowledge officer executives; dedicated staff / knowledge managers
- Communities of practice (COPs)
  - Informal social networks of professionals and employees
  - Activities include education, online newsletters, sharing knowledge
  - Reduce learning curves of new employees

Types of Knowledge Management Systems

- Enterprise-wide knowledge management systems
  - General-purpose firm-wide efforts to collect, store, distribute, and apply digital content and knowledge
- Knowledge work systems (KWS)
  - Specialized systems built for engineers, scientists, other knowledge workers charged with discovering and creating new knowledge
- Intelligent techniques
  - Diverse group of techniques, such as data mining, expert systems, machine learning, used for various goals: discovering knowledge, distilling knowledge, discovering optimal solutions

Figure 11.2 Major Types of Knowledge Management Systems



What Is Artificial Intelligence?

- Artificial intelligence (AI): a form of intelligent technique
- Grand vision
  - Computer hardware and software systems that are as “smart” as humans
  - So far, this vision has eluded computer programmers and scientists
- Narrower, more realistic vision
  - Systems that take data inputs, process them, and produce outputs (like all software programs) and that can perform many complex tasks that would be difficult or impossible for humans to perform.

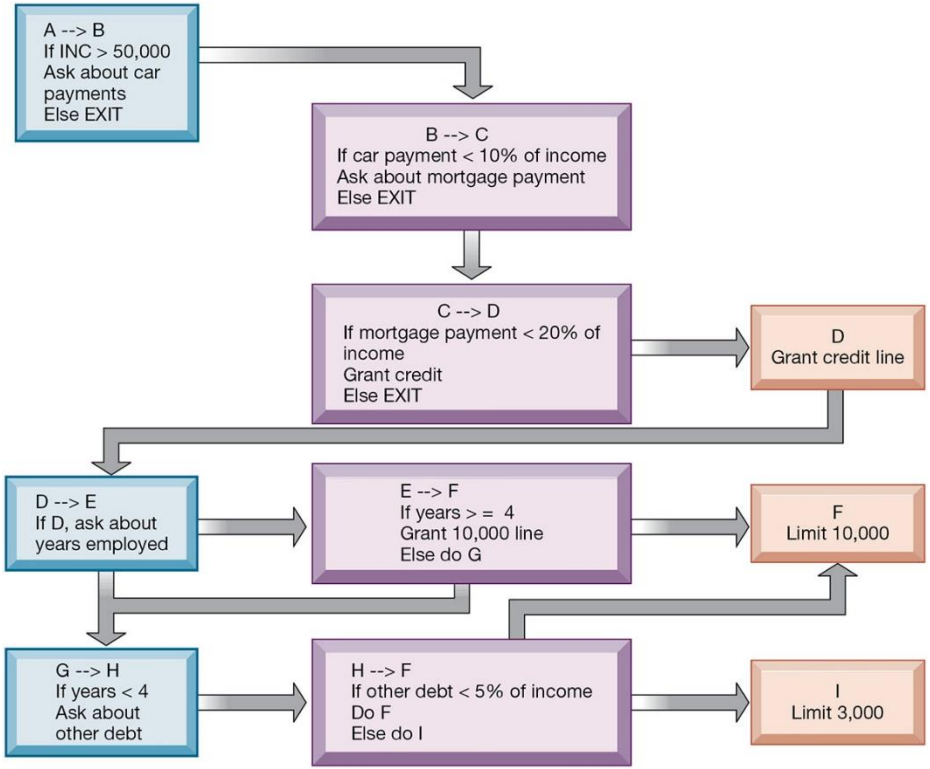
Major Types of AI

- Expert systems
- Machine learning
- Neural networks and deep learning networks
- Genetic algorithms
- Natural language processing
- Computer vision
- Robotics

Expert Systems

- Capture tacit knowledge in very specific and limited domain of human expertise
- Capture knowledge as set of rules
- Typically perform limited tasks
  - Diagnosing malfunctioning machine
  - Determining whether to grant credit for loan
- Used for discrete, highly structured decision making
- Knowledge base: Set of hundreds or thousands of rules
- Inference engine: Strategy used to search knowledge base
  - Forward chaining
  - Backward chaining

Figure 11.3 Rules in an Expert System



Machine Learning (1 of 2)

- Used by neural networks, deep learning networks, and genetic algorithms
- Different paradigm than expert systems
- Focuses on recognizing patterns in very large data sets
- Contemporary examples
  - Facebook ad display
  - Netflix recommender system

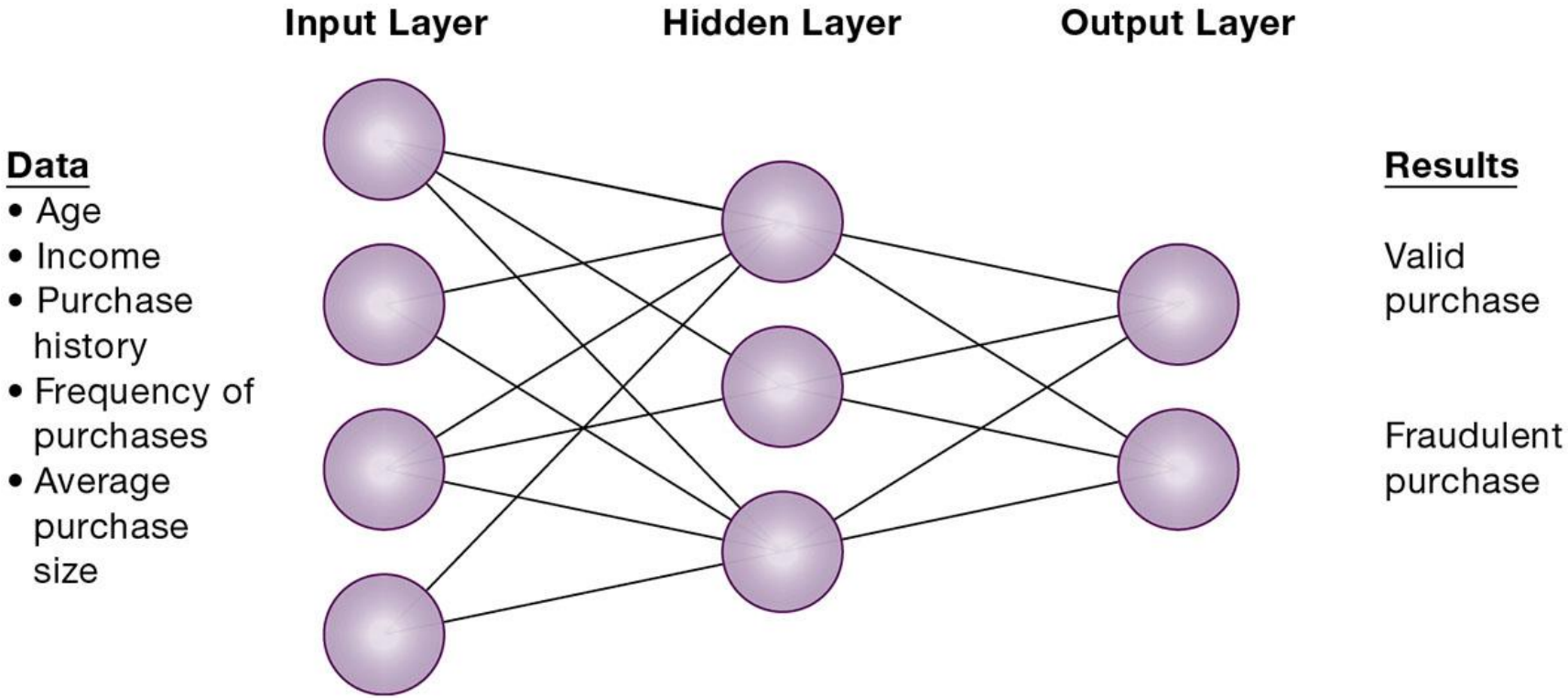
Machine Learning (2 of 2)

- 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
  - “Cat Paper”

Neural Networks (1 of 3)

- 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 11.4 How a Neural Network Works



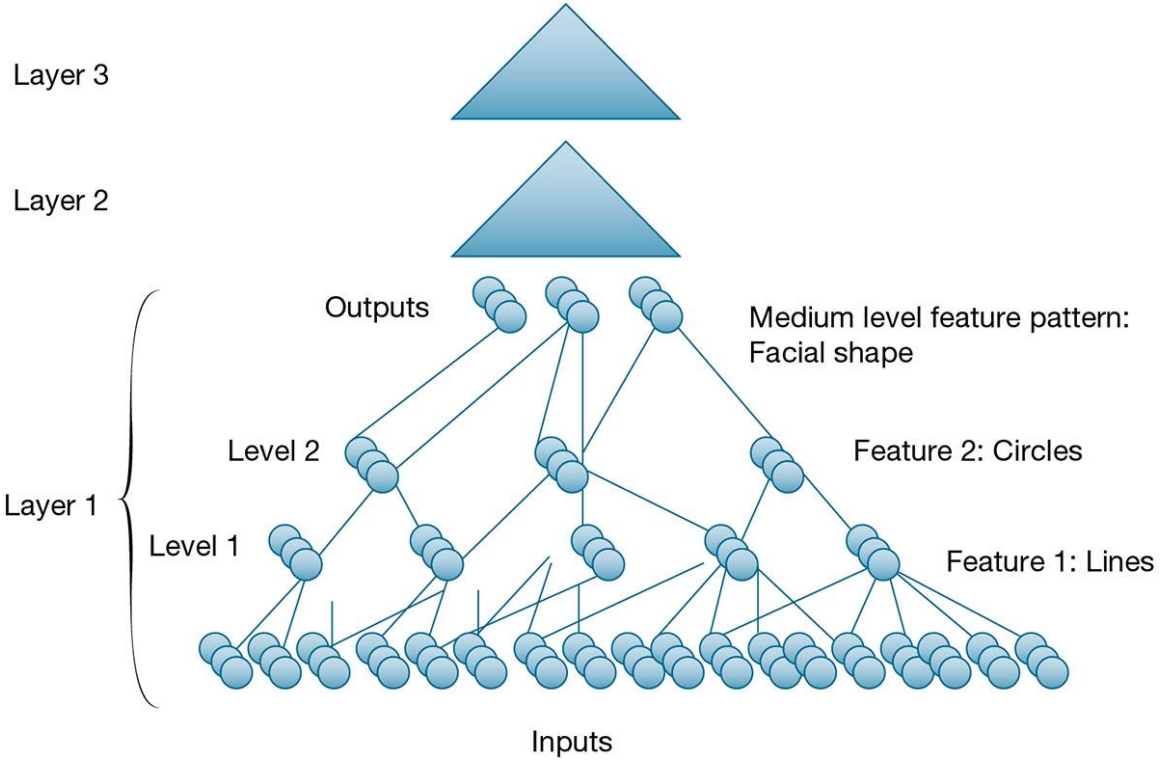
Interactive Session: Technology: Do You Know Who Is Using Your Face?

- Class discussion
  - Explain the key technologies used in facial recognition systems.
  - What are the benefits of using facial recognition systems. How do they help organizations improve operations and decision making. What problems can they help solve?
  - Identify and describe the disadvantages of using facial recognition systems and facial databases.

Neural Networks (2 of 3)

- Deep learning neural networks
  - 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)
  - Some believe these come closest to “grand vision” of AI

Figure 11.5 A Deep Learning Network



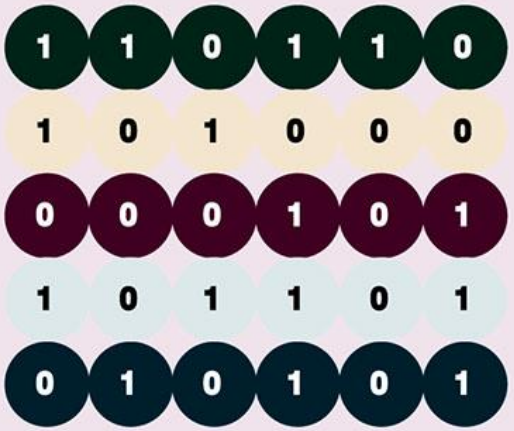
Neural Networks (3 of 3)

- Limitations of neural networks and machine learning
  - Require very large data sets to identify patterns
  - Patterns may not “make sense: or may be ephemeral
  - How system arrived at a particular solution often cannot be explained
  - Most useful for classifying digital assets into binary categories (yes or no), but most real-world problems do not have binary solutions
  - No sense of ethics, so may recommend actions that are illegal or immoral

Genetic Algorithms

- Useful for finding optimal solution for specific problem by examining very large number of possible solutions for that problem
- Conceptually based on process of evolution
  - Search among solution variables by changing and reorganizing component parts using processes such as inheritance, mutation, and selection
- Used in optimization problems (minimization of costs, efficient scheduling, optimal jet engine design) in which hundreds or thousands of variables exist
- Able to evaluate many solution alternatives quickly

Figure 11.6 The Components of a Genetic Algorithm



A population of chromosomes

	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

Natural Language Processing

- Software that can process voice or text command using natural human language
- Typically based on machine learning, including deep learning
- Examples: Google search; spam filtering systems; text mining sentiment analysis; customer call center interactions

Computer Vision Systems

- Emulate human visual system to view and extract information from real-world images
- Examples:
  - Facebook's DeepFace can identify friends in photos across their system and the entire web
  - Autonomous vehicles can recognize signs, road markers, people, animals, and other vehicles with good reliability

Robotics

- Design, construction, and operation of movable machines that can substitute for humans, along with computer systems for their control, sensory feedback, and information processing
- Generally programmed to perform specific and detailed actions in limited domains, e.g. robots spray paint autos, and assemble certain parts, welding, heavy assembly movement
- Used in dangerous situations like bomb disposal, delivering medical supplies to coronavirus-contaminated locations
- Surgical robots are expanding their capabilities

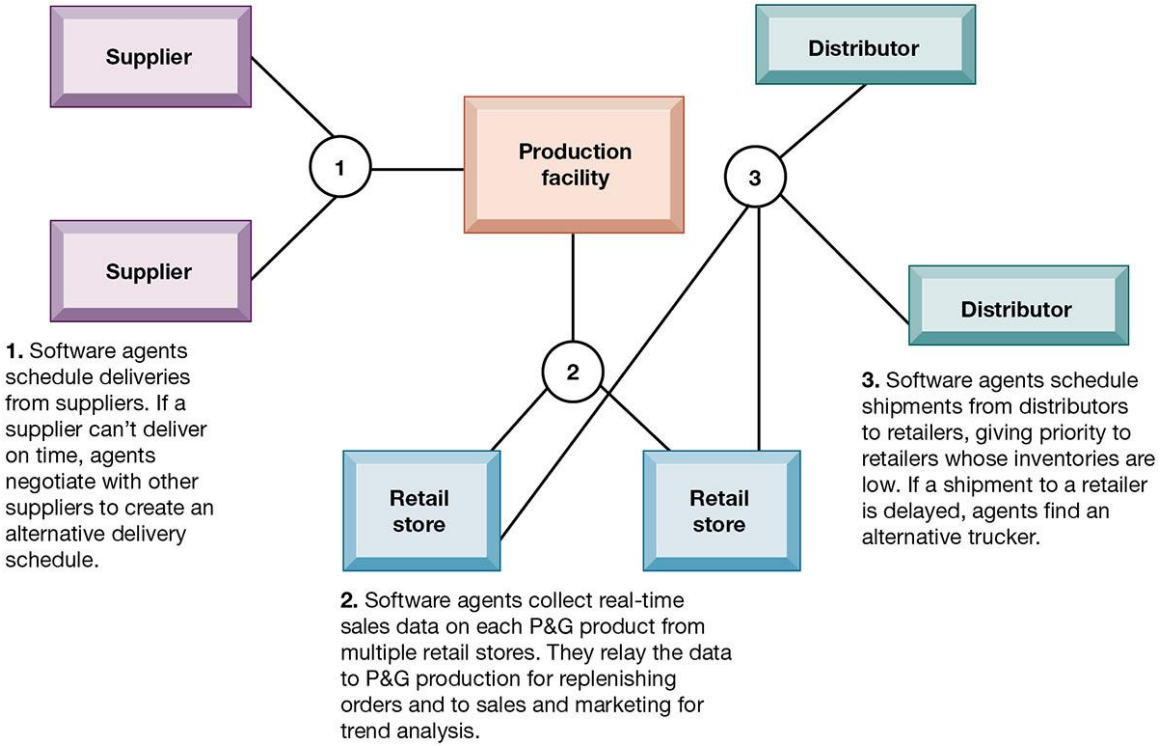
Interactive Session: Organizations: Will Automation Steal Our Jobs?

- Class discussion
  - How does automating jobs pose an ethical dilemma for stakeholders. Identify the options that can be taken and the potential consequences of each.
  - Does automation cause job loss? Explain your answer.
  - If you were the owner of a factory deciding on whether to acquire robots to perform certain actions, what management, organization, and technology factors would you consider?

Intelligent Agents

- Work without direct human intervention to carry out repetitive, predictable tasks
  - Deleting junk e-mail
  - Finding cheapest airfare
- Use limited built-in or learned knowledge base
  - Some are capable of self-adjustment, for example: Siri
- Chatbots
- Agent-based modeling applications:
  - Model behavior of consumers, stock markets, and supply chains; used to predict spread of epidemics

Figure 11.7 Intelligent Agents in P&G's Supply Chain Network



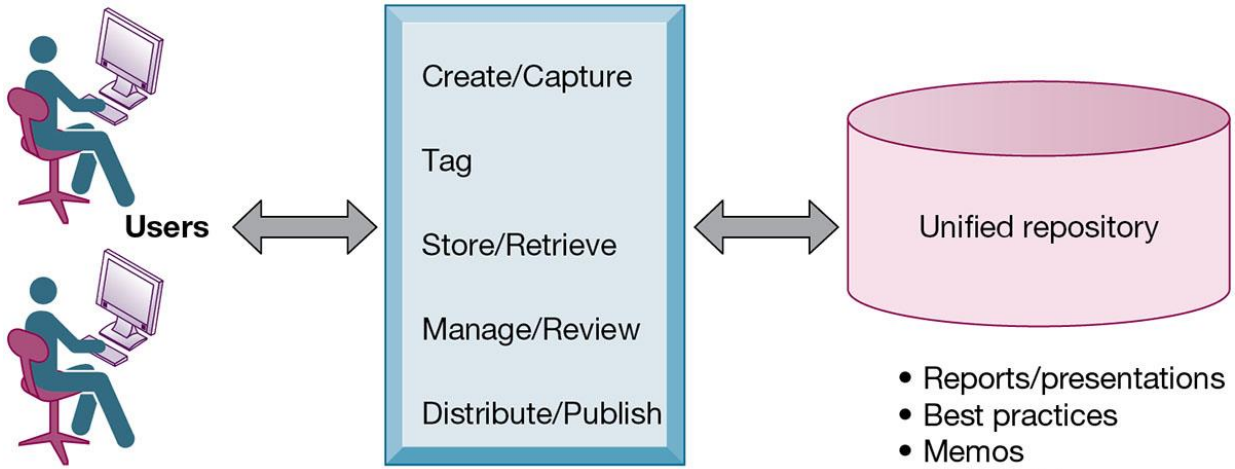
What Types of Systems Are Used for Enterprise-Wide Knowledge Management?

- Three major types of knowledge in an enterprise
  - Structured documents
    - Reports, presentations
    - Formal rules
  - Semistructured documents
    - E-mails, videos
  - Unstructured, tacit knowledge
- 80% of an organization's business content is semistructured or unstructured

Enterprise Content Management Systems

- Help capture, store, retrieve, distribute, preserve documents and semistructured knowledge
- Bring in external sources
  - News feeds, research
- Tools for communication and collaboration
  - Blogs, wikis, and so on
- Key problem: developing taxonomy
- Digital asset management systems

Figure 11.8 An Enterprise Content Management System



Locating and Sharing Expertise

- Provide online directory of corporate experts in well-defined knowledge domains
- Search tools enable employees to find appropriate expert in a company
- Social networking and social business tools for finding knowledge outside the firm
  - Saving
  - Tagging
  - Sharing web pages

Learning Management Systems (LMS)

- Provide tools for management, delivery, tracking, and assessment of employee learning and training
- Support multiple modes of learning
  - web-based classes, online forums, and so on
- Automates selection and administration of courses
- Assembles and delivers learning content
- Measures learning effectiveness
- Massively open online courses (MOOCs)
  - Web course open to large numbers of participants

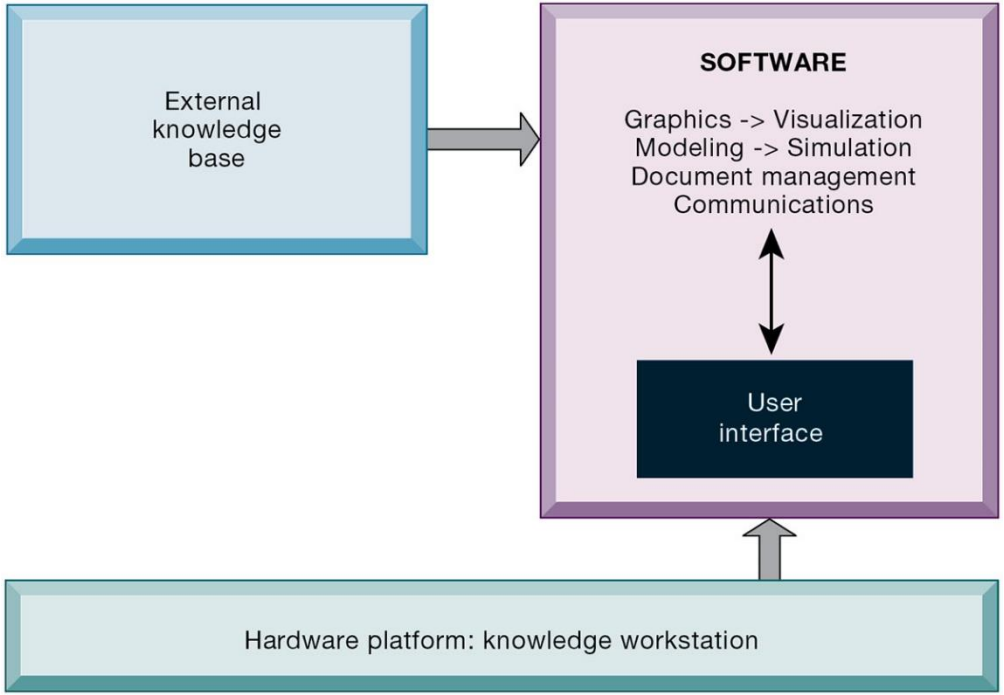
Knowledge Workers and Knowledge Work

- Knowledge workers
  - Researchers, designers, architects, scientists, engineers who create knowledge for the organization
  - Perform key roles critical to organization and managers who work within organization
- Knowledge work systems
  - Systems for knowledge workers to help create new knowledge and integrate that knowledge into business

Requirements of Knowledge Work Systems

- Sufficient computing power for graphics, complex calculations
- Communications and document management
- Access to external databases
- User-friendly interfaces
- Optimized for tasks to be performed (design engineering, financial analysis)

Figure 11.9 Requirements of Knowledge Work Systems



Examples of Knowledge Work Systems

- CAD (computer-aided design)
  - Creation of engineering or architectural designs
  - 3D printing
- Virtual reality systems
  - Simulate real-life environments
- Augmented reality (AR) systems
  - Enhance visualization by overlaying digital data and images onto physical real-world environment

How Will MIS Help My Career?

- The Company: RazzleDazzle Technology
- Position Description: Entry-level sales assistant
- Job Requirements
- Interview Questions
- Author Tips

Copyright