Chapter 11

Managing Knowledge

VIDEO CASES

Video Case 1: How IBM's Watson Became a Jeopardy Champion.
Video Case 2: Tour: Alfresco: Open Source Document Management System
Video Case 3: L'Oréal: Knowledge Management Using Microsoft SharePoint

The Knowledge Management Landscape

- **Knowledge management systems among fastest growing areas of software investment**
- **Information economy**
  - 37% U.S. labor force: knowledge and information workers
  - 45% U.S. GDP from knowledge and information sectors
- **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**

The Knowledge Management Landscape

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

Management Information Systems
Chapter 11: Managing Knowledge

MAJOR TYPES OF KNOWLEDGE MANAGEMENT SYSTEMS

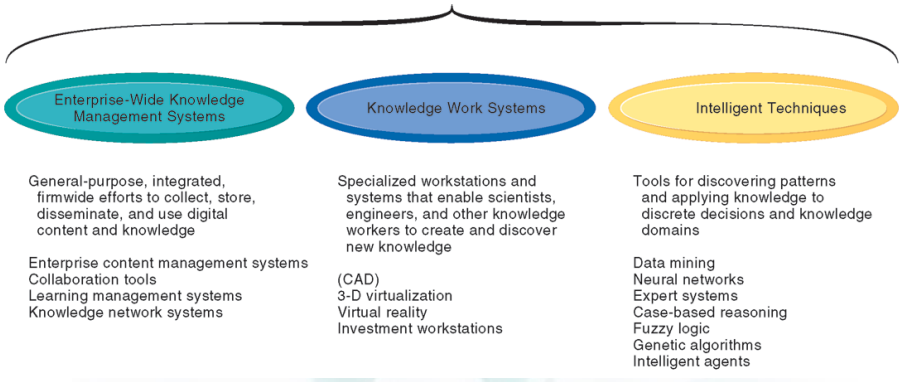


FIGURE 11-2 There are three major categories of knowledge management systems, and each can be broken down further into more specialized types of knowledge management systems.

- **Three major types of knowledge in enterprise**
  1. **Structured documents**
     - Reports, presentations
     - Formal rules
  2. **Semistructured documents**
     - E-mails, videos
  3. **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, reports, best practices
    - Semistructured knowledge (e-mails)
  - **Bring in external sources**
    - News feeds, research
  - **Tools for communication and collaboration**
    - Blogs, wikis, and so on

Enterprise-Wide Knowledge Management Systems

- **Knowledge network systems**
  - **Provide online directory of corporate experts in well-defined knowledge domains**
  - **Search tools enable employees to find appropriate expert in a company**
  - **Hivemine's AskMe**
    - Includes repositories of expert-generated content
  - **Some knowledge networking capabilities included in leading enterprise content management and collaboration products**

Knowledge Work Systems

- **Knowledge work systems**
  - **Systems for knowledge workers to help create new knowledge and integrate that knowledge into business**
- **Knowledge workers**
  - **Researchers, designers, architects, scientists, engineers who create knowledge for the organization**
  - **Three key roles:**
    1. Keeping organization current in knowledge
    2. Serving as internal consultants regarding their areas of expertise
    3. Acting as change agents, evaluating, initiating, and promoting change projects

Knowledge Work Systems

- **Requirements of knowledge work systems**
  - **Sufficient computing power for graphics, complex calculations**
  - **Powerful graphics and analytical tools**
  - **Communications and document management**
  - **Access to external databases**
  - **User-friendly interfaces**
  - **Optimized for tasks to be performed (design engineering, financial analysis)**

Knowledge Work Systems

- **Examples of knowledge work systems**
  - **CAD (computer-aided design):**
    - Creation of engineering or architectural designs
    - 3-D printing
  - **Virtual reality systems:**
    - Simulate real-life environments
    - 3-D medical modeling for surgeons
    - Augmented reality (AR) systems
    - VRML
  - **Investment workstations:**
    - Streamline investment process and consolidate internal, external data for brokers, traders, portfolio managers

- **Intelligent techniques:** Used to capture individual and collective knowledge and to extend knowledge base
  - **To capture tacit knowledge:** Expert systems, case-based reasoning, fuzzy logic
  - **Knowledge discovery**: Neural networks and data mining
  - **Generating solutions to complex problems:** Genetic algorithms
  - **Automating tasks:** Intelligent agents
- **Artificial intelligence (AI) technology:**
  - **Computer-based systems that emulate human behavior**

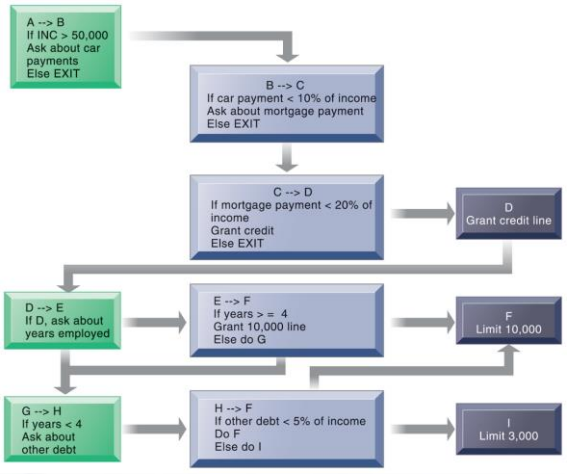
Management Information Systems
Chapter 11: Managing Knowledge
Intelligent Techniques

- **Expert systems:**
  - **Capture tacit knowledge in very specific and limited domain of human expertise**
  - **Capture knowledge of skilled employees as set of rules in software system that can be used by others in organization**
  - **Typically perform limited tasks that may take a few minutes or hours, for example:**
    - Diagnosing malfunctioning machine
    - Determining whether to grant credit for loan
  - **Used for discrete, highly structured decision making**

RULES IN AN EXPERT SYSTEM

An expert system contains a number of rules to be followed. The rules are interconnected; the number of outcomes is known in advance and is limited; there are multiple paths to the same outcome; and the system can consider multiple rules at a single time. The rules illustrated are for simple credit-granting expert systems.

FIGURE 11-5



Intelligent Techniques

- **How expert systems work**
  - **Knowledge base: Set of hundreds or thousands of rules**
  - **Inference engine: Strategy used to search knowledge base**
    - **Forward chaining:** Inference engine begins with information entered by user and searches knowledge base to arrive at conclusion
    - **Backward chaining:** Begins with hypothesis and asks user questions until hypothesis is confirmed or disproved

INFERENCE ENGINES IN EXPERT SYSTEMS

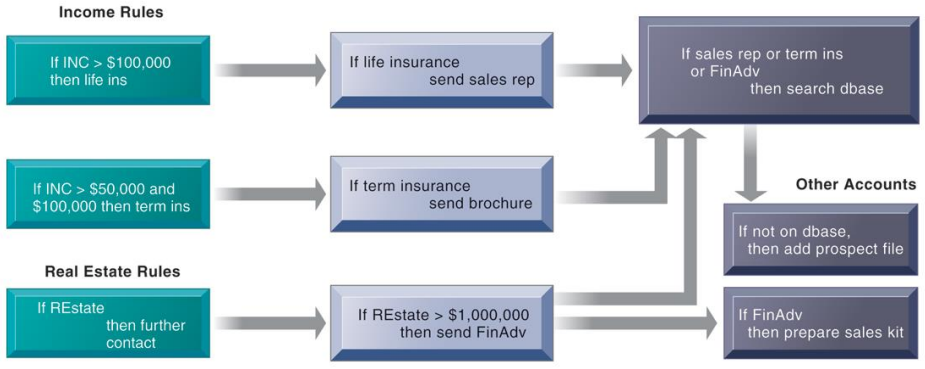


FIGURE 11-6 An inference engine works by searching through the rules and "firing" those rules that are triggered by facts gathered and entered by the user. Basically, a collection of rules is similar to a series of nested IF statements in a traditional software program; however, the magnitude of the statements and degree of nesting are much greater in an expert system.

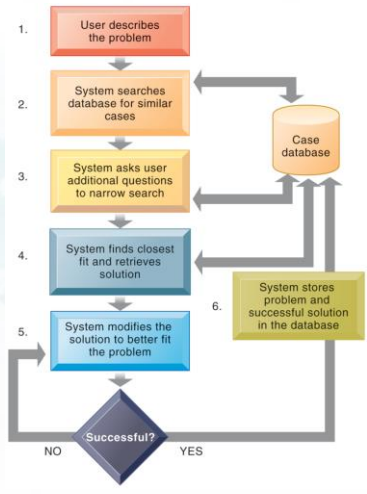
Intelligent Techniques

- **Successful expert systems:**
  - Con-Way Transportation built expert system to automate and optimize planning of overnight shipment routes for nationwide freight-trucking business
- **Most expert systems deal with problems of classification.**
  - Have relatively few alternative outcomes
  - Possible outcomes are known in advance
- **Many expert systems require large, lengthy, and expensive development and maintenance efforts.**
  - Hiring or training more experts may be less expensive

- **Case-based reasoning (CBR)**
  - **Descriptions of past experiences of human specialists (cases), stored in knowledge base**
  - **System searches for cases with characteristics similar to new one and applies solutions of old case to new case**
  - **Successful and unsuccessful applications are grouped with case**
  - **Stores organizational intelligence: Knowledge base is continuously expanded and refined by users**
  - **CBR found in**
    - Medical diagnostic systems
    - Customer support

Case-based reasoning represents knowledge as a database of past cases and their solutions. The system uses a six-step process to generate solutions to new problems encountered by the user.

FIGURE 11-7



- **Fuzzy logic systems**
  - **Rule-based technology that represents imprecision used in linguistic categories (e.g., "cold," "cool") that represent range of values**
  - **Describe a particular phenomenon or process linguistically and then represent that description in a small number of flexible rules**
  - **Provides solutions to problems requiring expertise that is difficult to represent with IF-THEN rules**
    - Autofocus in cameras
    - Detecting possible medical fraud
    - Sendai's subway system acceleration controls

- **Machine learning**
  - **How computer programs improve performance without explicit programming**
    - Recognizing patterns
    - Experience
    - Prior learnings (database)
  - **Contemporary examples**
    - Google searches
    - Recommender systems on Amazon, Netflix

Intelligent Techniques

- **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**
  - **Used in medicine, science, and business for problems in pattern classification, prediction, financial analysis, and control and optimization**

HOW A NEURAL NETWORK WORKS

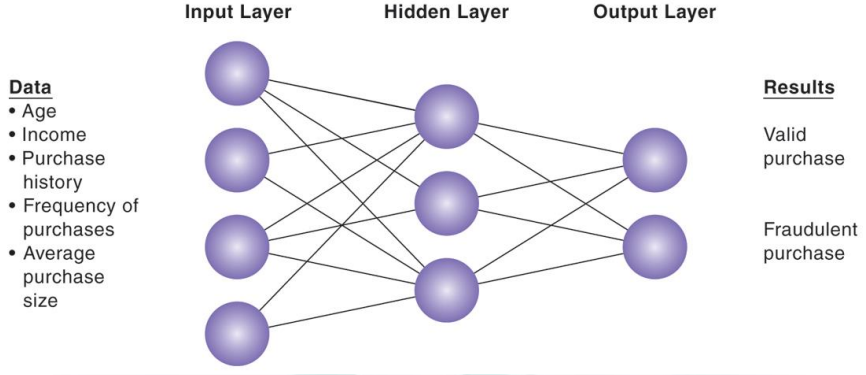


FIGURE 11-9 A neural network uses rules it "learns" from patterns in data to construct a hidden layer of logic. The hidden layer then processes inputs, classifying them based on the experience of the model. In this example, the neural network has been trained to distinguish between valid and fraudulent credit card purchases

- **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**

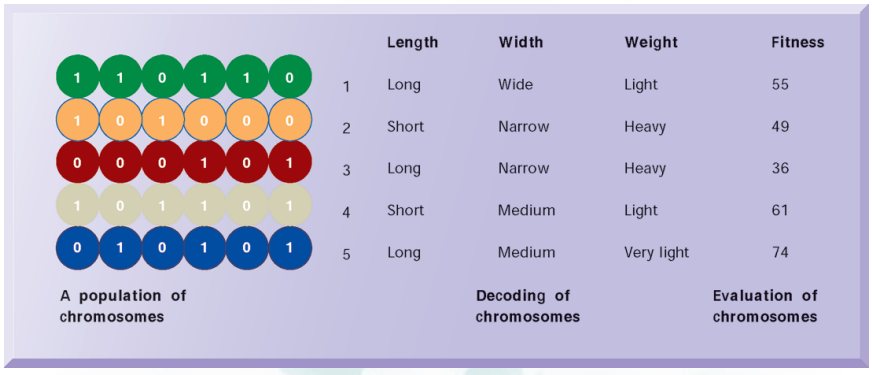


FIGURE 11-11 This example illustrates an initial population of "chromosomes," each representing a different solution. The genetic algorithm uses an iterative process to refine the initial solutions so that the better ones, those with the higher fitness, are more likely to emerge as the best solution.

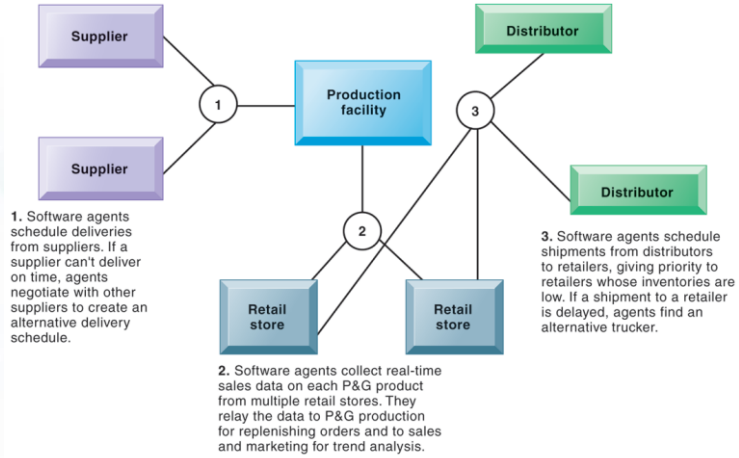
Intelligent Techniques

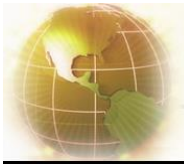
- **Intelligent agents**
  - **Work without direct human intervention to carry out specific, repetitive, and predictable tasks for user, process, or application**
    - Deleting junk e-mail
    - Finding cheapest airfare
  - **Use limited built-in or learned knowledge base**
    - Some are capable of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

INTELLIGENT AGENTS IN P&G'S SUPPLY CHAIN NETWORK

Intelligent agents are helping P&G shorten the replenishment cycles for products such as a box of Tide.

FIGURE 11-12





Intelligent Techniques

- **Hybrid AI systems**
  - **Genetic algorithms, fuzzy logic, neural networks, and expert systems integrated into single application to take advantage of best features of each**
  - **For example: Matsushita "neurofuzzy" washing machine that combines fuzzy logic with neural networks**