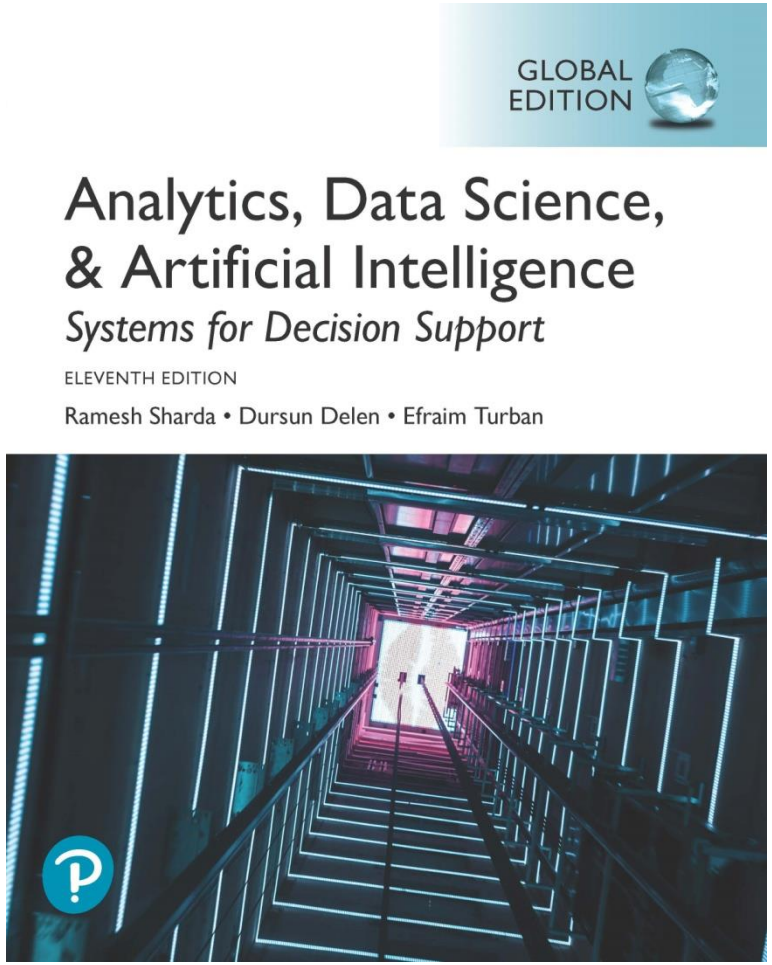
Analytics, Data Science and AI: Systems for Decision Support

Eleventh Edition, Global Edition



Chapter 12

Knowledge Systems: Expert Systems, Recommenders, Chatbots, Virtual Personal Assistants, and Robo Advisors

Pearson

Learning Objectives

12.1 Describe expert systems

12.2 Describe recommendation systems

12.3 Describe chatbots

12.4 Understand the drivers and capabilities of chatbots and their use

12.5 Understand virtual personal assistants

Concepts of Expert Systems (ES) (1 of 6)

- ES is a computer-based information system
- Emulates the decision making and/or problem solving abilities of human experts in complex areas
- Goal – help nonexperts to make decisions and solve problems that usually require expertise
- Works well in narrowly defined domains

Concepts of Expert Systems (ES) (2 of 6)

- **Expert** - A person who has the special knowledge, judgment, experience, and skills to provide sound advice and solve complex problems in a narrowly defined area.
- Experts have expertise that can help solve problems

Concepts of Expert Systems (ES) (3 of 6)

- **Typically, human experts are capable of doing the following:**
  - Recognizing and formulating a problem
  - Solving a problem quickly and correctly
  - Explaining a solution
  - Learning from experience
  - Restructuring knowledge
  - Breaking rules and norms, if necessary
  - Determining relevance and associations
- Real experts are rare and hard to find

Concepts of Expert Systems (ES) (4 of 6)

- **Expertise** - The extensive, task-specific knowledge that experts possess.
- The level of expertise determines the success of a decision made by an expert.
- Expertise is often acquired through training, learning, and experience in practice.
- Expertise includes explicit knowledge, such as theories learned from a textbook or a classroom and implicit knowledge gained from experience.

Concepts of Expert Systems (ES) (5 of 6)

- **Knowledge types (expertise) used in ES applications**
  - Theories about the problem domain
  - Rules and procedures regarding the general problem domain
  - Heuristics about what to do in a given problem situation
  - Global strategies for solving of problems amenable to expert systems
  - Meta knowledge (i.e., knowledge about knowledge)
  - Facts about the problem area

- These types of knowledge enable experts to make better and faster decisions than nonexperts.

Concepts of Expert Systems (ES) (6 of 6)

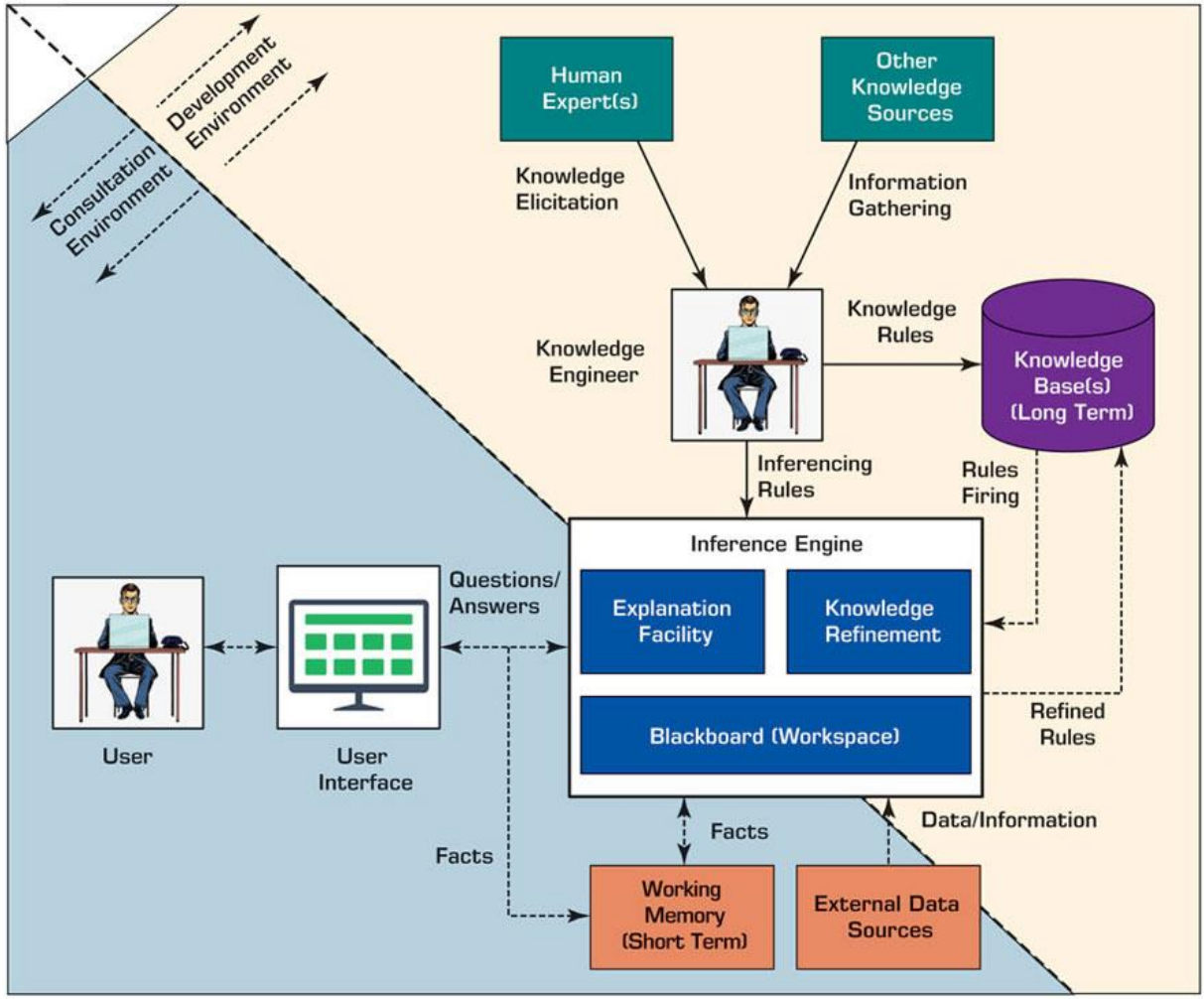
- **Expertise often includes the following characteristics:**
  - It is usually associated with a high degree of intelligence, but it is not always associated with the smartest person
  - It is usually associated with a vast quantity of knowledge
  - It is based on learning from past successes and mistakes
  - It is based on knowledge that is well stored, organized, and quickly retrievable from an expert who has excellent recall of patterns from previous experiences.

Benefits of ES

- Perform routine tasks (e.g., diagnosis, candidate screening, credit analysis) that require expertise much faster than humans.
- Reduce the cost of operations.
- Improve consistency and quality of work, reduce human errors.
- Speed up decision making and make consistent decisions.
- Preserve scarce expertise of retiring employees.
- Help transfer and reuse knowledge.
- Reduce employee training cost by using self-training.
- Combine expertise of several experts.
- Facilitate knowledge sharing.

Structure and Process of ES

- Consultation Environment (use of ES via GUI)
- Development Environment
- Component of an ES
  - Knowledge acquisition (from humans and others)
  - Knowledge representation (if-then-else rules)
  - Knowledge base (knowledge repository)
  - Inference engine (control/search structure)
  - User interface
    - Justifier/explanation module
    - Knowledge refinement system



Recommendation Systems

- Recommendation system, also known as recommender system or recommendation engine

- Recommending/suggesting one-to-one targeted products or services

- Predict the importance (rating or preference) that a user will attach to a product or service
  - Based on the prediction, specific products and services are recommended to the user
  - Top applications include movies, music, and books. However, there are also systems for travel, restaurants, and insurance.

Benefits of Recommendation Systems

- **Benefits to customer:**
  - Personalization
  - Discovery
  - Customer satisfaction
  - Reports
  - Increased dialog with seller
- **Benefits to seller:**
  - Higher conversion rate
  - Increased cross-sell
  - Increased customer loyalty
  - Enabling mass customization

Methods for Recommendation Systems

- **Collaborative filtering**
  - Building a model that summarizes the past behavior of shoppers in a multi-dimensional manner
  - Makes recommendations on the new customers based on the similarity to previous shoppers
  - Uses AI/machine learning to predict the preferences
- **Content-based filtering**
  - Allows vendors to identify customer preferences by the attributes of the product(s) that customers have bought
  - Recommend new products with similar attributes

Chatbots (1 of 2)

- Chatbots (chat robots) emerged in the last decade
- A computerized service that enables easy conversations between humans and humanlike computerized robots or image characters
- Some chatbots are equipped with NLP abilities for better understanding, and some with AI/machine learning for learning and improving
- Chatbot services are often available messaging services such as Facebook Messenger or WeChat, and on Twitter

Types of Bots

- Regular bots. These are essentially conversational intelligent agents (Chapter 2).
  - They can do simple, usually repetitive, tasks for their owners, such as showing their bank's debits, helping them to purchase goods online, and to sell or buy stocks online.

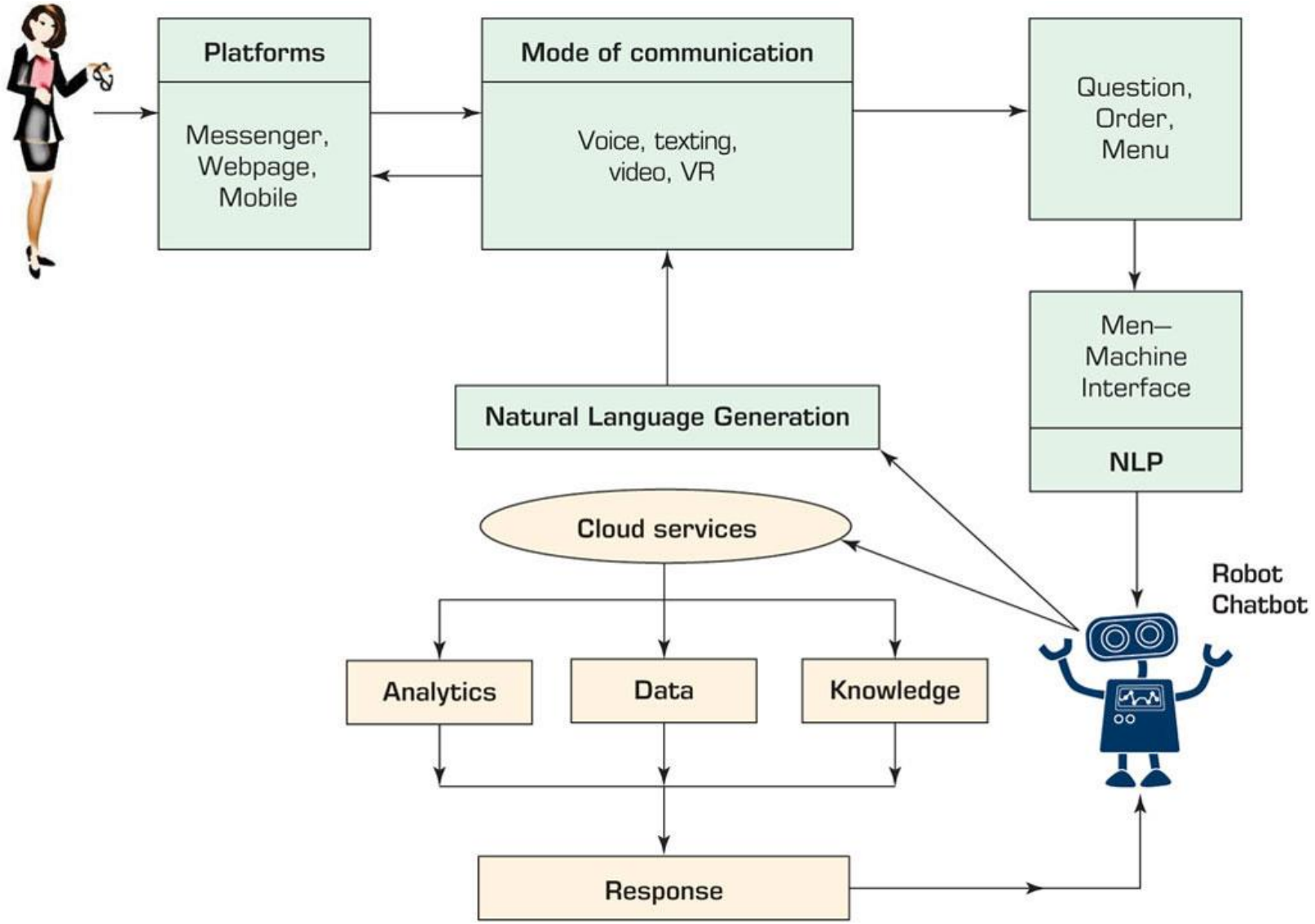
- Chatbots. In this category, we include more capable bots, for example, those that can stimulate conversations with people.

- Intelligent bots. These have a knowledge base that is improving with experience.
  - That is, these bots can learn, for example, a customer's preferences (e.g., like Alexa and some robo advisors).

Chatbots (2 of 2)

- **Drivers**
  - Powerful tools to build chatbots
  - The quality of conversations is improving
  - Demand for chatbots are increasing (allowing rapid growth without the need to hire many service personnel)
- **Components**
  - A person (client)
  - A computer, avatar, or robot (the AI machine)
  - A knowledge base (often stored at the cloud)
  - A human-computer interface (enabler of the dialog)
  - NLP that enables machine to “understand” the user

Process of Chatting with a Chatbots



Chatbots Drivers and Benefits

- The need to cut costs.
- The increasing capabilities of AI, especially NLP and voice technologies.
- The ability of conversing in different languages (via machine translation).
- The increased quality and capability of captured knowledge.
- Its use for text and image recognition.
- Its use to facilitate shopping and support of decision making.

Enterprise Chatbots (1 of 2)

- Chatbots can fundamentally change the way that business is done. The interest of enterprises in chatbots
  - Less expensive and more consistent
  - Mobile friendly (the new trend for new generation)
- Chatbots for marketing and customer experience
  - Improving the customer experience

Enterprise Chatbots (2 of 2)

- Enterprise Chatbots: Financial Services
  - Banking - Chatbots can use predictive analytics and cognitive messaging to perform tasks such as making payments, inquiring account details, etc.
  - Example: POSB of Singapore has an AI-driven bot on Facebook Messenger

- Enterprise Chatbots: Service Industry
  - Healthcare – robot receptionist, chatty companions, …
  - Education – tutors, translators, …
  - Government – dialog tool for use by the public
  - Travel and hospitality – tour guides, customer service

Virtual Personal Assistants (1 of 2)

- Assistant for Information Search

- Amazon's Alexa and Echo
  - Alexa can do many things…
  - Alexa can be taught/customized for individualized skills
  - Amazon Echo, Echo Dot, and Echo Tap
  - Alexa for Enterprise …

Virtual Personal Assistants (2 of 2)

- Apple Siri
  - Siri: Speech Interpretation and Recognition Interface
- Goggle Assistant
- Other personal assistants
  - Microsoft Cortana (Cortana with Bing)
  - Samsung Bixby
- Knowledge for Virtual Personal Assistants

Q & A