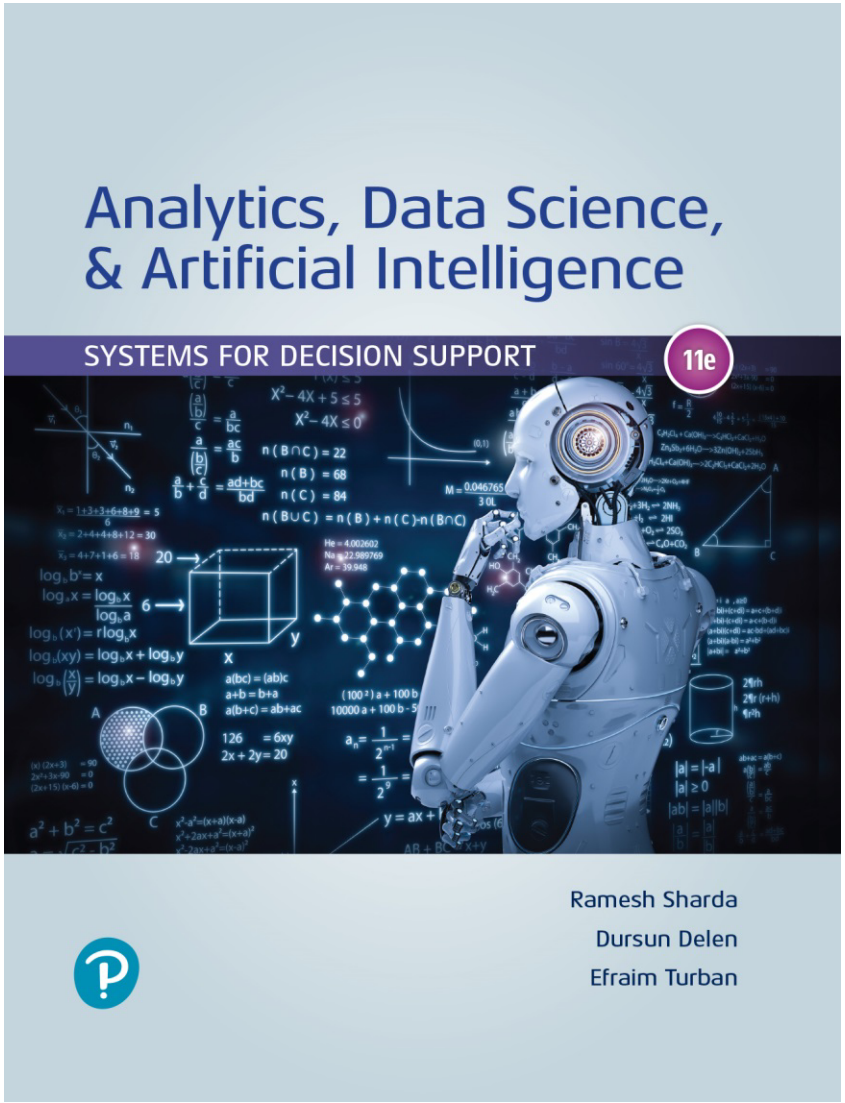
Analytics, Data Science and A I: Systems for Decision Support

Eleventh Edition



Chapter 2

Artificial Intelligence Concepts, Drivers, Major Technologies, and Business Applications

Pearson

Learning Objectives

2.1 Understand the concepts of artificial intelligence (AI).

2.2 Become familiar with the drivers, capabilities, and benefits of AI.

2.3 Describe human and machine intelligence.

2.4 Describe the major AI technologies and some derivatives.

2.2 Introduction to Artificial Intelligence

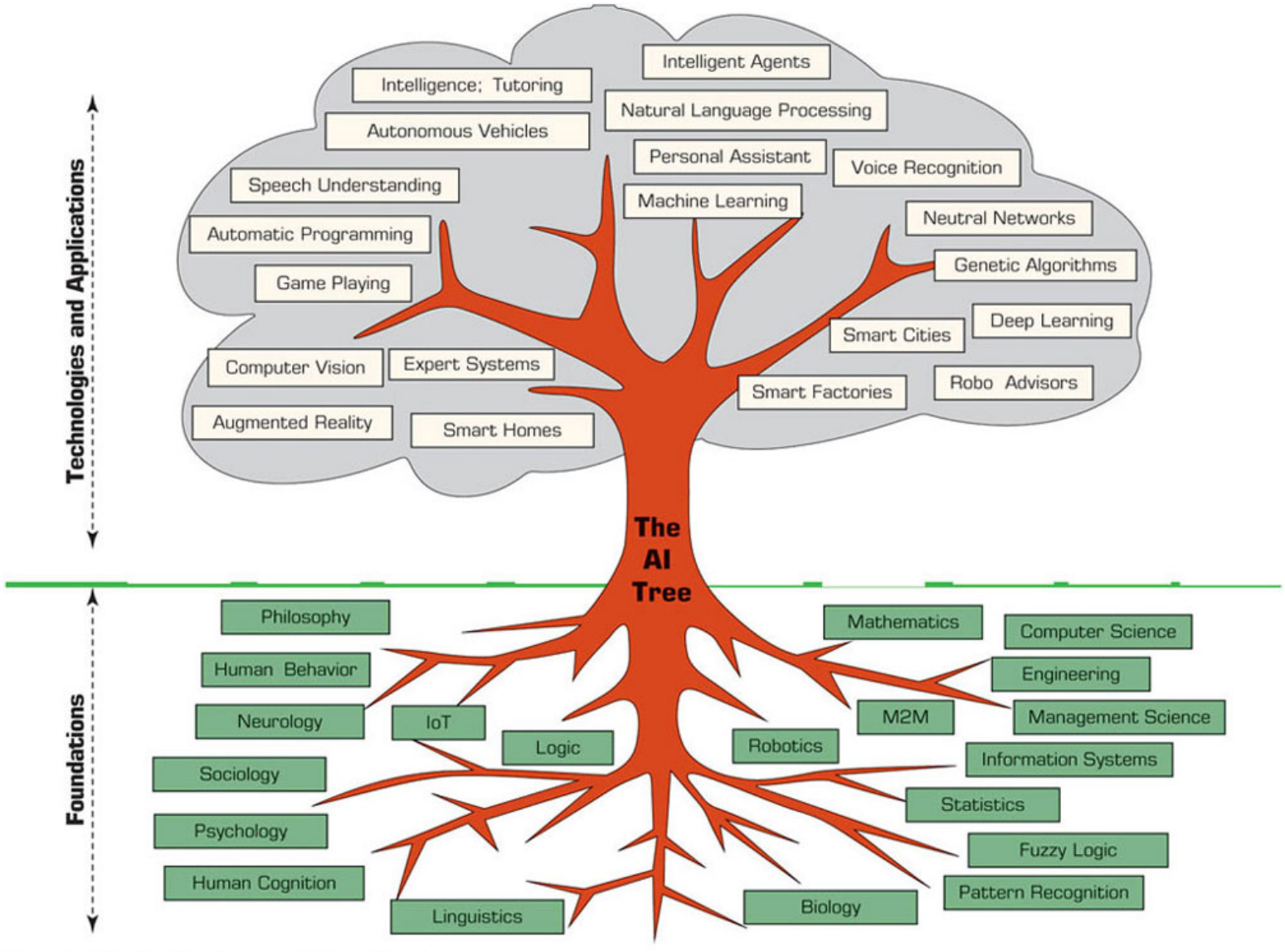
- One Possible Definition for artificial intelligence (A I)
  - The capabilities of a machine to imitate intelligent of human behavior.

- AI is mainly concerned with:
  - The study of human thought process
  - The representation and duplication of those thought processes in machines

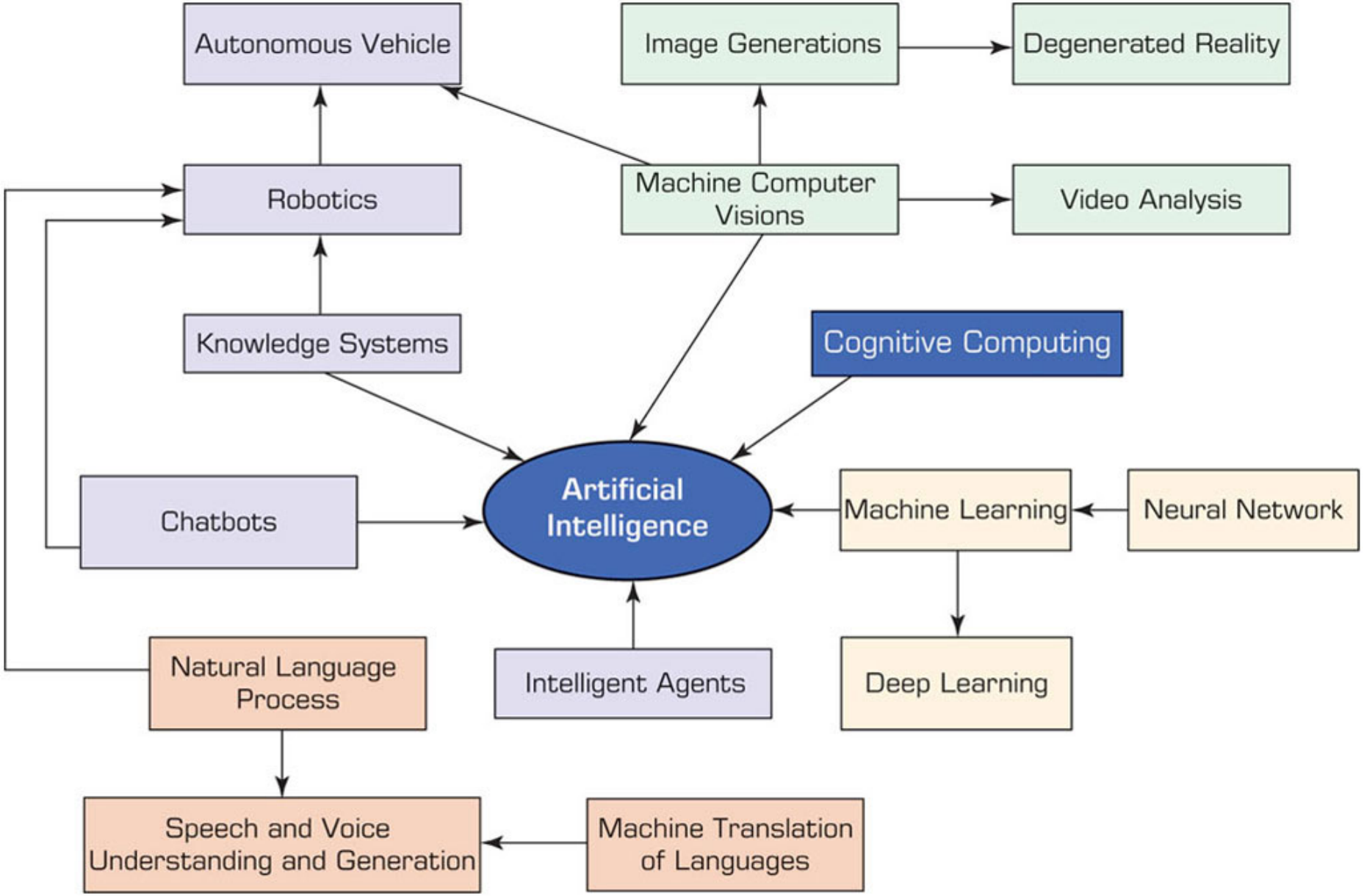
2.3 Human and Computer Intelligence

- What is intelligence?
- Types of intelligence:
  - Linguistic and verbal, logical, spatial, body/movement, musical, interpersonal, intrapersonal, naturalist
- Intelligence is not a simple concept!
- Content of intelligence
  - Reasoning, learning, logic, problem-solving, perception, and linguistic ability

The Functionalities and Applications of A I



2.4 Major A I Technologies



2.4 Major AI Technologies & Drivers

- Intelligent agents (IA)
  - An intelligent agent (IA) is an autonomous, small computer program that acts upon changing environments as directed by stored knowledge.
  - Help human agents in achieving specific goals related to the changes in the surrounding environment.
  - Intelligent agents may learn by using the expanding knowledge embedded in them.
  - Examples:
    - Virus detection program, recommending product, making price recommendations.

Major AI Technologies & Drivers

2.4.2 Machine learning (ML)

- Teaching computers to learn from examples and large amounts of data, and new situations.
- Scientists teach computers to identify patterns and make connections by showing them a large volume of examples and related data.
- Allow the system to monitor and sense their environmental activities and adjust their behavior as needed.
- Learn based on data coming from sensors, databases, and other sources.
- Can be used to make predictions, recognize patterns, predict performance.

- Examples: credit card fraud detection, improving customer loyalty and retention, hiring the right people, predictive maintenance, retail shelf analysis.

Major AI Technologies & Drivers

2.4.2 Deep learning (DL)

- A subset of machine learning
- Tries to mimic how the human brain works
- Uses artificial neural networks
- Play a major role in dealing with complex applications that regular machine learning cannot handle.
- Deliver systems that not only think but also keep learning, enabling self-direction based on fresh data that flaw in (big data).
- As long as new data arrive, learning occurs.
- Deep learning is a key technology in autonomous vehicles by helping to interpret road signs and road obstacles.
- DL is most useful in real-time interactive applications in the areas of vision recognition, scene recognition, robotics, and speech and voice processing.

Major AI Technologies & Drivers

2.4.3 Machine and computer vision

- Technology and methods used to provide image-based automated inspections and analysis for applications such as robot guides, process controls, automated vehicles, and inspections.
- An important tool for the optimization of production and robotic processes.
- Industrial camera is important tool for capturing, storing, and archiving images/videos that can then be processed by humans or computers.
- Lowers cost of performing repetitive tasks that are cumbersome and possible make the human eyes tired.

- Example application (objects counter):
- https://youtu.be/RcUUM3mLK7Q

Major AI Technologies & Drivers

2.4.3 Video analytics

- Applying computer vision techniques to videos
- Enables the recognition of patterns, and potential events.

- Example: predicting potential trouble behavior in certain situations at major human gatherings.

Major AI Technologies & Drivers

2.4.4 Robotic systems

- A robot is an electromechanical device that is guided by a computer program to perform manual and/or mental tasks.
- An intelligent robot has a sensory apparatus such as a camera that collects information about the robot's surroundings and its operations.
- Combines with machine and deep learning, can perform many tasks including learning from situations.
- Possible types of robots:
  - Industrial robots [for manufacturing]
  - Service robots
  - Example application (Walmart stock scanning robot):
    - https://youtu.be/XZBSR_3rvxg
  - In ecommerce (shopbots):
    - https://youtu.be/ssZ_8cqfBIE

Major AI Technologies & Drivers

2.4.5 Natural language processing (NLP)

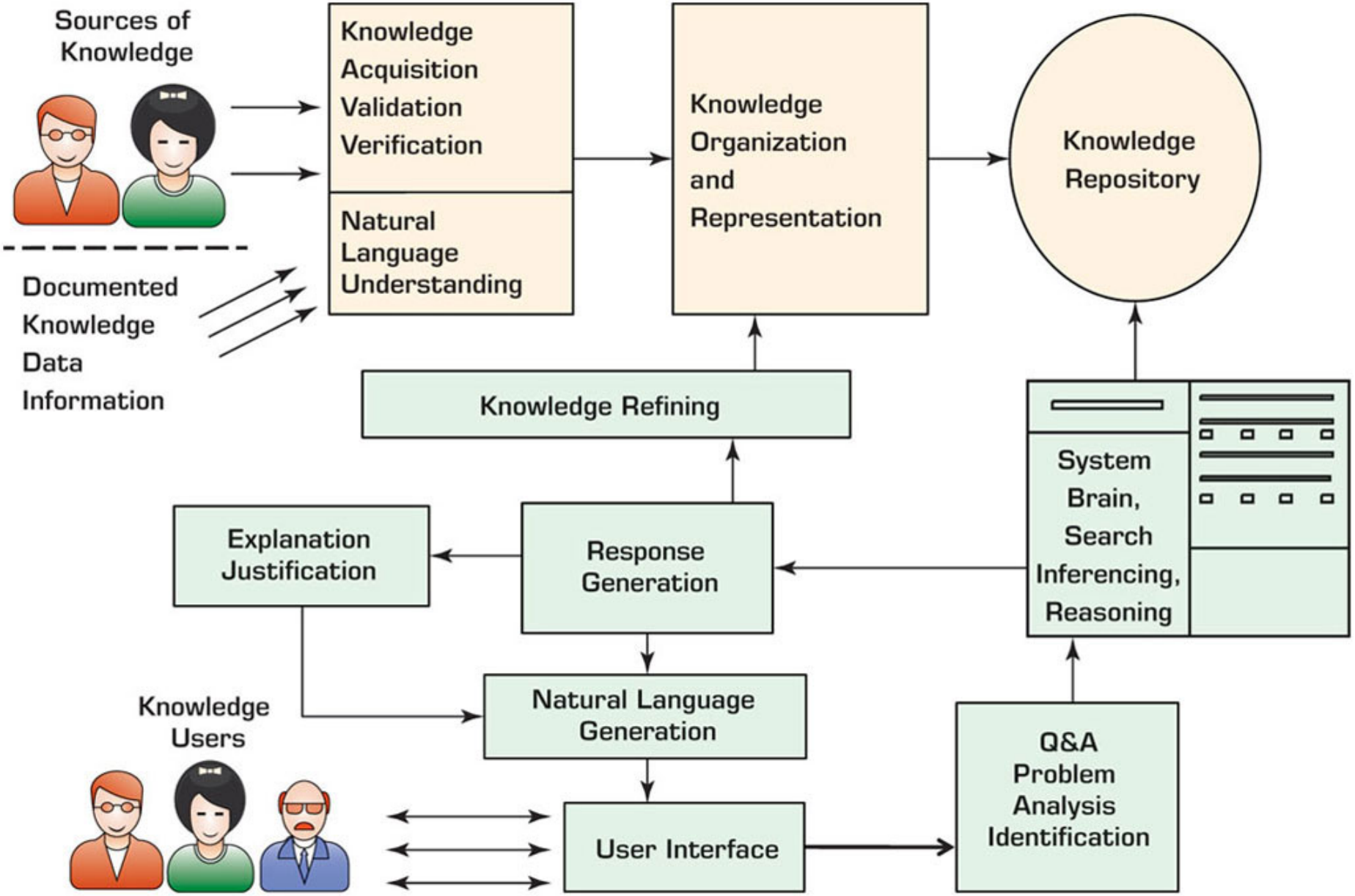
- A technology that allows people to communicate with a computer in their native language.
  - Language can be in written text or voice (speech).
- NLP has two subfields:
  - Natural language understanding
  - Natural language generation
- Sample applications:
  - Speech (voice) understanding by automated call centers
  - Machine translation of human languages
    - Example: https://youtu.be/Pk6a6mvOoJA

Major AI Technologies & Drivers

- 2.4.6 Knowledge & Expert Systems & Recommenders
  - Computer programs that store knowledge, which their applications use to generate expert advice, give recommendations, and/or perform problem solving.
- Knowledge sourced intelligent systems
  - Knowledge acquisition
    - Identifying experts
    - Extracting and structuring knowledge (observing, interviewing, scenario building, and discussing).
    - Needs trained knowledge engineers for knowledge acquisitions and building system.
  - Knowledge representation
    - How will the knowledge be organized and stored
    - Simple form is in questions & answers (Q&A).
  - Reasoning from knowledge
    - Process users' requests and provides answers.

Major AI Technologies & Drivers

Expert Systems



Major AI Technologies & Drivers

- 2.4.7 Chatbots
  - A chatbot is a type of a robot, which is also a knowledge-based system.
  - Is a conversational robot that is used for chatting with people
  - Text or voice
  - Can be:
    - Intelligent agents for retrieving information
    - Personal assistants that provide advice
  - Are equipped with NLP that enables conversations in natural human languages.
  - Example: Google Assistant:
    - https://youtu.be/FPfQMVf4vwQ
    - https://youtu.be/-qCanuYrR0g

Major AI Technologies & Drivers

- 2.4.8 Emerging AI Technologies (1)
  - Cognitive computing
    - The application of knowledge derived from cognitive science (the study of human brain) and CS theories to simulate human thought processes.
    - Uses: self-learning algorithms, pattern recognition, NLP, machine vision, etc.
    - Example: IBM Watson

Major AI Technologies & Drivers

- 2.4.8 Emerging AI Technologies (2)
  - Augmented reality
    - Augmentation: integration of digital information within the user environment in real time, providing people real-world interactive experience with the environment.
    - Uses: machine vision, scene recognition, gesture recognition, in general, data captured by sensors.
    - Example: Google Maps (https://youtu.be/4F0gFpzsYLM)

AI in Human Resource Management (1 of 2)

- Recruitment – talent acquisition
  - LinkedIn uses AI algorithms to suggest matches to both recruiters and job seekers.
  - removes unconscious biases and prejudices of humans.
- Training – AI facilitates training
  - Chatbots can be used as a source of knowledge to answer learners' queries.
  - AI can be used to test progress, and personalize online teaching for individuals

AI in Human Resource Management (2 of 2)

- Performance assessment (evaluation)
  - Breaking work into many small components and by measuring the performance of each employee and team on each component.
  - Performance is compared to objectives, which are provided to employees and teams.
- Retention – eliminating attrition
  - Predicting attrition way ahead of time to eliminate loss of talent

AI in Marketing & Advertising (1 of 2)

1. Product and personal recommendations
2. Smart search engines (e.g., Google's Rank AI system)
3. Fraud and data breaches detection
4. Social semantics (sentiment analysis & voice recognition)
5. Web site design
6. Producer pricing (predictive analysis, dynamic pricing, forecasting)

AI in Marketing & Advertising (2 of 2)

7. Predictive customer service options
8. Ad targeting
9. Speech recognition
10. Language translation
11. Customer segmentation
12. Sales forecasting
13. Content generation

AI in Production-Operation Management

- AI in manufacturing
  - Automation for compliance and cost reduction
  - React quicker and more effectively (agility)
- Implementation model
  - Streamlining processes, smart outsourcing, work automation, improving customer experience
- Intelligent factories
- Logistic and transportation
  - Example: DHL supply-chain

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