PLUG IT IN 5

Intelligent Systems

1. Introduction to intelligent systems
2. Expert Systems
3. Neural Networks
4. Fuzzy Logic
5. Genetic Algorithms
6. Intelligent Agents

>>>

1. Explain the potential value and the potential limitations of artificial intelligence.
2. Provide examples of the benefits, applications, and limitations of expert systems.
3. Provide examples of the use of neural networks.
4. Provide examples of the use of fuzzy logic.

>>>

5. Describe the situations in which genetic algorithms would be most useful.
6. Describe the use case for several major types of intelligent agents.

PI5.1 Introduction to Intelligent Systems

- Intelligent Systems
- Artificial Intelligence (AI)
- Intelligent Behavior
- Algorithm

Natural versus Artificial Intelligence (AI)

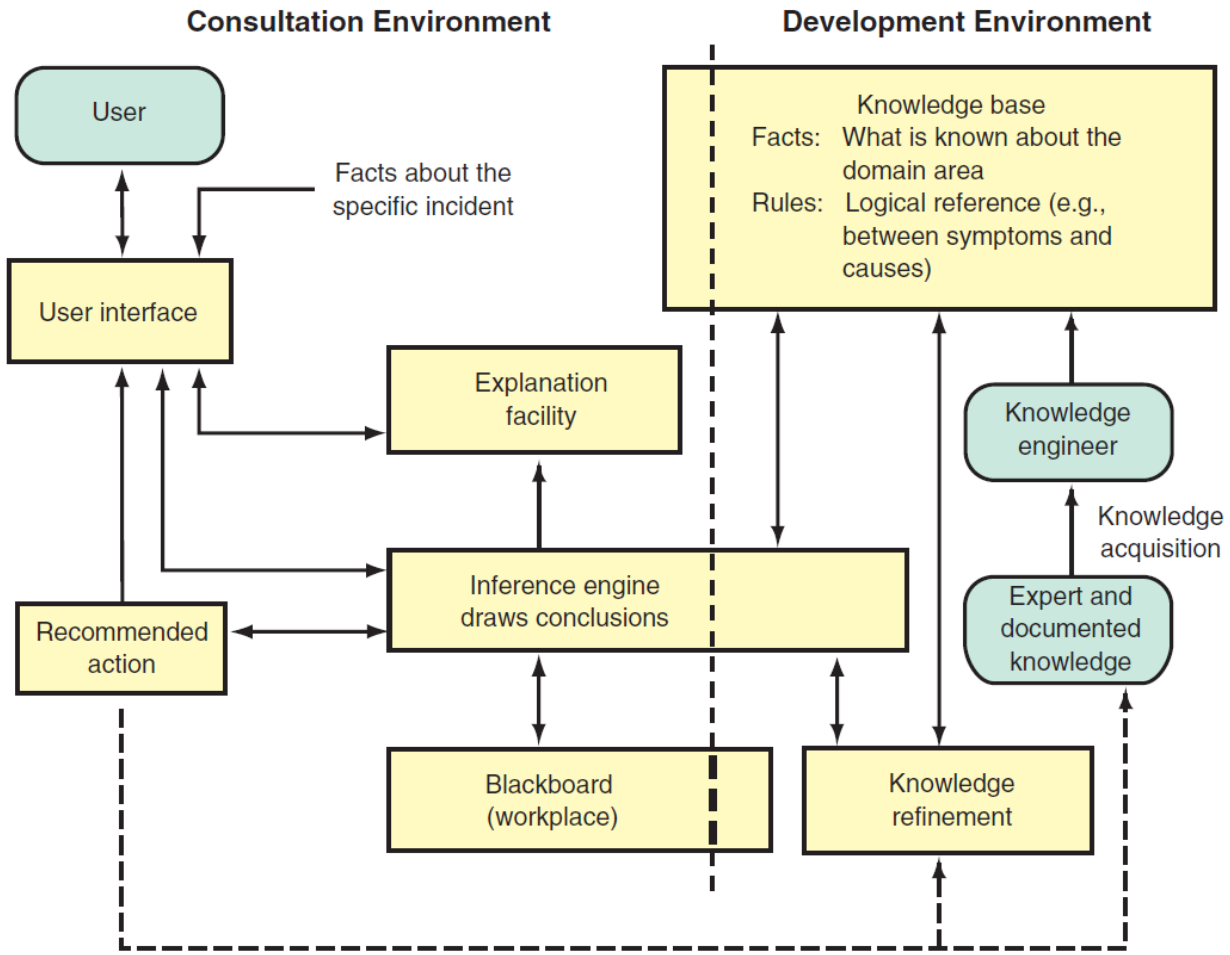
TABLE PI5.1 Comparison of the Capabilities of Natural Versus Artificial Intelligence

Capabilities	Natural Intelligence	Artificial Intelligence
Preservation of knowledge	Perishable from an organizational point of view	Permanent
Duplication and dissemination	Difficult, expensive, takes time	Easy, fast, and inexpensive of knowledge in a computer
Total cost of knowledge	Can be erratic and inconsistent, incomplete at times	Consistent and thorough
Documentability of process and knowledge	Difficult, expensive	Fairly easy, inexpensive
Creativity	Can be very high	Low, uninspired
Use of sensory experiences	Direct and rich in possibilities	Must be interpreted first; limited
Recognizing patterns and relationships	Fast, easy to explain	Machine learning still not as good as people in most cases, but in some cases better than people
Reasoning	Making use of wide context of experiences	Good only in narrow, focused, and stable domains

PI5.2 Expert Systems (ES)

- Expertise
- Expert System
- Four Activities of Expertise Transfer
- The Components of Expert Systems
- Applications, Benefits, and Limitations of Expert Systems

Structure and Process of an Expert System (Figure PI5.1)



Four Activities of Expertise Transfer from an Expert to a Computer

1. Knowledge Acquisition
2. Knowledge Representation
3. Knowledge Inferencing
4. Knowledge Transfer

Components of Expert Systems (ES)

- Knowledge Base
- Inference Engine
- User Interface
- Blackboard (workspace)
- Explanation Subsystem (justifier)

Application of Expert Systems (ES)

Ten Generic Categories of ES's

1. Interpretation
2. Prediction
3. Diagnosis
4. Design
5. Planning
6. Monitoring

Application of Expert Systems (ES) (continued)

Ten Generic Categories of ES's (con't)

7. Debugging
8. Repair
9. Instruction
10. Control

Benefits of Expert Systems (ES)

1. Increased output and productivity
2. Increased quality
3. Capture and dissemination of scarce expertise
4. Operation in hazardous environments

Benefits of Expert Systems (ES) (continued)

5. Accessibility to knowledge and help desks
6. Reliability
7. Ability to work with incomplete or uncertain information
8. Provision of training

Benefits of Expert Systems (ES) (continued)

9. Enhancement of decision-making and problem-solving capabilities
10. Decreased decision-making time
11. Reduced downtime

Benefits of Expert Systems (ES)

TABLE PI5.3 Benefits of Expert Systems

Benefit	Description
Increased output and productivity	ESs can configure components for each custom order, increasing production capabilities.
Increased quality	ESs can provide consistent advice and reduce error rates.
Capture and dissemination of scarce expertise	Expertise from anywhere in the world can be obtained and used.
Operation in hazardous environments	Sensors can collect information that an ES interprets, enabling human workers to avoid hot, humid, or toxic environments.
Accessibility to knowledge and help desks	ESs can increase the productivity of help desk employees, or even automate this function.
Reliability	ESs do not become tired or bored, call in sick, or go on strike. They consistently pay attention to details.
Ability to work with incomplete or uncertain information	Even with an answer of "don't know," an ES can produce an answer, although it may not be a definite one.
Provision of training	The explanation facility of an ES can serve as a teaching device and a knowledge base for novices.
Enhancement of decision-making and problem-solving capabilities	ESs allow the integration of expert judgment into analysis (e.g., diagnosis of machine malfunction and even medical diagnosis).
Decreased decision-making time	ESs usually can make faster decisions than humans working alone.
Reduced downtime	ESs can quickly diagnose machine malfunctions and prescribe repairs.

Limitations of Expert Systems (ES)

- Transferring domain expertise from human experts to the expert system can be difficult
- Automating the reasoning process of domain experts may not be possible
- Potential liability from the use of expert systems

PI5.3 Neural Networks

- A Neural network
- Machine Learning Systems
  - Optical character recognition
  - Face recognition
  - Topic identification
  - Fraud detection
  - Customer segmentation

Neural Network

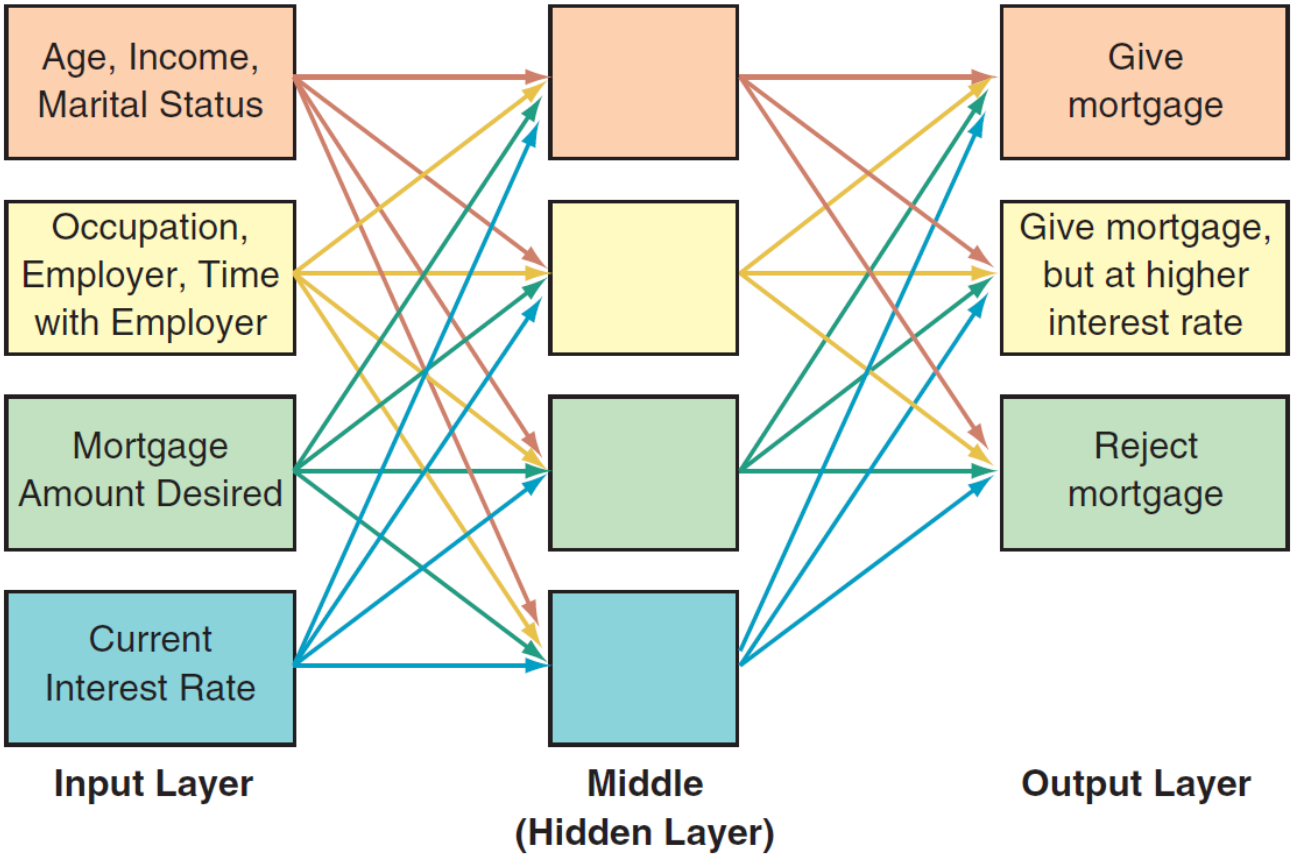


Figure PI5.2 Neural network.

Application of Neural Networks

- Bruce Nuclear Facility in Ontario
- Disease research
- Investor forecasting
- Detecting fraud in banking systems

Application of Machine Learning Systems

- Optical character recognition
- Face recognition
- Topic identification
- Fraud detection
- Customer segmentation

PI5.4 Fuzzy Logic

- Fuzzy Logic
- Examples of Applied Fuzzy Logic
  - Bank loan application approval
  - Financial analysis
  - Internet search engines

PI5.5 Genetic Algorithms

- Three functional characteristics
  - Selection, Crossover, & Mutation
- Examples
  - Boeing, design of aircraft parts
  - Retailers, inventory management and display optimization
  - Air Liquide, Operations optimization

PI5.6 Intelligent Agents

- Information Agents
- Monitoring and Surveillance Agents
- User Agents

Application of Information Agents

- Amazon.com
- Google and Ask.com
- Federal Electronic Research and Review Extraction Tool (FERRET)

Application of Monitoring and Surveillance Agents

- Allstate Insurance, computer network management
- Competitor pricing alerts
- Stock market environment / rumor alerts
- Best prices when shopping online

Application of User Agent

- Automated e-mail management
- Automatic Online Form Completion