Unit I

Introduction to Artificial Intelligence

(6 Hours)

1.1 Introduction to AI, AI Perspectives: Acting and thinking humanly, Acting and thinking rationally

1.2 Scope of AI

- 1.2.1. Game Playing
- 1.2.2. Problem Solving:
- 1.2.3. Natural Language Processing
- 1.2.4. Robotics
- 1.2.5. Computer Vision
- 1.2.6. Expert Systems

1.3 Turing Machine and Turing Test

1.4. Intelligent Agents, Structure of Intelligent agent, Properties of Intelligent Agents

Case Example: "SmartFarm AI – Helping a Farmer with Artificial Intelligence"

1. Ramesh is a farmer in Nepal.
2. He grows tomatoes, potatoes, and rice on his small farm.
3. Every year, he faces problems with plant diseases.

4. Sometimes his crops get damaged before he even notices it.
5. He loses a lot of money due to late detection of crop disease.
6. He wishes he could get early warnings before his plants die.
7. One day, his friend tells him about **SmartFarm AI**, a mobile app that uses Artificial Intelligence.
8. The app can identify plant diseases from photos taken by the farmer.
9. Ramesh decides to try it out.
10. He opens the app and takes a photo of an infected tomato leaf.
11. The app immediately analyzes the photo.
12. It detects brown spots and discolored edges on the leaf.
13. Within a few seconds, it says:
14. "Your plant may have *Early Blight* disease."
15. It also shows what medicine to use and how to prevent it next time.
16. Ramesh is surprised and happy.
17. He realizes this is **Artificial Intelligence** at work.
18. But what exactly is happening inside the app?
19. Let's break it down to understand how AI helps Ramesh.

Part 1: How the AI Works

20. The app uses a **camera** (sensor) to capture the image.
21. The photo is sent to a computer model trained on thousands of leaf images(ML).
22. The model has learned from **past data** to recognize patterns of healthy and infected leaves.
23. The computer compares Ramesh's leaf with known examples in its database.
24. It uses a **machine learning algorithm** to predict the disease.
25. The algorithm gives a result: "Early Blight, 95% confidence."
26. It then generates suggestions and sends them back to Ramesh's phone.
27. The app acts as an **intelligent agent** — it perceives, thinks, and acts.
28. The AI doesn't just see colors; it interprets meaning — like a human would.
29. It has learned from experience, not by being told every rule manually.
30. That's what makes it "intelligent."

Part 2: Difference Between Human and AI Thinking

31. If a human expert saw the leaf, he would:
32. Observe the color and texture.
33. Recall past experiences of plant diseases.
34. Think logically and emotionally ("I've seen this disease before").
35. Then decide which treatment to apply.
36. The AI system, on the other hand:
37. Doesn't have feelings or experience pain or stress.
38. It just processes the image mathematically.
39. It calculates similarity scores and probabilities.
40. It uses stored data and algorithms instead of emotions.
41. It works faster but only in the field it was trained for.

42. If the app is shown a banana leaf (not in its training data), it may fail.
43. So, humans are flexible and adaptive — AI is powerful but limited.

(a) Plantix-your crop doctor (b) AgroAI-Plant Diseases Diagnosis (Early Access)

Part 3: Understanding AI Perspectives through this Case

1. Acting Humanly

44. The app acts like a human plant expert.
45. It observes the leaf, identifies the problem, and gives a solution.
46. Ramesh talks to it like a person — "What's wrong with my plant?"
47. The app responds naturally, like a conversation.
48. It passes the "acting humanly" test because Ramesh feels like he's talking to an expert.

2. Thinking Humanly

49. The AI "thinks" by simulating how a human reasons.
50. It doesn't just store pictures — it looks for patterns and causes.
51. For example, it identifies that brown spots usually mean fungus.
52. It has learned cause-and-effect relationships like humans do.
53. It "thinks" but without emotions or fatigue.

3. Acting Rationally

54. The AI tries to choose the best action for the situation.
55. It doesn't panic or guess randomly.
56. It analyzes data and selects the most effective disease treatment.
57. That's rational action — doing what maximizes success.
58. Humans might hesitate or delay, but AI acts immediately.

4. Thinking Rationally

59. The app uses logic and rules behind the scenes.

60. For example:
61. IF leaf has dark circular spots AND yellow edges, THEN disease = Early Blight.
62. These are logical rules that follow the “laws of thought.”
63. It reasons step by step to reach a conclusion.

Part 4: Inside the Intelligent Agent

64. The app behaves as an **Intelligent Agent**.
65. It perceives the environment using its camera.
66. It reasons using algorithms and learned knowledge.
67. It acts by giving the user advice and actions.
68. It can even improve with feedback — a key property of learning agents.
69. Over time, as more farmers use the app, the model becomes smarter.

Agent Components:

70. Sensor → Camera (captures leaf image)
71. Processor → AI model (analyzes the data)
72. Actuator → App interface (shows diagnosis and advice)

Properties:

73. Autonomy — works on its own.
74. Reactivity — responds to user input quickly.
75. Proactiveness — gives preventive advice before diseases occur.
76. Rationality — chooses best solution with available information.
77. Learning — improves through continuous data updates.

Part 5: How AI Learns Like a Student

78. AI learning is similar to how a student studies for exams.
79. Suppose you show a student 100 pictures of diseased leaves.
80. The student learns to recognize patterns — shapes, colors, textures.
81. Then you test them with a new image.
82. If they recognize it correctly, they’ve learned.
83. Similarly, AI uses “training data” and “testing data.”
84. The more examples it sees, the better it gets.
85. But unlike humans, AI can learn from **millions of examples** in minutes.

Part 6: Expanding AI in the Farm

86. SmartFarm AI doesn’t stop at disease detection.
87. It also uses AI to predict **weather conditions**.
88. It combines data from satellites and local sensors.
89. The AI forecasts rainfall, temperature, and humidity.

90. It alerts Ramesh: “Heavy rain tomorrow, avoid spraying chemicals.”
91. It helps him plan his work smarter.
92. The AI is like a “digital assistant farmer.”

Part 7: How Humans and AI Work Together

93. Humans have **intuition** and **creativity**.
94. AI has **data and computation power**.
95. Together, they form a strong partnership.
96. Ramesh still decides what to do, but the AI helps him make better choices.
97. The AI learns patterns faster, but Ramesh knows his farm better.
98. So both intelligence types complement each other.

Part 8: Advantages of AI in this Case

99. Early detection of diseases.
100. Saves time and effort.
101. Reduces crop loss and increases productivity.
102. Provides consistent advice without fatigue.
103. Works 24/7 and improves continuously.

Part 9: Limitations of AI

104. Depends on quality of data and internet connection.
105. May fail if shown something completely new.
106. Cannot replace human judgment or creativity.
107. Needs updates and maintenance regularly.
108. May be costly for small farmers initially.

Part 10: Learning from the SmartFarm Example

109. Through this example, we can understand AI concepts easily.
110. It shows **AI is not magic**, it’s logic and learning combined.
111. Machines are powerful because they follow rules without getting tired.
112. But they lack feelings and social understanding.
113. Humans, on the other hand, can feel empathy and make moral decisions.
114. The goal of AI is not to replace humans but to assist them.
115. AI augments human intelligence — not competes with it.

Learning Points

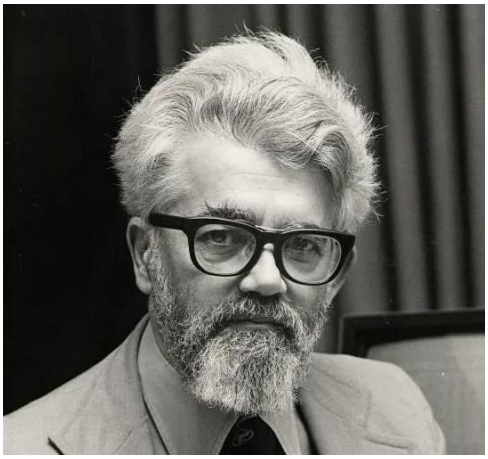
116. SmartFarm AI acts humanly — like an agricultural expert.
117. It thinks humanly — by recognizing disease patterns.
118. It acts rationally — choosing the best solution.
119. It thinks rationally — using logical rules.
120. It behaves like an intelligent agent with perception, reasoning, and action.
121. The Turing Test concept can be applied — if Ramesh can't tell if advice came from a person or AI, it's intelligent.
122. This is how AI makes real-world impact.
123. Farmers, doctors, teachers, and engineers can all use AI tools similarly.

In Summary

124. Humans and AI are both intelligent in their own ways.
125. Humans are creative, emotional, and adaptive.
126. AI is logical, fast, and precise.
127. Together, they can solve big problems — like hunger, disease, and education.
128. Ramesh's SmartFarm AI shows how intelligence can be shared between man and machine.
129. Artificial Intelligence is not just technology — it's the next step in human innovation.
130. Understanding how AI works in simple examples helps us use it responsibly.

1.1 Introduction to Artificial Intelligence

Artificial Intelligence (AI) is a branch of computer science that focuses on creating machines capable of performing tasks that require human-like intelligence such as reasoning, learning, decision-making, perception, and understanding natural language.



Origin:
The term *Artificial Intelligence* was first introduced by **John McCarthy in 1956** during the Dartmouth Conference.

Objectives of AI:

- To build systems that can simulate human thinking and behavior.
- To design machines that can solve complex problems intelligently.
- To enable computers to learn from experience and adapt to new situations.
- To automate reasoning and improve human decision-making.

Examples of AI Applications:

- Virtual assistants (Siri, Alexa, Google Assistant)
- Self-driving cars
- Recommendation systems (Netflix, YouTube)
- Fraud detection in banking
- Smart home automation

AI Perspectives

Artificial Intelligence can be viewed from four main perspectives that describe how a system can behave or think intelligently.

1. Acting Humanly (The Turing Test Approach)

- Proposed by **Alan Turing (1950)**.
- Focuses on building systems that behave like humans.
- The **Turing Test** evaluates whether a machine can exhibit human-like behavior that is indistinguishable from a person.
- If a human evaluator cannot differentiate the machine's responses from a human's, the machine is said to possess intelligence.
- Example: Chatbots or virtual assistants that communicate naturally with humans.

Key Idea:
If a machine can *act* humanly, it can be considered intelligent.

2. Thinking Humanly (The Cognitive Modeling Approach)

- Tries to model how humans think and reason.
- Involves understanding the human brain and replicating its functions using computational models.
- Often data from cognitive psychology and neuroscience is used.

- Example: Neural networks and cognitive architectures that mimic brain processing.

Key Idea:
AI should *think* the same way humans do — by replicating mental processes like learning and memory.

3. Acting Rationally (The Rational Agent Approach)

- Focuses on designing intelligent agents that act to achieve the best possible outcome in any given situation.
- A **rational agent** perceives its environment and takes actions to maximize performance or success.
- Example: Self-driving cars choosing the safest and most efficient path.

Key Idea:
Intelligence means choosing and executing the *best possible action* based on goals and knowledge.

4. Thinking Rationally (The Laws of Thought Approach)

- Based on the use of logic and reasoning to make decisions.
- Derived from the principles of philosophy and mathematics (e.g., Aristotle's logic).
- AI systems are designed to *reason correctly* using logical rules and formal proofs.
- Example: Expert systems that use rule-based reasoning to diagnose diseases.

Key Idea:
AI should *think logically and rationally* — following correct principles of reasoning to reach conclusions.