

Detailed Notes on Artificial Neural Networks (ANN) and Uncertainty

1. Artificial Neural Networks (ANN)

What is ANN?

- ANN is like a machine trying to behave like a human brain.
- It learns from examples, just like humans learn from experience.
- It is built with simple parts called neurons that work together to solve problems.

Structure of ANN:

- Input Layer: This is where data enters the network (like your senses).
- Hidden Layers: These are the "thinking" parts of the network where data is processed.
- Output Layer: This is where the network gives its answers (like saying "this is a cat").

How ANN Works:

- Data passes through layers, and weights are adjusted to improve answers.
- For example, if the network is wrong, it learns by changing its weights to do better next time.

Why ANN is Special:

- It can handle problems where we do not have clear rules (like recognizing faces).
- It learns from examples, so it improves as it gets more data.

2. Types of Learning in ANN

Supervised Learning:

- The network is given examples with answers.
- It learns to match the input to the correct answer.
- Example: Matching pictures of animals with their names.

Unsupervised Learning:

- The network is given data but no answers.
- It organizes the data into groups or patterns.
- Example: Grouping photos of animals without knowing their names.

Reinforcement Learning:

- The network learns by trying actions and getting feedback (rewards or punishments).
- Example: Teaching a robot to walk by rewarding it for steps.

3. Applications of ANN

Where is ANN used?

- Pattern Recognition: Recognizing handwriting or faces in photos.
- Medical Diagnosis: Predicting diseases by analyzing symptoms.
- Speech Recognition: Converting spoken words into text.
- Predictions: Forecasting stock prices or weather.

Why Use ANN?

- It adapts and learns from new information.
- It can solve problems that traditional computers cannot.

4. Advantages of ANN

- Adapts to Changes: Learns from new data automatically.
- Fault Tolerance: Works even if some parts fail.
- Handles Complexity: Can solve tough problems like predicting emotions.

5. Uncertainty in Artificial Intelligence

What is Uncertainty?

- In life and AI, we do not always know everything.
- Example: Will you reach the airport on time? Traffic and other delays are uncertain.

How AI Deals with Uncertainty:

- AI uses probabilities to make the best guesses.
- For example, it might say, "There is a 70% chance of rain tomorrow."

6. Decision-Making with Uncertainty

How Decisions Work in AI:

- AI combines probabilities (how likely something is) with goals (how important it is).
- Example: If there is a 70% chance of traffic, leaving earlier might be a better decision.

Key Formula: Bayes' Rule

- AI uses this formula to update its guesses when new information arrives.
- Formula: $P(A|B) = [P(B|A) * P(A)] / P(B)$
- Do not worry about memorizing it; just understand that it helps update beliefs.

7. Probability Basics

- Prior Probability: What we believe before new information.
Example: Probability of rain without looking outside.
- Posterior Probability: Updated belief after seeing new evidence.
Example: Probability of rain after seeing dark clouds.

How Probabilities Help:

- They simplify complex problems by breaking them into smaller parts.
- Example: Predicting weather involves combining multiple probabilities.

8. Applications of Uncertainty

- Medical Diagnosis: Estimating the chance of a disease based on symptoms.

- Traffic Predictions: Estimating delays based on current road conditions.
- Weather Forecasting: Predicting rain, snow, or sunshine.

Final Study Tips for Exam:

1. Understand how ANN learns (input, hidden, and output layers).
2. Know the types of learning: supervised, unsupervised, and reinforcement.
3. Practice examples of probabilities and Bayes' Rule in real life.
4. Focus on applications like medical diagnosis and pattern recognition.
5. Remember: AI helps where rules are unclear, and it improves with data.

Good luck with your exam!
