

Summary: Reinforcement Learning and Artificial Neural Networks

Reinforcement Learning (RL)

- **Concept:** A method where an agent learns to make decisions by interacting with an environment to maximize cumulative rewards.
- **Key Components:**
 - **Agent:** The decision maker.
 - **Environment:** The context in which the agent operates.
 - **Actions:** Choices made by the agent.
 - **Rewards:** Feedback from the environment.
 - **States:** Different situations or configurations in the environment.
- **Algorithms:**
 - **Q-Learning:** Learns the value of actions in states.
 - **Deep Q-Networks (DQN):** Uses neural networks to approximate Q-values.
 - **Policy Gradient Methods:** Directly optimizes the policy.
- **Challenges:** Balancing exploration vs. exploitation and scaling to complex environments.

Artificial Neural Networks (ANNs)

- **Definition:** Artificial Neural Networks (ANNs) are computational models inspired by the human brain, consisting of interconnected layers of nodes (neurons) that process input data to perform tasks such as classification, regression, and pattern recognition.
- **Parameters:**
 - **Weights:** Strength of connections between neurons.
 - **Biases:** Adjust the activation level of neurons.
- **Hyperparameters:**
 - **Learning Rate:** Step size in the training process.
 - **Number of Layers:** Depth of the network.
 - **Neurons per Layer:** Width of each layer.
 - **Batch Size:** Number of samples processed in one iteration.
 - **Epochs:** Total number of passes through the dataset.
- **Activation Functions:**
 - **Sigmoid:** Outputs between 0 and 1.
 - **ReLU:** Outputs the input if positive, otherwise zero.
 - **Tanh:** Outputs between -1 and 1.
 - **Softmax:** Converts outputs into probabilities.
- **Regularization:**
 - **L1 and L2 Regularization:** Adds penalties to the loss function to reduce overfitting.
 - **Dropout:** Randomly omits neurons during training to improve generalization.
 - **Early Stopping:** Halts training when performance on validation data starts to worsen.