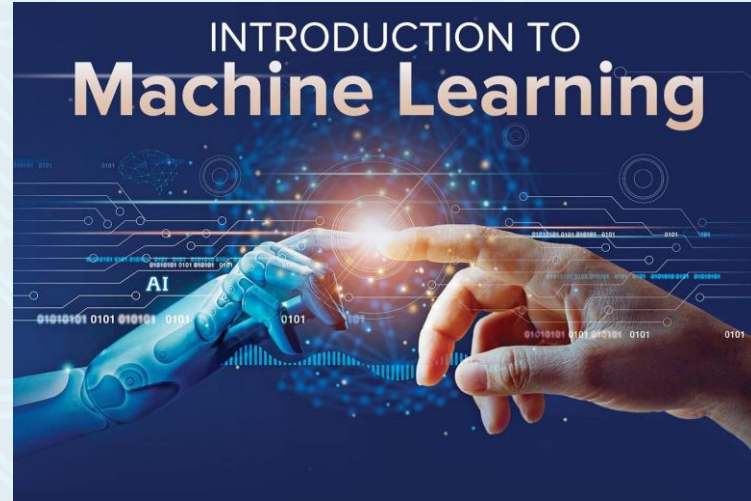


Introduction to machine learning (lecture 4)



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Lesson Outline

- ***Reinforcement learning***
- ***Reinforcement learning in real world***
- ***Reinforcement learning with mechanical computer***

Reinforcement learning

Reinforcement learning differs from supervised and unsupervised learning as it involves learning through experience and experimentation, akin to trial and error. For instance, when training a dog, the dog experiments with responses to commands like "sit" or "stay". Upon executing the correct action, the dog receives a reward, such as a biscuit, reinforcing the desired behavior. Over time, the dog understands that obeying the command yields a reward.



Reinforcement learning consists of several key concepts:

- *Agent is the entity being trained. In our example, this is a dog.*
- *Environment is the “world” in which the agent interacts, such as a park.*
- *Actions are performed by the agent in the environment, such as running around, sitting, or playing ball.*
- *Rewards are issued to the agent for performing good actions.*

Reinforcement learning in the real world

Using the game Breakout as an illustration, reinforcement learning involves a model learning to maximize rewards over time. Initially unaware of the game's objective, the model learns to control the paddle and hit bricks with the ball for the best rewards

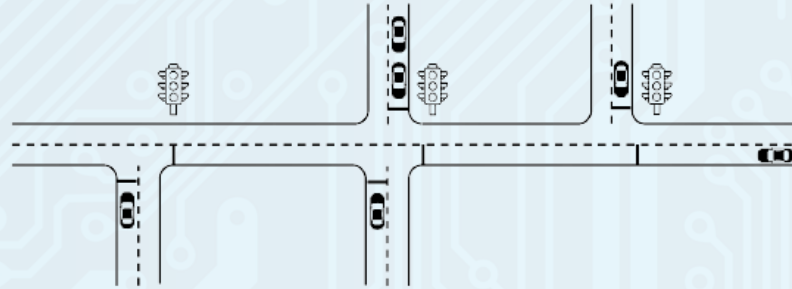
- *Agent is the paddle*
- *Environment is the game scenes with the bricks and boundaries*
- *Actions are the movement of the paddle*
- *Rewards are issued by the reinforcement learning model based upon the number of bricks hit with the ball.*



Reinforcement learning in the real world

Reinforcement learning can optimize traffic signals to reduce congestion. Imagine a system where traffic lights adapt in real-time, minimizing stops and enhancing flow, all driven by the model's goal to maximize its reward.

- *Agent is the traffic light control system*
- *Environment is the road network*
- *Actions are changing the traffic light signals (red-yellow-green)*
- *Rewards are issued by the reinforcement learning model based upon traffic flow and throughput in the road network.*



Reinforcement learning in the real world

Reinforcement learning is key for autonomous vehicles, teaching them to stay on the road, avoid collisions, and maintain optimal speeds through reward mechanisms, ensuring safer journeys.

- *Agent is the car (or, more correctly, the self-driving software running on the car)*
- *Environment is the roads and surrounds on which the car is driving*
- *Actions are things such as steering angle and speed*
- *Rewards are issued by the reinforcement learning model based upon how successfully the car stays on the road and drives to the destination.*



Reinforcement learning with a mechanical computer:

Thank you

Any Question?