REINFORCEMENT LEARNING
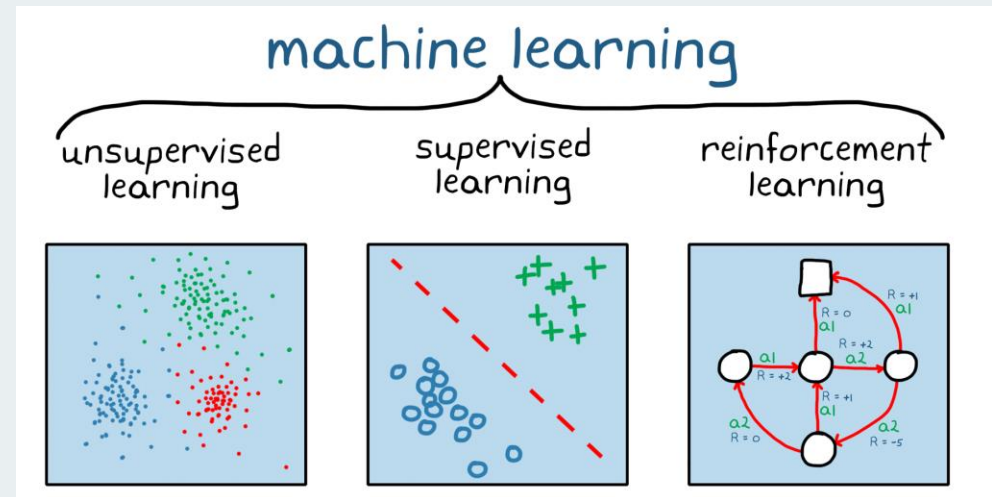
MASHED 2024

What Is Reinforcement Learning?

- A type of machine learning technique

- Makes decisions for optimal results
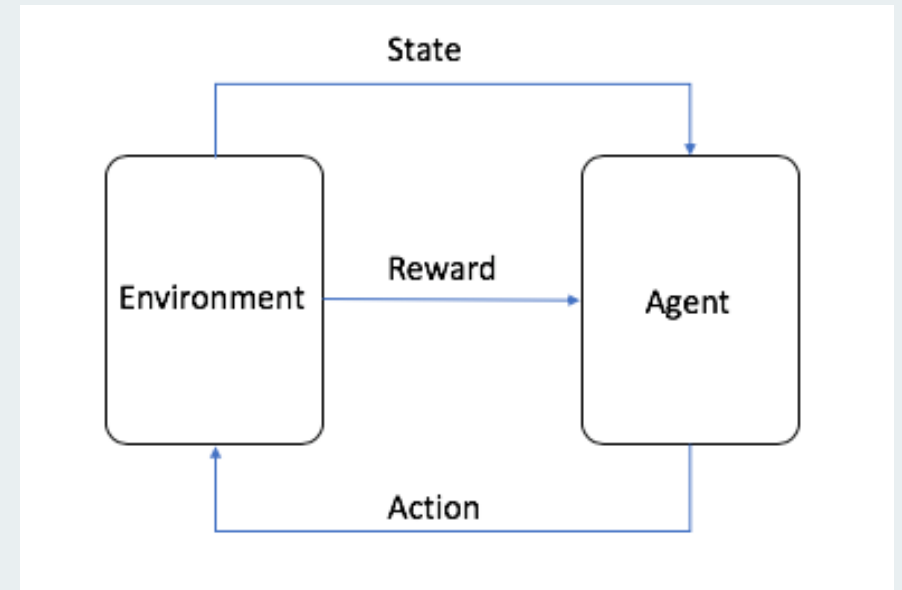
- Based on the trial-and-error process

How Does It Work?

- Implements a reward-and-punishment paradigm

- Learns from feedback from previous actions

- Previous actions as in previous generations (like epochs)

- Discovers the best path to achieve a goal

Basic RL Algorithm

- **Agent**: the RL algorithm

- **Environment**: problem space with variables and bounds

- **Action**: a step that the agent takes to navigate

- **State**: the environment at a point in time

- **Reward**: some value (reward or punishment) for an action

- **Cumulative Reward**: End value of rewards at a generation

Deep Q Learning

- **Epsilon**: Randomness of selecting actions with probability regardless of q value

- **Learning Rate**: How big of a leap to find optimal policy (Q-value update)

- **Replay Buffer**: The model's "memory" of previous states

- **Batch Size**: Number of samples per step (in my case, 1 state per step)

- **Gamma**: Higher weights for future states

- This is the agent of the reinforcement learning algorithm

Training On A Rhythm Game


```
inputs = {
  "Key 1": 0.25,
  "Key 2": 0.25,
  "Key 3": 0.25,
  "Key 4": 0.25
}
```

```
rewards = {
  "PERFECT": 3,
  "GREAT": 1,
  "GOOD": 0,
  "OK": -1,
  "MEH": -3,
  "MISS": -10,
  "FAIL": -10000
}
```

Try It Yourself!

- Compiled Files and Model:
    - https://github.com/m-a-s-h-e-d/rl-osu-mania
    - Sample charts included; no account registration required
    - README includes instructions for installation and setup

References

- https://aws.amazon.com/what-is/reinforcement-learning
  - What is Reinforcement Learning? (Amazon)

- https://www.youtube.com/watch?v=DcYLT37ImBY
  - Training AI to Play Pokémon with Reinforcement Learning (Peter Whidden)

- https://www.youtube.com/watch?v=OQitI066aI0
  - AI Learns to Speedrun Mario (Kush Gupta)

- https://www.youtube.com/watch?v=qv6UVOQ0F44
  - MarI/O – Machine Learning for Video Games (SethBling)

- https://www.youtube.com/watch?v=CI3FRsSAq_U
  - AI Learns to Play Super Mario Bros! (Chrispresso)

- Additional attributions in GitHub repository