Reinforcement Learning & It's Applications

Reinforcement Learning is a branch of machine learning that allows an agent to learn from its own actions and rewards in an environment. The agent does not have prior knowledge or supervision, but it learns from the trial and error based on the rewards and penalties. The goal of reinforcement learning is to find an optimal/ best possible policy that maximizes the expected overall rewards over the time. Reinforcement learning has a lot of applications in various domains such as gaming, medicine, financing, robotics, and more.

In autonomous robotics, reinforcement learning applicability is more suitable to handle the dynamic, unstructured environments. Reinforcement learning allows robots to learn from the trial and error based on rewards, penalties and policies, unlike supervised learning which relies on the labelled data or unsupervised learning which explores data patterns without explicit guidance. This is particularly advantageous while dealing with real-world uncertainties, as robot can adapt their actions based on feedback received from the environment. As robots might not have the access to the labelled data or predefined rules for their behaviour, making supervised and unsupervised learning insufficient. Reinforcement learning can enable robots to learn from their own experience and feedback, using methods such as policy gradient, actor-critic, or Q-learning.

Another famous applications of reinforcement learning is Alpha Go, a computer program that learned to play the board game GO at a superhuman level. Go is complex game which a hugh stat space and degree of uncertainty which makes it hard to apply traditional methods such as supervised or unsupervised learning. AlphaGO used a combination of deep learning neural networks and Monte Carlo tree search to learn from the both human expert games and self-play games using reinforcement learning to improve its policy and value functions. AlphaGo demonstrated the power of reinforcement learning to master the challenging tasks that require strategic thinking and creativity. A third application of reinforcement learning is in finance, where reinforcement learning agents can learn to optimize trading strategies, portfolio management, asset allocation and risk management. Finance is a domain where reinforcement learning can be beneficial because financial markets are highly dynamic, and competitive which require agent to balance the exploration and exploitation as well as the short and long term rewards/goal. As financial data might not be labelled or clustered making supervised and unsupervised learning less effective. Reinforcement learning can allow agents to learn from the market data and feedback signal using methods such as deep Q-networks, deep deterministic policy gradient etc.

In summary, reinforcement learning's suitability for applications like autonomous robotics, gaming, finance, healthcare, and recommendation systems lies in its capacity to adapt the dynamic and uncertain environments. Traditional supervised and unsupervised methods often fall shot in these domains due to their reliance on static data or lack of guidance.

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