Why study reinforcement learning? Reinforcement learning is an exciting an active field of machine learning research. It has been used to solve a wide variety of problems, including robotics, game playing, and resource management. Reinforcement learning is also a powerful paradigm for studying animal and human behavior. In this book, we will focus on the problem of learning to make decisions in a sequential manner. This problem is a natural fit for many real-world problems, such as autonomous driving, robotics, and finance.

This book expects some knowledge of linear algebra and multivariable calculus. Students should be familiar with the following concepts:

- **Linear Algebra:** Vectors, matrices, matrix multiplication, matrix inversion, eigenvalues and eigenvectors, and the Gram-Schmidt process.
- **Multivariable Calculus:** Partial derivatives, gradient, directional derivative, and the chain rule.

0.1 Notation

We will use the following notation throughout the book: add notatio

0.2 Challenges of reinforcement learning

Exploration-exploitation tradeoff. Should the agent try a new action or stick with the action that it knows is good?

Prediction. The agent might want to predict the value of a state or state-action pair.

Policy computation (control). In a complex environment, even if the dynamics are known, it can still be challenging to compute the best policy.