Model Based vs Model Free Learning

A **model** is basically a plan for our agent. When we have a set of defined state transition probabilities, we call that working with a model. Reinforcement learning can be applied with or without a model, or even used to define a model.

A complete model of the environment is required to do Dynamic Programming. If our agent doesn't have a complete map of what to expect, we can instead employ what is called **model-free learning**. In layman's terms, this is learning by trial and error.

For some board games such as chess and go, although we can accurately model the environment's dynamics, computational power constrains us from calculating the Bellman optimality equation. This is where model-free learning methods shine. We handle this situation by optimizing for a smaller subset of states that are frequently encountered, at the cost of knowing less about the infrequently visited states.

Further reading:

Model Free Reinforcement learning algorithms

https://medium.com/deep-math-machine-learning-ai/ch-12-1-model-free-reinforcement-learning-algorithms-monte-carlo-sarsa-q-learning-65267cb8d1b4

Temporal-Difference Learning (RL: An Introduction Chapter 6)

http://incompleteideas.net/book/the-book.html

Reward-Based Learning, Model-Based and Model-Free (2014)

https://www.quentinhuys.com/pub/HuysEa14-ModelBasedModelFree.pdf

Temporal Difference Models: Model-Free Deep RL for Model-Based Control (2018)

https://bair.berkeley.edu/blog/2018/04/26/tdm/

https://arxiv.org/abs/1802.09081