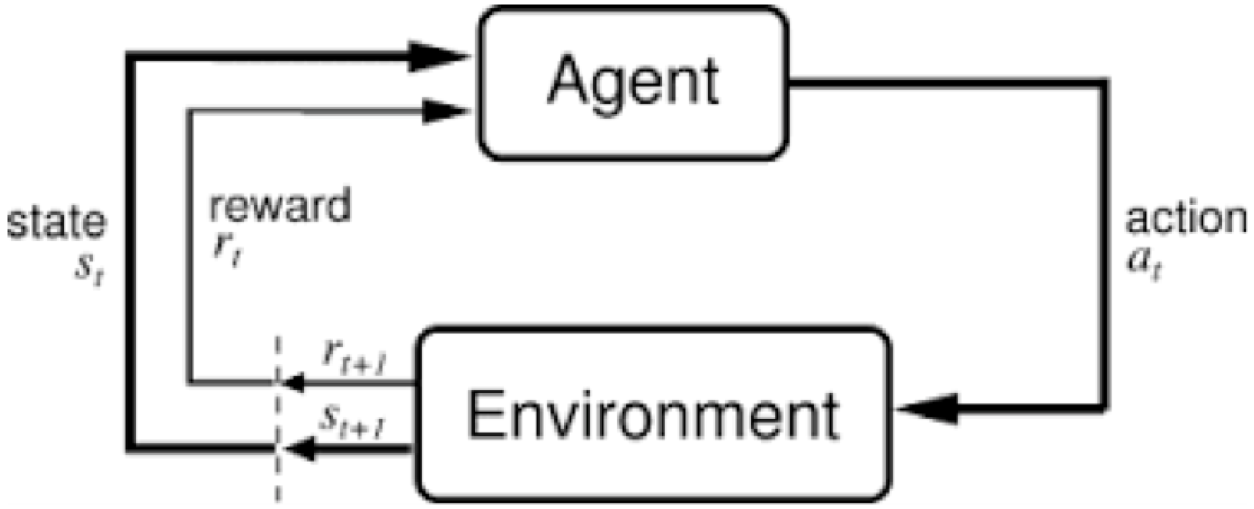
Source: https://skymind.ai/wiki/deep-reinforcement-learning

- Agent: An **agent** takes actions; for example, a drone making a delivery, or Super Mario navigating a video game. The algorithm is the agent. In life, the agent is you.[1]
- Action (A): A is the set of all possible moves the agent can make. An **action** is almost self-explanatory, but it should be noted that agents choose among a list of possible actions. In video games, the list might include running right or left, jumping high or low, crouching or standing still. In the stock markets, the list might include buying, selling or holding any one of an array of securities and their derivatives. When handling aerial drones, alternatives would include many different velocities and accelerations in 3D space.
- Discount factor: The **discount factor** is multiplied by future rewards as discovered by the agent in order to dampen these rewards' effect on the agent's choice of action. Why? It is designed to make future rewards worth less than immediate rewards; i.e. it enforces a kind of short-term hedonism in the agent. Often expressed with the lower-case Greek letter gamma: γ. If γ is .8, and there's a reward of 10 points after 3 time steps, the present value of that reward is $0.8^{3}x10$. A discount factor of 1 would make future rewards worth just as much as immediate rewards. We're fighting against delayed gratification here.
- Environment: The world through which the agent moves. The environment takes the agent's current state and action as input, and returns as output the agent's reward and its next state. If you are the agent, the environment could be the laws of physics and the rules of society that process your actions and determine the consequences of them.
- State (S): A **state** is a concrete and immediate situation in which the agent finds itself; i.e. a specific place and moment, an instantaneous configuration that puts the agent in relation to other significant things such as tools, obstacles, enemies or prizes. It can the current situation returned by the environment, or any future situation. Were you ever in the wrong place at the wrong time? That's a state.
- Reward (R): A **reward** is the feedback by which we measure the success or failure of an agent's actions. For example, in a video game, when Mario touches a coin, he wins points. From any given state, an agent sends output in the form of actions to the environment, and the environment returns the agent's new state (which resulted from acting on the previous state) as well as rewards, if there are

any. Rewards can be immediate or delayed. They effectively evaluate the agent's action.

- Policy (π): The **policy** is the strategy that the agent employs to determine the next action based on the current state. It maps states to actions, the actions that promise the highest reward.
- Value (V): The expected long-term return with discount, as opposed to the short-term reward R. $V^{\pi}(s)$ is defined as the expected long-term return of the current state under policy π. We discount rewards, or lower their estimated value, the further into the future they occur. See discount factor. And remember Keynes: "In the long run, we are all dead." That's why you discount future rewards.
- Q-value or action-value (Q): **Q-value** is similar to Value, except that it takes an extra parameter, the current action a. $Q^{\pi}(s, a)$ refers to the long-term return of the current state s, taking action a under policy π. Q maps state-action pairs to rewards. Note the difference between Q and policy.
- Trajectory: A sequence of states and actions that influence those states. From the Latin "to throw across." The life of an agent is but a ball tossed high and arching through space-time.

So environments are functions that transform an action taken in the current state into the next state and a reward; agents are functions that transform the new state and reward into the next action. We can know the agent's function, but we cannot know the function of the environment. It is a black box where we only see the inputs and outputs. It's like most people's relationship with technology: we know what it does, but we don't know how it works. Reinforcement learning represents an agent's attempt to approximate the environment's function, such that we can send actions into the black-box environment that maximize the rewards it spits out.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