

# Building a Self-Driving Car using Q-Learning

Nathan Metze

## Introduction:

Machine learning continues to offer many real-world solutions to problems humans struggle to solve both means. One such question currently being answered is the building of autonomous vehicular systems. Many companies such as Tesla, Google, and Uber are currently developing their own renditions of self-driving cars with hopes of having a fully autonomous car available within the next decade.

The focus of this proposed research project is to develop a machine learning model using reinforced learning to train an autonomous car. I will proceed to do this by using OpenAI's Universe and Gym libraries in Python 3.5<sup>i</sup>. The autonomous car, or agent, will be able to drive without human input based upon a reward system. When the artificial intelligence performs a positive action, it will be rewarded, an example of this would be if the car successfully drives without crashing.

This project will be based upon the works found in *Human-level control through deep reinforcement learning*<sup>ii</sup> as well as *StarCraft II: A New Challenge for Reinforcement Learning*<sup>iii</sup>. In doing so, many inspirations will arise from the aforementioned projects with differences arising in choice of game as well as artificial intelligence being trained. I will be using Q-Learning to training the agent to perform different actions.

This project is of immense interest to me because reinforced learning is similar to ways in which humans are conditioned. Autonomous cars are also fascinating to me due to the untold possibilities it could create in the next decade.

### **Proposal Design:**

In order to ensure a smooth and successful project, I will divide the project up into multiple parts.

1. Clear vision and goals of desired project
2. First implementation of agent acting without human control
3. First implementation of intelligent agent
4. Refined and tested implementation of agent on different race courses
5. Documentation and presentation

### **Time Line:**

*Weeks 1-2:* Continued reading and further understanding of desired goals of project

*Weeks 2-3:* Initial prototyping of Q-Learning algorithm with intelligent-less car moving

*Weeks 3-4:* Expertise in Q-Learning algorithm

*Weeks 4-5:* Initial integration of intelligent agent

*Weeks 5-11:* Refined integration of proposal with satisfactory model

*Weeks 11-12:* Documentation and Presentation

## **Sources:**

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<sup>i</sup> “OpenAI Discovering and enacting the path to safe artificial general intelligence.” *OpenAI*. Web.

<sup>ii</sup> Mnih, Volodymyr, et. al. “Human-level control through deep reinforcement learning”.

<sup>iii</sup> Vinyals, Oriol, et. al. “StarCraft II: A New Challenge for Reinforcement Learning”.