

Project Proposal

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Abstract

Project in mind is an implementation based project. More specifically, to utilize reinforcement learning to train a autonomous driving agent. The main motivation behind this project is to explore the effectiveness of reinforcement learning for the purpose of autonomous driving. Another motivation is the increasing demand for autonomous vehicles for the foreseeable future. The main objective is to train an agent to perform autonomous driving in city and highway both, this will required training the agent on both types of environments. For the purpose of this implementation a simulation environment such as the one provided by AirSim will have to be used for testing purposes.

There are different methods of performing reinforcement learning, some use as single agent, some use multi agents and currently the objective is to utilize just one agent but with further research perhaps multiple agents might yield a better outcome. There are also various methodologies, some only use reinforcement learning, others use a combination of planning and reinforcement learning. For the current standpoint the planning combines with reinforcement learning has shown more effective autonomous driving capabilities but is also more complicated to implement.

Keywords: reinforcement learning, autonomous, deep learning, planning

1 Outline

The main implementation goal is to use existing research to implement a reinforcement learning algorithm, either based on deep learning or standard learning. The things to consider when implementing this algorithm is the number of variables to consider, the inputs, and the outputs of the learning process. The main inputs will be sensors to detect the surrounding, which includes static objects and dynamic objects. Some ideas for this implementation process will be extracted from the findings below.

The reinforcement learning will have to take place in a simulated environment, for this reason the AirSim project by Microsoft [3] can be used to perform the reinforcement learning. Utilizing some of the existing work such as [5] which discusses the permissibility of prediction in autonomous with deep reinforcement learning. This will be critical creating the reinforcement learning algorithm as creating some cost function to evaluate possible actions can directly impact the

size of the learning process. Another aspect of autonomous driving is the ability for the vehicle to recognize and follow a path, this requires detecting surroundings and learning from prior understanding for new environments encountered. For this process the methods described in the paper 'reinforcement learning for adaptive path tracking approach for autonomous driving'. This paper provides some algorithms for the learning process used for path tracking [4].

A different approach to consider then training the agent through reinforcement learning is to use a combination of planning and deep learning [2], the planning aspect described uses a Monte Carlo tree search algorithm and the this allows for tactical decision making similar to the ideas used in the AlphaGo Zero algorithm.

Another interesting approach to consider is to use the survival oriented reinforcement learning model described in [1], which takes a different approach to the deep reinforcement learning presented in the previous sources mentioned. The paper described a way of achieving the survival aspect of the deep reinforcement learning with negative avoidance functions.

References

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