

# Autonomous Car Parking

## CS7IS2 Project (2021/2022)

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**Abstract.** Motivation behind the work, high level description of the problem, how it was solved by the proposed algorithms.

**Keywords:** soft-actor-critic, behaviour cloning, evolutionary algorithm, parking

## 1 Introduction

The Autonomous Vehicle (AV) industry is one of the most active and promising area in the recent years with many ongoing research to make it fully autonomous [6]. The International Society of Automotive Engineers (SAE) proposed a six-degree autonomy scale with level 0 as no automation and level 5 as full automation without any human interventions [5]. The current level of autonomy scale achieved today is between level 2 and 3 requiring some assistance from the driver and limited to ideal conditions.

Car parking is challenging and disliked by most drivers due to time required searching for spaces, risk of scratching vehicle, safety of pedestrian, etc [1][3]. It requires the driver to estimate the space required for the car and manoeuvre it into available space by controlling the steering angle and accelerator. While in fact the traffic report statistics survey results found in 12 million traffic accidents, there are about 10,000 traffic accidents occurring in the parking lots with many more number of accidents not reported [7].

Most vehicles are parked 95% throughout the lifetime [2]. Parking is required by every driver and apply AV will greatly improve the quality of life and ease of drivers. It increases driving safety by utilising various sensors to understand the environment surround vehicle and park at the designated space avoid collisions due to lack of human experiences [7]. Other potential application for autonomous car parking is saving spaces in car parking lots by parking in an optimal grid resulting in a much efficient parking lot capable of more car [2].

The highway-env github repository<sup>1</sup> contains a collection of autonomous driving and tactical decision-making tasks environment [4]. The parking environment<sup>2</sup> is selected for the project which is a goal-conditioned continuous control task in a given space with a vehicle aiming to reach the destination point. The

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<sup>1</sup> <https://github.com/eleurent/highway-env>

<sup>2</sup> id of "parking-v0"

parking environment uses a grid like layout similar to actual car parks. the vehicle requires input of the steering angle and accelerator. The selected algorithms to be investigated in the project are Soft-Actor-Critic (SAC) from the reinforcement learning family, behaviour cloning from the imitation family and evolutionary algorithm from the genetic population-based family.

## 2 Related Work

Related work

## 3 Problem Definition and Algorithm

Problem definition and algorithm

## 4 Experimental Results

Experimental result

## 5 Conclusions

Conclusion

## References

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