Final Year Project Proposal

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Suggested Supervisor:
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Project Details

Project Title	Autonomous Self Driving Car in an Urban Setting using Deep Reinforcement Learning.		
Project Area of Specialization	Deep Reinforcement Learning		
Project Start Date	2021-09-11	**Project End Date**	2022-05-31
Project Summary (less than 2500 characters)	To perform a large variety of tasks and to achieve human-level performance in complex real-world environments, Artificial Intelligence (AI) Agents must be able to learn from their past experiences and gain both knowledge and an accurate representation of their environment. Traditionally, AI agents have suffered from difficulties in obtaining a good representation of their environment and then mapping this representation to an efficient control policy. Deep reinforcement learning algorithms have provided a solution to this issue. This project aims to train an autonomous self-driving car agent in a simulated environment of CARLA using different models of deep RL.		
Project Objectives (less than 2500 characters)	1. Self-driving an autonomous self-driving car in a dynamic simulated environment safely without collisions. 2. Self-driving in a complex urban environment having different weather conditions, day & night		

Project Implementation Method (less than 2500 characters)	To know about reinforcement learning how it works we need to run in such an environment where we can run different algorithms like proximal policy optimization (PP0), genetic algorithm (GA), and Q-learning to find out the optimal algorithm and to know it's working. For that, we use **slimevolleygym** (a simple gym environment for testing single and multi-agent reinforcement learning algorithms). As an example, the Cartpole gaming agent will be run in the deep reinforcement learning and Q-learning of the gym. This will give an idea of how the model act when it is incorporated into an actual environment. Later on, it can be applied to the autonomous self-driving car agent. Reinforcement learning is all about rewards and punishment. If you do the right job you will get a reward if you don't do the right job you will get punishment. So basically the whole story of reinforcement learning moves around reward function, i.e. upon which action the agent will get positive reward and on which actions the agent will get a negative reward. In the case of an autonomous self-driving agent, the environment of reward function will be created where the agent will get a positive reward when it does the right task (driving through the road safely) and will get a negative reward for doing a wrong task (colliding and accidents, etc). After that, the agent will be trained to be trained using different models of deep reinforcement learning and will try to achieve human-level intelligence.
Benefits of the Project (less than 2500 characters)	The project will be beneficial to give the understanding of different models of deep reinforcement learning and will help to solve the real-world problem by making use of those models other than the autonomous self-driving agent. Controlling autonomous cars in a simple & static environment is an easy task due to limited state space. But when it comes to a complex dynamic environment where there are pedestrians, traffic signals, changing of day & night, and weather, then the environment and the state space become complex which in turn become hard to compare to the static. Training a self-driving car in such an environment is the simulated environment of CARLA can

	lead to achieving human-level intelligence in the industry of self-driving cars. Research in autonomous urban driving is hindered by infrastructure costs and the logistical difficulties of training and testing systems in the physical world. Instrumenting and operating even one robotic car requires significant funds and manpower. And a single vehicle is far from sufficient for collecting the requisite data that cover the multitude of corner cases that must be processed for both training and validation. An alternative is to train and validate driving strategies in simulation. Simulation can democratize research in autonomous urban driving. It is also necessary for system verification since some scenarios are too dangerous to be staged in the physical world (e.g., a child running onto the road ahead of the car).
Technical Details of Final Deliverable (less than 2500 characters)	To create a constraint environment to train a reinforcement learning agent of an autonomous self-driving car in a simulated environment on different models of deep RL. The agent will be able to drive in a dynamic environment of changing weather, day & night. Besides, the agent will be able to follow all traffic rules while driving and keep in view a dense urban environment.
Final Deliverable of the Project	1. Experimental Results and Evaluation Scores for different models 2. Architecture and Trained Parameters of RL models 3. CARLA Autonomous Self Driving Agent
Type of Industry	Artificial Intelligence, Robotics. Self-Driving Cars
Technologies	Python, OpenCV. Tensorflow, GitHub, Qt, Keras, PyTorch, Retro, Gym
Sustainable Development Goals	To create an autonomous self-driving car agent which can drive in a dense dynamic urban environment which can drive safely to its destination following the different traffic rules efficiently.

Project Key Milestones

Elapsed time in (days or weeks or month or quarter) since the start of the project	Milestone	Deliverable
FYP-1	1st 4 Month	Getting Familiar with CARLA Static Driving. Static Route Planning
FYP-2	2nd 4 Months	Training the agent on different Models in the Simulated Environment of CARLA

Project Equipment Details

Item Name	Type	No. of Units	Cost (in PKR)	Total (in PKR)
Nvidia GTX 1060 6 GB	GPU	1	75000	75000
Total				**75000**