ClearWay Project Internships Summer 2024

The ClearWay Project[1]
Offering predictable journey times is important to the uptake of sustainable road transportation including future public, shared, and on-demand mobility services and to on-time delivery of goods. To achieve such predictability, the ClearWay[1] project at TCD is exploring 'slot-based driving' (SBD) as a strategy for active management of roads (especially highways). SBD abstracts traffic as flows of slots with each slot having a specified trajectory. Vehicles are associated to slots and their trajectories are intended to follow those of their assigned slots. In practice, depending on the level of control available and/or the degree of compliance of drivers with guidance, vehicles may depart from their slots. However, slots provide an abstraction over which the road traffic management system can reason and exercise control. In particular, we are exploring the use of reinforcement learning to have controllers learn appropriate slot-management strategies.

Project 1. Evaluating Slot-based Driving
This project will develop a simulation environment to allow the evaluation of the potential benefit of SBD in realistic traffic scenarios initially focusing on highways but extending to urban environments if time permits. Taking a previous study [1] as a starting point, this project will initially develop representative simulation models of SBD in both motorway (a section of the Dublin M50 ring road) and potentially urban (Dublin city centre) environments calibrated using historical traffic data and built using the SUMO microscopic traffic simulator [2]. The results of that study will be used as a baseline against which the results of the project can be evaluated. At the end of the project, a report on the performance of representative SBD scenarios vs. the baseline will be delivered.

Project 2. Implementing Slot-based Driving on Mobile Robots
This project will develop a demonstration of SBD on a platoon of mobile robots. The project will involve identifying and possibly evaluating potential platform (e.g., [3]) and implementing a SBD controller on the chosen platform with a view to training a controller to coordinate multiple robots to accomplish a task such as avoiding a road blockage.

Project 3. Implementing a Framework for Road Travel Reservations.
This project will design, implement and demonstrate a framework for building a globally scalable distributed service whose primary purpose is to allow drivers to make journey reservations on highways. The design will adopt a microservice-based approach and exploit emerging clouds platforms, such as AWS, and should focus on providing appropriate levels of performance, scalability, availability, and reliability, considering that the service may need to grow to be used by very many vehicles.

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[1] The *ClearWay* project is supported by the SFI Frontiers for the Future Programme under award number 21/FFP-A/8957 from 2022 to 2026.

Skills required:
Excellent computer programming skills (preferably using Python) as well as:
For post (1) ideally previous experience of computer simulation preferably using SUMO;
For post (2) mandatory previous experience of machine learning, preferably reinforcement learning, and ideally experience with mobile robotics and/or embedded systems;
For post (3) mandatory previous experience of developing distributed applications, preferably with AWS.

References

[1] Maxime Guériau and Ivana Dusparic, "Quantifying the Impact of Connected and Autonomous Vehicles on Traffic Efficiency and Safety in Mixed Traffic", IEEE International Conference on Intelligent Transportation Systems, 2020.

[2] Pablo Alvarez Lopez, Michael Behrisch, Laura Bieker-Walz, Jakob Erdmann, Yun-Pang Flötteröd, Robert Hilbrich, Leonhard Lücken, Johannes Rummel, Peter Wagner and Evamarie Wiessner, "Microscopic Traffic Simulation using SUMO", IEEE International Conference on Intelligent Transportation Systems, 2018.

[3] AWS DeepRacer, https://aws.amazon.com/deepracer/, accessed 2024-05-13.

Application details:
The positions are full-time and tenable immediately for up to twelve weeks (expected to finish no later than the 30th of August 2024) and interns will be expected to work primarily on campus. As full-time positions, applications from continuing students enrolled in full-time courses and who have coursework to complete over the summer months (e.g., a dissertation) are not eligible.

Continuing students will be paid a stipend of EUR500 gross per week for the equivalent of a 39-hour week (and may be eligible to avail of a tax exemption).

Registered students who have recently completed their degrees will be paid at point 1 of the SFI Team Member Budget Scale (April 2024) Research Assistant (equivalent to EUR31,151 per annum).

Please send applications by email to vinny.cahill@tcd.ie quoting "ClearWay Internship" in the subject line and containing only a single PDF file with your CV (including University grades, the contact details of two referees (at least one of which should be academic), and details of any software projects that you have undertaken that illustrate your suitability for the position(s) to which you are applying and taking account of the requirements above). Please identify the position(s) to which you are applying (in order of preference), in the body of the email.

Closing date: 12.00noon BST on Monday the 27th of May 2024.