Title: Reinforcement Learning Techniques for Fleets of Autonomous Vehicles

(supported by British Telecom – NC CDI Project)

Type of award: PhD Research Studentship

Department: Electrical and Electronic Engineering

Details: This project is funded for four years by the British Telecom Ltd. (Overseas candidates please contact r.j.piechocki@bristol.ac.uk before filing your application). Successful students will receive a generous stipend for four years (enhanced stipend). The stipend is £18K, £18.5K, £18.5K, £19K (in years 1-4). Substantial allowance for conference travel and consumables is also provided.

Duration: 4 years

Eligibility: Home/EU applicants

Start Date: As soon as possible

PhD Topic Background/Description

Machine Learning is a branch of Artificial Intelligence where the decision-making agent is learning from the data as opposed to relying on hand crafted decision rules. In recent years ML has become synonymous with AI and is certainly the domain witnessing a true explosion of interest with a plethora of success stories.

This project will explore a new paradigm of learning from interactions with the environment to achieve network control functions, which in turn can orchestrate networks of autonomous vehicles.

Traditionally, optimal control was being provided using heuristics guided by domain expertise. With ML showing unprecedented benefits in such as diverse domains as image classification, natural language processing, automated driving and anomaly detection, it is natural to attempt to reap the benefits for a range of problems in telecommunication industry. Specifically, this project will utilise Reinforcement Learning (a sub branch of AI) which is particularly suitable for a range tasks in network control such as Self Organising-Networks, Resource Allocation any more. RL is a revolutionary paradigm shift, already successfully applied to computer games (e.g. DeepMind’s AlphaGo & AlphaZero). Computer games are a natural training ground for continuous control problems. Computer games as well as many topics in network control can be modelled using Markov Decision Processes (MDP), and hence fundamental solutions developed for playing games are in principle transferable on any other problem modelled by MDP. In this project we focus on Deep Reinforcement Learning (DRL). DRL leverages universal function approximation capabilities of deep neural networks to vastly improve scalability of traditional RL techniques. DRL for orchestration of automated vehicles’ fleets is very much in its infancy. Therefore, there are significant opportunities to conduct ground breaking research with tremendous societal impact.
The successful PhD student will join a large team composed of UK Leading Universities and BT, working on recently funded Next Generation Digital Converged Infrastructure (NGCDI) Project.

**Further Particulars**

**Doing research at the University of Bristol**

The quality of research at the University of Bristol places it within the top five Universities in the UK based on the Research Excellence Framework and Times higher Education rankings 2014-15. The PhD candidate will be a part of a friendly and diverse community, with the Bristol Doctoral College (BDC) as the focal central coordinating facility. Alongside the specialist training the candidate will receive in PhD-specific topics, the BDC offers approximately 200 courses, interactive workshops and seminars as a part of the University’s Personal and Professional Development Programme for PGR students. The BDC organises University-wide events and provides a hub of information, guidance and resources to help researchers to get the most of their time at Bristol.

**Candidate Requirements**

We are looking for an enthusiastic student with a minimum 2:1 honours degree, or equivalent in Electrical and Electronic Engineering, Computer Science, Physics, Maths.

Basic skills and knowledge required in Solid Mathematics (statistics, multivariate calculus, optimisation, matrix algebra) and Programming (python, tensorflow).

**Scholarship Details**

Scholarship covers full UK/EU (EU applicants who have been resident in the UK for 3 years prior to application) PhD tuition fees and a tax-free stipend at the current RCUK rate plus an industrial top-up to give an initial amount of £18,000 p.a. EU nationals resident in the EU may also apply but will only qualify for PhD tuition fees.

**Informal enquiries**

For informal enquiries please email Dr Robert Piechocki r.j.piechocki@bristol.ac.uk

For general enquiries, please email sceem-pgr@bristol.ac.uk

**Application Details**

To apply for this studentship, submit a PhD application to the Department of Electrical and Electronic Engineering using our online application system [www.bristol.ac.uk/pg-howtoapply]

Please ensure that in the Funding section you tick “I would like to be considered for a funding award” and specify the title of the scholarship in the “other” box below with the name of the supervisor Dr Robert Piechocki.

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