

AIMS CDT Newsletter

Jan - Jul Edition

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A warm welcome to all our industrial partners and to our new partners: **ABB**, **Samsung** and **Toshiba**. We thank you all for your continued support and wish to showcase to you, the amazing work that is currently being undertaken in the EPSRC Centre for Doctoral Training in Autonomous Intelligent Machines and Systems. With the introduction of our new half-yearly student led newsletter, we hope to keep you informed and updated with research that is currently being undertaken and its potential applications for industry.

The AIMS program combines research from a plateau of domains. From autonomous vehicles, to visual recognition and object detection, sensor networks, smart buildings, 3D reconstruction, multi-agent systems, reinforcement learning, Bayesian inference, probabilistic programming and much, much more.

Robotics Week

During robotics week the new first year cohort split into three teams and worked together, with the aim to create and build a system that would allow a husky robot to navigate completely autonomously through three obstacle based challenges. Teams had to put the theory that they had learnt to the test and apply that knowledge to a real world system.



The first obstacle course was target detection, can the husky spot the goal and drive to it autonomously. The second was to navigate round a series of obstructions, correctly identify the target and then drive back. The third was similar to the second, but with more obstacles.

The competition was fierce and the final scores were close, but team three were the victors.



Team 3. From left to right: Xu Ji, Adam Goliński, Oliver Bent

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Internships

AIMS students are embarking on a wide range of internships this year

Stefan Safetscu (3rd year) will be an intern for **Google** in

California. Adam Cobb (2nd year) and Tim Seabrook (2nd year) will be both interning for **NASA's** Frontier Development Lab (FDL) in Mountain view, California. Oliver Bent (1st year) will be traveling to Kenya to work with **IBM Africa** on Mosquito detection. ■

Papers Submitted to 2017 Conferences

AIMS students have had a successful year so far

in both submitting and having papers accepted for this years big machine learning, computer vision and programming conferences, such as: NIPS, ICML, ICLR, ECML, POPL and ICCV.

Adam Cobb (2nd year student), who submitted the following to NIPS: **Learning from lions: inferring the utility of agents from their trajectories**.

The paper used GPS data from lions in order to make inferences about their preferences over waterholes, fences and other significant features.

Greg Farquhar (2nd year) and Triantafyllos Afouras (1st year), jointly submitted to NIPS this year, with a paper on multi-agent reinforcement learning: **Counterfactual Multi-Agent Policy Gradients**.

In the paper they train neural networks to play the computer game StarCraft, treating each unit as an independent agent with limited, local information. The algorithms are relevant for any context in which you can have centralised training, but the agents need to execute decentralised policies. The work could be used to help optimise the coordination of drones or autonomous vehicles.

Nikitas Rontsis (2nd year) also submitted to NIPS this year, with a paper: **Distributionally Robust Optimization Techniques in Batch Bayesian Optimization**.

The paper uses ideas from Convex Optimisation and Control theory, and applies them to Machine Learning techniques, with an emphasis to Gaussian Processes. Applications include Bayesian Optimisation and safety critical dynamical systems.

Robert Cornish (2nd year) submitted two papers to NIPS **Online Learning Rate Adaptation with Hypergradient Descent** and **On the Opportunities and Pitfalls of Nesting Monte Carlo Estimators**.

Finally, James Thewlis (3rd year) submitted to NIPS with **Unsupervised object learning from dense equivariant image labelling**

To ECML Ivan Kiskin (2nd year) submitted **Mosquito Detection with Neural Networks The Buzz of Deep Learning**

Léonard Berrada (2nd year) had his publication to ICLR 2017 **accepted**, which created a more efficient optimisation algorithm for Piecewise-Linear Convolutional Neural Networks (PL-CNNs), which enables better classification of objects within images. The paper is called **Trusting SVM for Piecewise Linear CNNs**

To ICCV James Thewlis submitted a paper for learning representations of objects called **Unsupervised learning of object landmarks by factorized spatial embeddings** Where with as little as 5 marked points and 20 training samples, it was possible to learn what a face is, or what characterises a shoe or a fox.

Greg Farquhar and Triantafyllos Afouras have had thier paper on multi-agent reinforcement learning **accepted** for ICML 2017. Their paper **Stabilising Experience Replay for Deep Multi-Agent Reinforcement Learning** has potential applications for urban traffic control and network packet routing, among others.

Robert Cornish had his paper **Efficient exact inference in discrete Anglican programs**. for the PPS workshop at POPL 2017 **accepted**

Siddarth Ghoshal has had his paper **Reading the Tea Leaves: A Neural Network Perspective on Technical Trading** published in KDD (Knowledge Discovery and Data, 2017) **accepted**. ■

SECTION B

Current Projects

The current first year students have competed their first mini-projects which took place over the Easter Vacation. Below are the subjects they have been working on.

- Counterfactual multi-agent policy gradients
- Improving exploration in deep reinforcement learning
- Forecasting financial time series with CNNs
- Neural networks for 2D to 3D human pose estimation
- Multi-layer stacked Gaussian Processes
- Seeing is believing: Contrastive hebbian clustering for unsupervised one-shot gameplay learning in a recurrent neural network
- Inference of spatial distribution from multi-sensor measurements along trajectories with inaccurate location information
- Closed-loop quantitative verification of rate-adaptive pacemakers
- Learning from limited demonstrations in high dimensional feature spaces
- Meta-probabilistic numerics

