

TALFAN EVANS

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RESEARCH FELLOW IN COMPUTATIONAL NEUROSCIENCE, UCL

- **Probabilistic World Models** I'm interested in how hierarchical probabilistic representations of the world are represented and developed in the brain, how they might improve generalization/improve learning efficiency, and how they might be computed (1, 3). I study these in the context of human/rodent spatial learning.
- **Active Learning** I'm interested in how animals/humans learn by active interaction/exploration.
- **SLAM** I organised an interdisciplinary 3-day workshop discussing the links between robotics/ML and neuroscientific research into spatial localization, learning and navigation (2, b). More broadly, I'm interested in the hardware ↔ software interaction in robotics.

EDUCATION

- **PhD Cognitive and Computational Neuroscience, UCL** 2014-2018
 - Application of approximate probabilistic inference techniques to neurobiological systems performing simultaneous localization and mapping (SLAM). *Sup. Neil Burgess*
- **MRes Modelling Biological Complexity, UCL (Distinction)** 2013-2014
 - [Structure learning in redundant motor control tasks](#). *Sup. M. Sahani, J. Diedrichsen*
 - [Active Learning Approaches to Classifying Camera Trap Images](#). *Sup. Gabe Brostow*
- **MEng Engineering Science, University of Oxford (2.1)** 2009-2013
 - Franklin Prize for best Master's thesis, Keble College
 - Distinction in all projects

PUBLICATIONS

1. **Evans** and Burgess. Probabilistic spatial inference in the hippocampal-entorhinal system. *Submitted*.
2. **Evans***, **Bicanski*** and Burgess. What can SLAM learn from neuroscience? *In preparation*.
3. **Evans and Burgess (2019)**. Coordinated hippocampal-entorhinal replay as probabilistic structural inference. *NeurIPS*.
4. **English***, **McKenzie***, **Evans**, **Kim**, **Yoon**, **Buzsaki (2017)**. Pyramidal cell-interneuron circuit architecture and dynamics in hippocampal networks. *Neuron*.
5. **Evans**, **Bicanski**, **Bush**, **Burgess (2015)**. How environment and self-motion combine in neural representations of space. *Journal of Physiology*.

CONFERENCES

- a **Evans** and Burgess (2019). Coordinated place-grid cell replay as structural inference. *NeurIPS*.
- b **Evans***, **Bicanski*** and Burgess (2019). What can neuroscience learn from SLAM (and vice versa)? *EITN, Paris*.
- c **Evans** and Burgess (2019). Coordinated place-grid cell replay as structural inference. *Cosyne, Lisbon*.
***Submission scored in top 5% by reviewer panel, approx. 65% rejection rate.**
- d **Evans**, **Bush**, **Burgess (2018)**. Probabilistic integration and learning in grid cells produces experience dependent distortion and rotational alignment. *Cosyne, Colorado*.

- e **Evans**, Bicanski, Bush, Burgess (2017). Neural models of spatial memory and navigation. *Human Brain Project Summit, Glasgow*.
- f **Evans**, McKenzie, English, Kim, Yoon, Buzsaki (2017). Optogenetic probing of pattern completion across the hippocampal subfields. *Society for Neuroscience, Washington DC*.

INVITED TALKS

- Coordinated HPC/mEC replay as structural inference. *Centre for Minds, Brains and Machines, MIT (December 2019)*.
- Structure learning in the hippocampal/entorhinal circuit. *Foundational AI Centre, UCL (November, 2019)*.
- Coordinated HPC/mEC replay as structural inference. *DeepMind, London (August, 2019)*.
- What can SLAM learn from neuroscience (and vice versa)? *The Brain Meeting, Wellcome Centre for Neuroimaging, London (March, 2019)*.
- On- and offline learning and navigation in place and grid cells and hippocampal replay as structural inference. *Human Brain Project Summit, Maastricht (October, 2018)*.
- A model of coordinated grid cell / place cell replay as structural inference. *HBP internal project meeting, UCL, London (June, 2017)*.
- Probabilistic integration in a biophysically realistic model of grid cell firing. *International Conference on Biologically Inspired Cognitive Architectures, Moscow (August, 2017)*.

AWARDS AND SCHOLARSHIPS

- **NVIDIA Hardware Grant** 2017
 · Awarded a NVIDIA Titan X Pascal GPU to contribute to my PhD research
- **UCL Bogue Scholarship & Guarantors of Brain Grant** 2016-2017
 · Visited the lab of Prof. Gyorgy Buzsaki (NYU) to learn to conduct combined electrophysiological/optogenetic experiments.

TECHNICAL

- **Programming**
 - Matlab
 - Python
 - Mathematica, C++
 - Some Javascript, HTML
 - *.mex* (C++) integration
 - Tensorflow, SKLearn, NumPy
 - See [website](#)
- **Stats/ML**
 - Probabilistic Graphical Models
 - Reinforcement Learning
 - Deep Learning/Neural Networks
 - *Inference*: BP/EP, VI, MCMC
 - *Algorithms*: DFS/BFS, A*, Kruskal etc.
- **Maths/CS** - Linear Algebra, Probability, Optimization, Graph Theory
- **Applications** - SLAM, Agent-based Modelling, Neurophysiological Data Analysis

INDUSTRY

- **Consultant research scientist, Limbic AI** 2017-2018
 · Affective computing startup developing technology for inferring the emotional states of users from wearable devices data. Developed early prototypes of their core technology as sole engineer/R&D scientist, involving time-series prediction from labelled physiological data using Bayesian deep learning.

TEACHING

CoMPLEX MatLab Course

2015-2017

- Taught and developed a 2-day course to teach MatLab programming to incoming PhD students covering and numerical optimization techniques, parallelization, .mex C++ integration and cluster computing.

SysMIC Course Developer and Lecturer

2013-2016

- Interactive online and taught material introducing graduate students in the biosciences to ad-vanced techniques in mathematics and computing. Taught in MatLab/R.

REFEREES

- Prof. Neil Burgess: n.burgess@ucl.ac.uk (PhD advisor)
- Prof. Tim Behrens: behrens@fmrib.ox.ac.uk (Thesis examiner)