2015 YCCSA SUMMER SCHOLARSHIP PROJECT SUBMISSION

This form is for prospective project supervisors to submit their projects to be included in the YCCSA Summer Scholarships Programme for 2015.

It is the purpose of the Summer School that any projects submitted are interdisciplinary in nature.

Date	*12th January 2015*
Main Supervisor's Name	*Dr Pen Holland*
Main Supervisor's Department	*Biology*
Co-supervisors' name(s) and Departments	*Dr Sam Devlin, Computer Science*
Project Title	*Using crowd sourcing via online games to fit complex models of animal location data*
Project Description	*How individual animals utilise a landscape is a mixture of their behavioural traits, movement capacity, resource preferences and memory. Recent advances in GPS technology have led to an increasing prevalence of fine-scale information on animal locations resulting in vast quantities of data. While a range of modelling techniques have been used to successfully infer unobserved behavioural modes and resource use from movement paths, the inclusion of memory has proven more challenging. Animal movements are restricted to a relatively limited area with respect to their movement capabilities, and memory plays a crucial role in defining an animal's home range.* *This project will develop a purpose-written, browser-based game in which players will adjust their parameters relating to animal responses to resources, memory capability and behavioural traits, in order to best match the supplied movement path of individual animals. The student will specify a flexible movement model that can incorporate one or more movement drivers such as resource preferences, movement capacity and memory. A metric that measures the distance between player-built paths and actual movement data will be defined and used to generate a player score, enabling model fitting, similar in principle to approximate Bayesian-computation. Collating game data from a large number of users will provide distributions for model parameters, with parameter values coming from players that achieved a higher score being weighted proportionally. We anticipate that this project will produce a prototype game, and collect and analyse preliminary data.* *Tutorial levels will get players to fit paths to 'animal' movement data simulated with known parameters, beginning with simple models and increasing in complexity. These tutorial levels will enable us to assess the ability of each player, as well as the potential for the method to be successful. Players will then play using real location data and geographic information for a range of mammal species, and game data will be used to fit models for*

	each species. This novel methodology that will overcome the previous computational issues inherent in incorporating memory into animal movement models, and will be used to test hypotheses about the role of memory in defining animal home-range formation.
Required skills	*Programming in C#* *Experience with Unity desirable but not required*
Project dates	*Monday, 13 July 2015 to Friday, 11 September 2015*
Other information	*Data for model fitting, and email/skype advice will be provided by Dr Andrew Gormley at Landcare Research New Zealand.*
References	Cooper S, Khatib F, Treuille A, Barbero J, Lee J, Beenen M, Leaver-Fay A, Baker D, Popović Z. and Foldit players. (2010) Predicting protein structures with a multiplayer online game. *Nature* 466, 756-760. Dalziel BD, Morales JM, Fryxell JM. (2008). Fitting probability distributions to animal movement trajectories: using artificial neural networks to link distance, resources, and memory. *The American Naturalist,* 172, 248-258. Khatib F, Cooper S, Tyka MD, Xu K, Makedon I, Popović Z, Baker D. and Foldit Players. (2011) Algorithm discovery by protein folding game players. *Proceedings of the National Academy of Sciences.* Morales JM, Haydon DT, Frair J, Holsinger KE, Fryxell JM. (2004). Extracting more from relocation data: building movement models as mixtures of random walks. *Ecology,* 85, 2436-2445.

When complete, please email the form to sarah.christmas@york.ac.uk