ROBOTICS

Paul Baxter

Link to my staff profile page:

http://staff.lincoln.ac.uk/pbaxter

Refer to my research page for my background and research interests:

http://paul-baxter.github.io/

For further project ideas (sporadically updated…), see:

http://paul-baxter.github.io/teaching-projects.html

Also see the L-CAS homepage:

https://lcas.lincoln.ac.uk/

With research interests in Human-Robot Interaction and Cognitive Systems, and being a member of L-CAS, I am primarily interested in supervising robotics-related projects. However, if you have an interesting idea related to robotics, AI, HCI, etc, then please do come and discuss them with me. All of my project ideas have some basis in current state-of-the-art research, and so there is the possibility (if you do your project well!) to make a real contribution to the latest research.

Project Name

Social Robot Behaviour for Human-Robot Interaction

Project Description:

Making robots behave in a socially appropriate and predictable way for people is important if they are to be used in the real-world. This includes the synchronisation of multiple modalities (such as speech and gesture, pointing and gaze, pose and emotion, and more besides). The aim of this project would be to investigate and implement such a system to allow it to generate online (i.e. not pre-programmed) behaviour in a specific scenario.

This is a research-informed project: you will be informed by recent research publications and systems to develop the interactive system.
There is an expectation that the developed system will be evaluated in user studies (i.e. a human-robot interaction experiment) to establish their effectiveness for the chosen task.

Work on this project will start with the use of robot simulators for development – one of a number of robots may be used (Baxter, Nao, Pepper, Turtlebot…). There may be the possibility of applying developed software to real robots (depending on progress and hardware availability).

There is some flexibility in the goals of this project: if you have a particularly relevant idea, then this can be explored, as can a range of different applications/scenarios. One particularly important aspect of this project however is that it should involve an evaluation with people, in addition to the technical work – i.e. an HRI experiment.

Are there any prerequisite skills / courses?

Good programming (C++, other…), of particular interest to those due to take the Autonomous Mobile Robotics module

Which degree program is this aimed at?

CS/GC

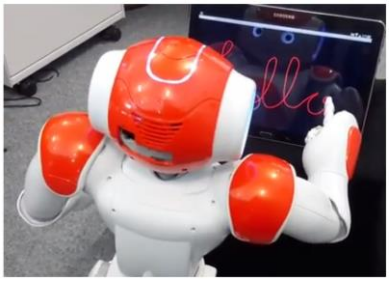
Number of students you wish to undertake this project

Depends – speak to me!

Project Name

Robot-Tablet Interaction

Project Description:



People will generally be able to interact very naturally with touchscreen devices, especially in recent years and the rapid increase of tablets, mobile phones etc. If robots are to prove useful for people, it is therefore increasingly important for the robots to also be able to interact with touchscreens.

This project will involve developing software (C++/Python using ROS) for the Nao humanoid robot, using both simulation (at least initially) and the real robot. The aim is to create a robot system that is able to physically locate a suitable tablet device in its vicinity, and then to 'virtually interact' with content displayed on it.

The touchscreen/tablet itself will be an Android device, and the app to be developed will be something that the robot and a person can interact with simultaneously, though there is flexibility regarding the actual content – if you have an idea, then this can be explored in the project.

This project will require a significant software development effort, though there are existing resources that will support the process. This project has the potential to significantly contribute to future research projects.

Relevant research papers (available on request):

-- Baxter, P., Wood, R., & Belpaeme, T. (2012), "A Touchscreen-Based "Sandtray" to Facilitate, Mediate and Contextualise Human-Robot Social Interaction", In 7th ACM/IEEE International Conference on Human-Robot Interaction (pp. 105–106). Boston, MA, U.S.A.: IEEE Press.

-- Hood, D., Lemaignan, S., & Dillenbourg, P. (2015), "When Children Teach a Robot to Write : An Autonomous Teachable Humanoid Which Uses Simulated Handwriting". In HRI 2015. Portland, OR, USA: ACM Press. http://doi.org/10.1145/2696454.2696479

Are there any prerequisite skills / courses?

Good programming (C++, other…), knowledge of/desire to engage with Android development; of potentially particular interest to those due to take the Autonomous Mobile Robotics module

Which degree program is this aimed at?

CS/GC

Number of students you wish to undertake this project

Depends – speak to me!

Project Name

Social Robots for Children with Autism Spectrum Disorder

Project Description:

There has been an increasing amount of work around the world in recent years that has demonstrated the positive impact that social robots can have on children with Autism Spectrum Disorders (ASD), whether it be in the context of play/entertainment or in terms of therapeutic interventions.

The aim of this project is to design and implement a (set of) robot behaviours that can fulfill a useful role for children with ASD. This project will be conducted in collaboration with colleagues in Psychology, which will involve requirements gathering, task selection, and validation of the designed system.

This is a research-informed project: you will be informed by recent research publications and systems to develop the interactive system. This project will primarily use the Nao robot (pictured), although the use of ROS is desired to facilitate the potential application to other robot platforms in future. Initial development will be conducted in simulation, though there is an expectation (subject to progress) that the system will be applied to the real robot. There will be a possibility for evaluating the system.

In order to take on this project, you should not only have good technical ability and desire (programming, …), but also a keen interest in the overlap between robotics and psychology.

Relevant research paper (available on request):
-- P. Gomez Esteban, P. Baxter, et al. (2017) “How to Build a Supervised Autonomous System for Robot-Enhanced Therapy for Children with Autism Spectrum Disorder,” Paladyn J. Behav. Robot., 8(1), 18-38.

Are there any prerequisite skills / courses?

Good programming (C++, other…), of particular interest to those due to take the Autonomous Mobile Robotics module, and to those with an interest in an applied interdisciplinary project

Which degree program is this aimed at?

CS/GC

Number of students you wish to undertake this project

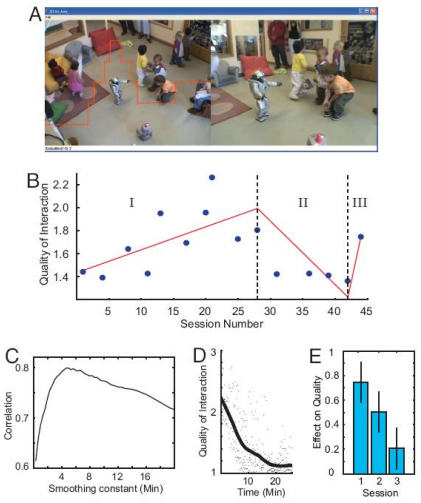
Depends – speak to me!

Project Name

The Human-Robot Interaction Engagement Meter

Project Description:

Engagement detection for robots/computer systems is an important task, so that the system can adapt accordingly. Unfortunately however, this is very difficult to do automatically. People, however, are good at assessing whether someone is engaged or not when just watching them. Prior research has used a continuous real-time coding scheme to enable people watching a video to turn a dial (or move a slider) to indicate whether they think the person they are watching is engaged or not in the activity they are performing.



The purpose of this project is to create a simple device and associated software (e.g. PC-based GUI) that can achieve this. The data created can subsequently be analysed further to help improve (among other things) the responsiveness of social robots. The project will involve creating/working with of an external sensor device and/or a mobile device, and a means of capturing the data in synchrony with a video playing on the main screen.

Some interest (ideally previous experience) in low-level hardware construction and/or mobile platform development is desirable to complete the sensor aspect of this project. This project has the potential to make a valuable contribution to current and future research projects.

Relevant research paper (available on request):
-- Tanaka, F., Cicourel, A., & Movellan, J. R. (2007), “Socialization between toddlers and robots at an early childhood education center”, PNAS, 102(46), 17954–17958.

Are there any prerequisite skills / courses?

Good programming (C++, Python, …); some GUI creation skills

Which degree program is this aimed at?

CS/GC

Number of students you wish to undertake this project

Depends – speak to me!