IPAB Links with Industry

The Institute for Perception Action and Behaviour has a variety of links to industry. These include collaborative research projects as well as spin-off technology transfer companies. The diversity of these links reflects the broad range of research conducted in the institute that is highly valued by our commercial counterparts.

Honda Research Institute Europe

Project: **Inferring Cost Functions for Motor Control**
People: Matthew Howard
Funding: CASE Studentship
Duration: October 2005 – October 2008

Detail:

A new collaborative project for research into machine learning for motor control in humanoid robotics. The project focuses on biomimetic movement selection, in particular *inferring cost functions for control of redundancy* using machine learning techniques.

The goal is to take human motion data and **extract** the criteria used to select an action from the huge repertoire of possible movements. Modelling these criteria as a utility surface, it is hoped that movement preferences can be transferred to the robot so that it can make similar movement *choices*. This avoids having the robot *directly* mimic the human. Instead, the robot can choose/optimise actions in its own way according to the inferred cost function.

The humanoid robot ASIMO.

HONDA HRI

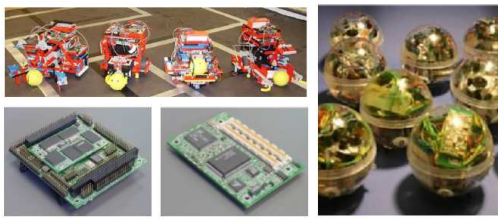
Edinburgh Robotics Ltd.

Project: **DevBot - Mobile Robotics Development Platform**
People: Joe Halliwell, Nils Roeder

Detail:

As autonomous mobile robots become a commercial reality and pressure grows to reduce development costs and time-to-market. DevBot is a complete toolkit for mobile robot development that allows developers and researchers to focus on high-level appliance-specific functionality. DevBot includes everything needed for the development of autonomous mobile robots, including a real-time embedded operating system and a cross-compiler toolkit.

The core of the platform is a lightweight and modular library that hides the complexity of robotic low-level hardware behind a clean and intuitive interface (API). Together with this hardware support, DevBot also offers a variety of generic building blocks for sensor processing, mapping and navigation. DevBot's integrated virtual environment allows applications to be tested without modification in a 3D physical simulator and enables machine-learning-based approaches to controller design. Although DevBot is targeted at industrial applications, its blend of usability and extensibility make it ideal for research and teaching.



Target hardware.

EDINBURGH ROBOTICS

Edinburgh Robotics is a spin-off started by former IPAB student Nils Roeder.

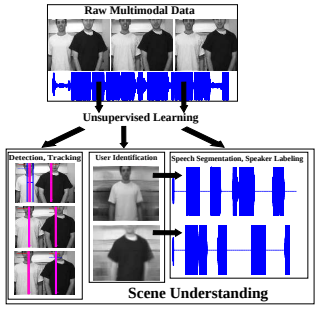
Microsoft Research

Project: **Inferring Multimodal Scene Structure**
People: Timothy Hospedales, Sethu Vijayakumar
Funding: Microsoft Research Internship, RAEng Senior Research Fellowship

Detail:

Sensor Combination is an important theoretical topic given the ubiquity and diversity of modern sensing devices. Moreover, the *data association* between objects in the world and sensor observations can be of pivotal intrinsic importance. For example understanding not just *who was in* a meeting, and *what was said*, but **who said what**. Our work has developed theory and implementation for *unsupervised* learning and inference of optimal sensor combination. The theoretical approach is that of **Bayesian structure inference**, in which the *automatic complexity control* of Bayesian Occam's razor enables optimal sensor combination and data association without heuristics.

An example (right) illustrates our system taking raw, high dimensional multi-sensor data and performing *real time* inference - **multi-target detection**, **identification**, **tracking**, and **speech segmentation**. Microsoft Research is hiring our student as a PhD intern to exploit our theoretical expertise in multisensor combination.



Real time inference of scene structure from raw multi-modal data.

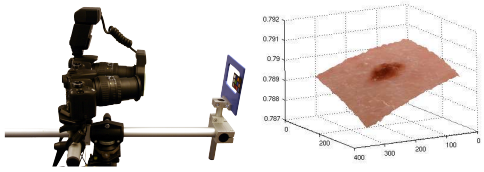
Microsoft

Dimensional Imaging

Project: **Pushing the Limits of Stereo Photogrammetry**
People: Tim Lukins
Funding: EPSRC CASE Studentship
Duration: May 2003 - April 2006

Detail:

Dimensional Imaging is a new spin-out company from Edinburgh and Glasgow Universities, established from earlier proof-of-concept work. We continue to collaborate with them in enhancing their novel high-resolution and 4D stereo technologies. One instance of this has been to develop extremely close-up photogrammetry to capture micro scale structure of skin lesions. This has benefits in providing non-invasive, instantaneous, true colour 3D models of the areas in question. A working system has been installed in a dermatology clinic, allowing collection of a comprehensive variety of examples. It is hoped this data-set can act as training tool, or to directly help toward early diagnosis of malignant melanoma, which can lead to 99% successful treatment if caught early enough.



A stereo capture rig (left) with macro lens configuration and guide target allowing extremely detailed capture of skin lesions (right).

dimensional imaging

Dimensional Imaging (formerly Virtual Clones) is a spin-off started by IPAB affiliate Colin Urquhart.

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