

Intelligent Signal and Image Processing

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**UNIVERSITY OF
STIRLING**

Overview

- Computing Science at Stirling currently holds over £2m in external research grants
- There are 3 Main Research Groups in the Computing Science Department:
 - Computational Intelligence (CI)
 - (Tele)Communications & Services (C&S)
 - Care Technologies (CT)
- The primary signal and image processing areas are within the CI group:
 - Speech Processing (including multi-modal audio-video signal processing)
 - Neural signal processing (Neuroinformatics)
- There is also signal processing related work in care technologies and telecommunications services, as well as development of a USB board for signal input to Linux systems

Computational Intelligence (CI) - Overview

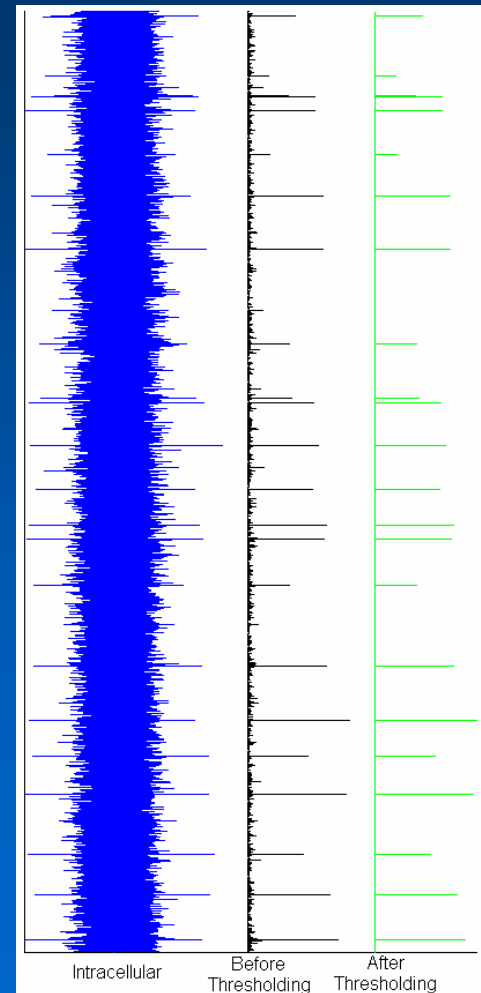
Senior Staff

- Professor Leslie Smith (Head)
- Dr. Amir Hussain, Reader
- Dr. Bruce Graham, Reader

- CI covers neural and natural signal processing, as well as modern optimization techniques such as genetic algorithms, particle swarm optimization and self-organizing multi-agent systems. It includes neurally inspired signal processing as well as processing techniques for neural signals.

CI - Application Areas

- **Sound processing**
 - Enhancing speech in noisy environments using intelligent multi-modal signal processing
 - Biologically inspired techniques for sound interpretation
- **Neuroinformatics**
 - Signal processing for neurophysiological signals
- **Intelligent Control systems**
 - Next generation controllers for complex systems using CI and machine learning techniques
- **Optimization Problems**
 - Treatment schedules and time intervention
- **Diagnostic systems**
 - Differential diagnosis of dementia syndromes
- **Community support systems**
 - CI to support field work in archaeology (and other areas)



CI – Example Projects

- CARMEN (Code analysis, repository, and modeling for e-Neuroscience) – large £4.5m EPSRC e-Science project involving 11 Universities (www.carmen.org.uk)
- Dynamical Information Processing in a Neuronal Microcircuit – understanding real neural systems – funded by the EPSRC
- COST 2102 on advanced speech and natural language processing, including multi-modal (audio and video) signal processing – funded by the European Science Foundation
- Symptom Modeling using Data Mining Techniques - funded by Cancer Research UK & NHS Forth Valley
- Semantic Web Mining - this is a new EPSRC and industry funded project in collaboration with the world-leading MIT Media Lab (USA)
- Artificial Immune Systems: New Models and Applications – funded by BBSRC Network

CI - funding, collaborations and papers

- The CI group is funded primarily by research councils and the EU.
- The CI group works in conjunction with other larger Scottish University Departments
 - School of Engineering and Electronics at Edinburgh University
 - Signal & Image Processing and Industrial Control Centres at Strathclyde
 - Electronics and Electrical Engineering at Glasgow University
- Papers are published in a wide range of journals including:
 - IEEE Transactions (on Neural Networks, on Acoustics, Speech and Signal Processing), (Elsevier) Neurocomputing, Journal of Neuroscience Methods, Journal of Physiology, (Springer) Journal of Computational Neuroscience, (Oxford) IMA Journal of Mathematical Medicine and Biology, IEE/IET Proceedings & Electronics Letters, International Journal of Control and Intelligent Systems
- A new Journal of Cognitive Computation (published by Springer, USA) has been launched by CI members, which focuses on cognitive signal and image processing research – www.springer.com/12559

Commercial Exploitation & Technology Transfer - I

- The CS&M Department actively promotes commercial exploitation and technology transfer using Stirling University Research & Enterprise (SURE) Office to establish new industrial liaisons.
- The MATCH project is collaborative with eleven external partners and knowledge transfer is a key element.
 - MATCH applied processing to tele-care technology a rapidly growing market. MATCH works with Scottish Enterprise, SURE, BT, and ITI Techmedia.
- The Department has two Knowledge Transfer Partnership (KTP) projects, one with Think Analytics Ltd. and another with SysNet Ltd, both based in Glasgow.
- A new EPSRC CASE industrial PhD project in the area of statistical signal processing for semantic web mining is co-funded by Sitekit Solutions Ltd. and is being carried out in collaboration with MIT Media Lab (USA)
- Two members of the CI group are directors of a spin-out company (ITL) that is wholly owned by the University.

Research Themes: (Tele)communications & Services (C&S)

- The **Communications and Services** research group has a wide ranging interest in telecommunications service engineering across an array of network technologies, including voice, home and data networks.
- This applies the results of signal processing: for example
 - PROSEN (Networking of Distributed Sensors for Proactive Condition Monitoring of Wind Turbines) – funded by EPSRC and is a collaborative project between a number of universities and companies, including Stirling, Strathclyde, Essex and Kent. The focus is on the use of (wireless) sensor networks to provide **proactive** condition monitoring of wind farms.

Summary

- Computational Intelligence (CI) & (tele)Communications and Services (C&S) are our two main strengths: CI is more directly involved with signal and image processing.
- Within CI, sound processing and neural signal processing are our primary signal processing strengths
- In addition we apply CI based techniques (for example bio-inspired techniques) to other fields specifically including signal and image processing aspects of their problems.
- We are keen to continue developing external collaborations, both with Universities and companies.
- We actively promote commercial exploitation and technology transfer and we work closely with the Stirling University Research & Enterprise (SURE) Office to establish new and effective industrial liaisons and partnerships.