



UCC

Coláiste na hOllscoile Corcaigh, Éire  
University College Cork, Ireland

Research at UCC

# Computer Science





## Overview

Computer Science is a modern scientific discipline that impacts almost every aspect of human activity, ranging from commerce and government, to entertainment, medicine and telecommunications. In contrast to conventional scientific disciplines, Computer Science combines elements drawn from science, engineering and business. Research in Computer Science is driven by a vibrant and growing IT industry and is the key contributor towards building the national vision of a 'knowledge economy'.

Computer Science at UCC is an exciting and dynamic department and a major contributor to UCC's success in terms of attracting research funding, partnerships with industry, and achieving a high international profile. It builds on a proud and historic tradition – back in the 19th century at UCC, George Boole developed the mathematical (Boolean) logic which is the basis for all digital computer design today.

Today at UCC the Department of Computer Science comprises nearly 30 full-time academic staff, an equivalent number of post-doctoral researchers and approximately 80 post-graduate research students. Academic staff members have doctorate degrees from many of the world's top universities, including Cambridge University, Carnegie Mellon University, Cornell University and Oxford University. In terms of key indicators - over the past five years, the Department has secured approximately €30 Million in external research funding, and produced over 550 peer-reviewed published scientific papers. In addition to major government grants, current research projects are funded by nearly a dozen companies, including indigenous Irish companies as well as large multinationals. As evidence of the broad impact of Computer Science, staff in the Department enjoy active collaborations with their peers in other disciplines at UCC, including Engineering, History, Medicine and Mathematics. Further afield, many collaborative projects involve fellow computer scientists working at many of the world's top universities and research laboratories.

Computer Science at UCC has played a pivotal role in the economic development of the region by supplying graduates, stimulating inward direct investment and supporting indigenous companies. It also has a key role within UCC, as formally recognised by its inclusion in the University's strategic plan. UCC recently demonstrated its commitment to Computer Science and the IT industry by initiating construction of a major new IT Building to provide high quality teaching, research and commercialisation facilities to support the future growth and development of the Department.

## Research Activity

Computer Science has an active research programme in a range of areas. Research is mainly funded through Science Foundation Ireland (SFI), Enterprise Ireland, Higher Education Authority (HEA), the European Union and industrial sponsorship for work on projects with collaborators spread throughout Europe and North America. The key research areas of the Computer Science Department focus around six major themes:

- **Artificial Intelligence, Constraint Programming and Case-Based Reasoning**
- **Multimedia**
- **Computer Security**
- **Distributed Computing**
- **Networking and Embedded Systems**
- **Foundations of Computing and Formal Verification**

# Research Centres

The majority of research within the Department of Computer Science takes place in its key research laboratories:

## Boole Centre for Research in Informatics (BCRI)

**Directors: Professor John Morrison,  
Professor Pat Fitzpatrick**  
<http://www.bcri.ucc.ie/>

The Boole Centre for Research in Informatics brings together the expertise of the Department of Computer Science and the School of Applied Mathematics, Mathematics and Statistics in unique inter-disciplinary initiative. The research of the Centre is currently in three broad themes namely, Information Theory, the Theory of Computation, and Computing Paradigms.

The centre was established with a grant of €5.2 Million that was secured from the Irish Higher Education Authority as the result of a highly competitive peer-reviewed selection process. Since its inception members of the BCRI have also secured major grants from Science Foundation Ireland and other sources. The BCRI has a 100-node cluster, manufactured at Dell's European Manufacturing Facility in Limerick. This machine is used to support a range of projects both internally and also externally through participation in national Grid computing networks.

## Centre for Efficiency-Oriented Languages (CEOL)

**Director: Professor Michel Schellekens**  
<http://www.ceol.ucc.ie>

CEOL was established with initial funding from Science Foundation Ireland in the form of an Investigatorship Award to its director, Professor Michel Schellekens, and is also supported by Sun, Xilinx and Synopsis. The centre forms part of Ireland's determined large scale investment in ICT and aims to contribute to the ICT 'music'\* of the future.

Real-Time software can guarantee that deadlines are met in safety critical situations and is widely applied in telephone exchanges, satellite communications, medical equipment, chemical-plant control, stock-market analysis and robotics. CEOL's mission is to improve software timing at source code level. CEOL focuses in particular on modular static derivation of running time and on related investigations in memory use and energy use.

\*CEOL, pronounced 'kyohl' is the Irish Gaelic word for music.



## Centre for Unified Computing (CUC)

**Director: Professor John Morrison**

<http://www.cuc.ucc.ie>

Research at The Centre for Unified Computing is focused primarily on the fields of High Performance and Distributed Computing, with related work being performed in numerous areas such as Peer-to-Peer Computing, Autonomics, Security, Reconfigurable Computing and Economic Models. It is perhaps best known for WebCom, a fully-featured distributed computing environment and workflow enactment system that has been the focus of many years of research. Much of its work, including WebCom, stems from the Condensed Graphs model of computing developed by the group's founder, Professor John Morrison. This model is unique in that it allows three different evaluation strategies (availability-driven, coercion-driven and control-driven) to be incorporated within the same computation. The group has been in existence for almost a decade. Over this period it has attracted significant amounts of funding from Science Foundation Ireland and Enterprise Ireland, written a large number of published papers, hosted several events and participated in a number of collaborations with outside researchers.

## Cork Constraint Computation Centre (4C)

**Director: Professor Eugene Freuder**

<http://www.4c.ucc.ie>

The mission of the Cork Constraint Computation Centre (4C) is to help computers to help individuals and businesses make better decisions. Constraints arise in design and configuration, planning and scheduling, diagnosis and testing, and many other contexts; constraint computation can solve problems in manufacturing, telecommunications, supply chain optimisation, network management, internet commerce, electronics, bioinformatics, transportation, and many other fields. 4C members have won national and international recognition for their work. For example, two 4C students were shortlisted for the 2006 Irish Software Association Student Medal for Commercially Viable Software, and the Director of 4C was elected a Fellow of the American Association for the Advancement of Science in 2005 and a Member of the Royal Irish Academy in 2007. 4C has been awarded approximately 20M euro in funding. Its core funding has come from Science Foundation Ireland; it also has received funding from the European Union, Enterprise Ireland, the Embark Initiative, the Health Services Executive, and from industry. 4C has worked with local Irish industry and with multinationals like Lucent, Xerox, Bausch & Lomb, British Telecom and Microsoft.



## Mobile & Internet Systems Laboratory (MISL)

**Director: Professor Cormac J. Sreenan**

<http://www.cs.ucc.ie/misl/>

The Mobile & Internet Systems Laboratory (MISL) was founded in 2000 after Professor Sreenan joined UCC from AT&T (Bell) Labs Research in the USA. The Laboratory conducts research in the area of computer networking, with a focus on mobile/wireless networks and multimedia systems. In these areas the members of the laboratory are active in terms of publications, patents, and professional activities such as journals and conference committees. Recent work has focused primarily on wireless sensor networks – an area in which MISL has established a very high profile internationally. Other ongoing projects include content distribution in IPTV networks, handover in next-generation mobile networks, and routing in wireless mesh networks. The laboratory currently hosts over 10 research staff and students. Recent sponsors include AT&T, Australian Research Council, Enterprise Ireland, EU, FEXCO, Irish Research Council, Microsoft Research, and Science Foundation Ireland.



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