

MSc Computer Science

Project Themes

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January 18

Programmes and Course Leaders

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Software Engineering Methods

The study of different approaches to engineering large software systems. This can encompass studies of these methods themselves or application of novel engineering techniques in order to build example systems.

Programming Lang. Theory and Implementation

Programming Languages research concerns the design, implementation and analysis of new programming language paradigms. This area embraces research from techniques in compilation to code-generation to static analysis and theoretical approaches.

- Adaptive code
- Code-generation techniques
- Type systems
- Static analyses
- Proof systems for programming languages

Formal Methods & Model Checking

This area involves advanced work on the tools and techniques of formally verified program construction. This may involve using and possibly extending the Event B language and the Rodin tool or performing critical comparisons with other formal techniques.

Model checking is a powerful program analysis technique which can be exploited to find bugs in code. Typically program properties are expressed using a logical formalism and algorithms to determine whether properties hold of programs are used to explore the program's state space.

Concurrent, Embedded and Real-time Systems

This area covers software aspects related to the construction of concurrent, embedded and real-time systems. You should be keen on programming low level languages and/or using higher-level tools for supporting real-time programming.

- Applications for mobile devices
- Control applications
- Time-critical software

Accessible Systems

Accessibility focuses on how a people accesses or benefit from a site, system or application and ensures that all potential users, including people with disabilities, have a decent user experience and are able to easily access information.

Summer projects may be in the areas of
Localisation of accessibility tools,
Accessibility of e-Texts,
Mobile accessibility,
Accessible mathematical equations,
Accessible MOOCs, videos & e-learning,
Accessibility training and education,
Accessible travel planning, Symbol communication

E-commerce, online auctions, collaborative filtering and trust

Both retail and industry businesses rely on e-commerce and auction techniques.

E-Learning and MOOCs

The use of technology to enhance learning, either through effective use of computer aided assessment and feedback, enhanced information systems, automated time management, option recommender systems, e-portfolios, educational games or massive online open courses. In particular, this would include opportunities to work on the development of in-house ECS systems.

Cognitive Systems

ECS researchers study networks of computers, networks of documents and networks of data - we are also interested in the networks in and of minds. We see these networks in the mental representations of meanings, the evolutionary origins of language, the interlinked structures of words within dictionaries and the clusters of categories that our brains form. You will have the opportunity to run experiments and create models to explore these ideas through the Web.

Crowd-sourced Applications and Social Machines

Applications that derive information from thousands of people on the Web are said to "crowd-source" their input. e.g. OpenStreetMap crowdsources its map information and Wikipedia crowd-sources its encyclopaedia updates.

How can these combinations of computer and human expertise be engineered effectively?

Rather than issuing instructions to passive machines, we will increasingly work in partnership with highly inter-connected computational components (aka agents) that are able to act autonomously and intelligently.

Eco-web apps and open data for energy monitoring, prediction and feedback

The intelligent use of energy within a homes requires the development of algorithms and methodologies that will enable intelligent appliances and energy storage devices (such as plug-in hybrid electric vehicles) to autonomously negotiate and coordinate for optimal energy use.

In particular, it will address the need for algorithms that can continuously adapt the behaviour of the home in response to information such as weather, energy prices, energy carbon content and the lifestyle and preferences of the home owners.

Open Data and Innovation Apps / Mobile Apps

The Web enables the free exchange and use of all kinds of data for innovation in research, business and government. Interest in growing in the use of personal data, collected by individuals and sold to third parties.

The Web is more than just an ecosystem based on desktop computers and traditional browsers. In particular, mobile devices including smartphones, tablets and health monitoring gizmos have redefined the user interface and user experience of the web, while still using its fundamental architecture and protocols.

From Web-enabled intelligence (like Siri) to innovative user experiences like Flipboard and Aweditorium, the Web is becoming a more varied experience.

Next Generation Networking and the Internet of Things

This scale of the internet has increased by seven orders of magnitude and from its simple, original architecture (16 specification documents) has accreted several hundred additional protocols and extensions.

Networks based upon this more complex architecture are increasingly difficult to manage so that the qualities of service delivered meet the needs of the over 1 billion users. Additionally, the original Internet was designed in an era of mutual trust that now raises urgent issues of cybercrime and cybersecurity.

Many of the protocol additions/extensions have had to retrofit protection mechanisms to reflect the less trustworthy environment of the current Internet. In addition, new kinds of device are being attached to the internet enabling very different networks of communication and interaction.

Semantic Web, Linked Data

The Semantic Web is an extension of the current Web in which information is given a well- defined meaning, better enabling computers and people to work in cooperation.

Linked data are mechanisms that borrow from the Semantic Web to increase the use and usefulness of data that can be shared by independent parties.

The Web can reach its full potential if it becomes a place where data can be processed by automated tools as well as people. You will have the opportunity to use Semantic web tools and techniques to design new information environments

Social Networks & Social Network Data Analysis

Social networks bring together social network infrastructure, social networking tools, social network data & analysis and the use of social networks in industry. They are used intensively for marketing and publicity purposes, and for businesses to interact with their customers and to understand how their businesses are perceived.

You will have the opportunity to build tools to analyse social networks, create corporate intelligence and/or build new kinds of social network environments.

Web Data Mining and Web Analysis

The Web is a rich source of knowledge and data about human activity, with new techniques for harvesting data to answer research questions by analysing information from services such as Wikipedia, Twitter and Facebook. The Web Observatory is an international project run from Southampton that is creating systems for making novel analyses of "big data" from the Web; you will have the opportunity to work with researchers to create new tools for Web analysis.