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Computer Science/Cognitive Science PhD

Postgraduate research degree in Computer Science/Cognitive Science PhD/MSc by Research:

The **School of Computer Science (http://www.cs.bham.ac.uk)** welcomes highly motivated and well qualified graduates to join us to work towards a doctorate. Our work is regularly presented in international conferences and journals, indicating the high standards we achieve in research.

In the last Research Assessment Exercise the School was ranked equal 7th in the proportion of 4* awards, for research quality that is world-leading in terms of originality, significance and rigour.

Study here and find out why the University of Birmingham has been awarded The Times and The Sunday Times University of the Year 2013-14 (http://www.birmingham.ac.uk/news/latest/2013/09/20-sep-Birmingham-announced-as-University-of-the-Year.aspx)

Course fact file

Type of Course: Doctoral research

Study Options: Full time, part time, 2 years

Duration: PhD: 3 years full-time; MSc by Research: 2 years full-time

Start date: Contact the School for information about specific starting dates

Contact

Contact us online (http://bham.hobsons.co.uk/ask.aspx?cid=1223&did=24) or at +44 (0)121 414 5005.

Details

The School of Computer Science welcomes highly motivated and well qualified graduates to join us to work towards a doctorate. Our work is regularly presented in international conferences and journals, indicating the high standards we achieve in research. In the 2008 Research Assessment Exercise the School was ranked equal 7th in the proportion of 4* awards, for research quality that is world-leading in terms of originality, significance and rigour.

Our research is grouped into the following main themes:

Artificial intelligence

Sub-themes:

- **Reasoning and cognition**

  This sub-theme covers research on architectures for human mental states and processes, as well as recreating them in computer programs. It also includes research on automated reasoning with applications to mathematical knowledge management and computer algebra. Analysing architectures for human mental states and processes allows us to investigate whether the ability to have emotional states is an accident of animal evolution, or an inevitable consequence of design requirements and constraints.

  Automated reasoning research is relevant both to understanding how human reasoning works and to the design of useful practical tools. Modelling assertion evaluation research is important as it allows us to model the human ability to acquire knowledge through testimony in sufficient detail to allow a computer program to be written which emulates this ability. Collaborations include participations in Calculemus and the MKM network.

  Contact: Dr Manfred Kerber
  Tel: +44 (0)121 414 4787
  Fax: +44 (0)121 414 4281
  Email: **m.kerber@cs.bham.ac.uk (mailto:m.kerber@cs.bham.ac.uk)**

- **Robotics**

  We conduct basic research in intelligent robotics and related areas, including cognitive robotics, learning robotics, fault diagnosis, machine learning and sequential decision-making. In cognitive robotics, we design robots that are capable of having simple conversations about everyday objects in collaboration with a human. In diagnosis, we have made significant contributions to the state of the art, with applications to the NASA Mars rover programme.

  We also have a strong track record in planning and control for planetary rovers, including planning technologies designed for use on the Mars rover missions. Our approach has a sound basis in decision theory and statistical methods from machine learning. We also support some work on robot learning and evolutionary robotics, and collaborate with members of the School working on natural computation, AI and machine learning.

  The group is led by two senior lecturers with two research fellows and four doctoral students. We currently hold over £600,000 in externally funded grants from funders including the European Commission and The Royal Society. We have collaborations with a dozen different universities, including leading institutions in the United States, Canada, Europe and Japan.

  Contact: Dr Jeremy Wyatt
  Tel: +44 (0)121 414 4788
  Fax: +44 (0)121 414 4281
  Email: **j.l.wyatt@cs.bham.ac.uk (mailto:j.l.wyatt@cs.bham.ac.uk)**

- **Natural language processing**

  The Natural Language Processing group performs research on every level of language from speech understanding to pragmatics and conceptual metaphorical

reasoning. We also have research interests in applied natural language processing and information retrieval.

Contact: Dr Mark Lee
Tel: +44 (0)121 414 4765
Fax: +44 (0)121 414 4281
Email: m.g.lee@cs.bham.ac.uk (mailto:m.g.lee@cs.bham.ac.uk)

Nature-inspired computation

Sub-themes:

- **Natural computation**

  The Natural Computation Group is one of the world's leading groups in this field as evidenced by journal editorships, conference committee memberships and refereeing activities. It conducts both basic and applied research in areas including evolutionary computation; neural computation; artificial life; self-organising systems; emergent behaviours; machine perception; evolutionary robotics; complex adaptive systems; swarm intelligence; and real-world applications.

  The group is supplemented by CERCIA (Centre of Excellence for Research in Computational Intelligence and Applications), which, with major funding from Advantage West Midlands, investigates the industrial applications of natural computation techniques. The group includes at least six teaching staff, ten research fellows and more than 25 PhD researchers. It has averaged more than £1 million annual external grant income in the last four years.

  Contact: Professor Xin Yao
  Tel: +44 (0)121 414 3747
  Fax: +44 (0)121 414 4281
  Email: x.yao@cs.bham.ac.uk (mailto:x.yao@cs.bham.ac.uk)

- **Image interpretation**

  This theme covers multidisciplinary research on computational techniques for image interpretation. The core activities relate to medical imaging, and aim to develop diagnostic aids that quantitatively characterise the properties of body tissues and organs. Current projects target the early diagnosis of skin and colon cancer and diabetic retinopathy. Some of the most exciting results have been achieved through techniques based on the understanding of the physics of image formation pioneered by this group. The most notable example is SIAscopy, now used worldwide in the diagnosis of skin cancers.

  The same principles have been shown to work successfully for images in such diverse domains as astronomy and fluorescence microscopy, which, with other domains, will be the subject of further developments. Another new area is the exploration of evolutionary computation for image interpretation.

  The group includes and collaborates with physicists and clinicians, and is funded by grants from research councils and major charities.
  Contact: Dr Ela Claridge
  Tel: +44 (0)121 414 4778
  Fax: +44 (0)121 414 4281
  Email: e.claridge@cs.bham.ac.uk (mailto:e.claridge@cs.bham.ac.uk)

Computing and systems

Sub-themes:

- **Distributed and autonomic systems**

  The Distributed Systems Laboratory conducts research in areas from principles, frameworks and tools for the design, modelling and implementation of distributed systems, to engineering novel systems such as distributed simulation kernels and microprocessors. Current research includes work on infrastructures for distributed virtual and collaborative environments, large-scale distributed simulation, grid computing, security, and verification of distributed systems.

  The group is a founding member of MeSC, the Midlands e-Science Centre of Excellence. It has several ongoing projects and wide-ranging national and international research collaborations. **Contact:** Dr Georgios Theodoropoulos
  Tel: +44 (0)121 414 4780
  F ax: +44 (0) 121 414 4281
  Email: g.k.theodoropoulos@cs.bham.ac.uk (mailto:g.k.theodoropoulos@cs.bham.ac.uk)

- **Human–computer interaction**

  Human–computer interaction is the focus of the Advanced Interaction Group. The group exists to promote leading-edge research and development in theories, designs, methodologies, and systems to support people in whatever they want to achieve. The group acts as a focal point for research, development and expertise in anything that has the user at the core. This includes:
  - Mobile computing: laptops, handhelds, tablets, phones
  - Internet-based systems: e-commerce, web design, shared spaces, communities
  - New media and new technologies
  - Ambient computing: ad-hoc interaction with the environment, other users, other systems
  - Intelligent agents: entities acting for or on behalf of the user
  - Usability and design: theories and methodologies to promote effective, usable, enjoyable systems
  - Visualisation, virtual and augmented realities: the representation of complex information in effective ways
  - Gaming, edutainment
  - Interaction technologies: speech, gesture, vision

  The group is an interdisciplinary grouping of researchers who bring a range of backgrounds and perspectives to bear on research problems.
  Contact: Dr Russell Beale
  Tel: +44 (0)121 414 3729
  Fax: +44 (0)121 414 4281
  Email: r.beale@cs.bham.ac.uk (mailto:r.beale@cs.bham.ac.uk)

- **Modelling and analysis of systems**

  The research conducted under this theme is centred on languages and formalisms for modelling complex systems, especially those involving randomness, as well as software tools for their analysis. The analysis methods include simulation and verification via model checking. Current research areas include the feature interaction problem, access control systems, analysis of security protocols, verification of control software using real-time model checkers, and analysis of mobile ad-hoc networks.

  The group has developed the PRISM system for building and analysing probabilistic models, and this has been applied to a wide range of real-life systems,

including state-of-the-art communication protocols such as FireWire and Bluetooth, power management schemes and biological processes. The group is also a leading member of the Midlands e-Science Centre (MeSC).
Contact: Dr Mark Ryan
Tel: +44 (0)121 414 7361
Fax: +44 (0)121 414 4281
Email: m.d.ryan@cs.bham.ac.uk (mailto:m.d.ryan@cs.bham.ac.uk)

Theoretical computer science

- **Principles of programming**

  This theme covers model-based and semantics-based approaches to program development, program structuring and program reasoning. Interests include type systems for programming languages; the study of computational effects (including control and state-manipulation operations); data abstraction mechanisms; object-oriented programs; dynamic data structures and concurrency.

  The group is an active member of the APPSEM Thematic Network, funded by EU FP5, and has wide-ranging global collaborations.
  Contact: Professor Uday Reddy
  Tel: +44 (0)121 414 2740
  Fax: +44 (0)121 414 4281
  Email: u.s.reddy@cs.bham.ac.uk (mailto:u.s.reddy@cs.bham.ac.uk)

- **Mathematical foundations of computer science**

  This group is concerned with developing mathematical models and theories that underpin the design and analysis of programming languages, helping to explain computational phenomena such as real number computation.

  The major areas of research include domain theory and topology, exact numerical computation and computational logic and the relationship between them.

  The group has wide-ranging global collaborations and is a leading member of the APPSEM Thematic Network, funded by EU FP5 and the TYPES network. It is also a founding member of the Midlands Graduate School in Theoretical Computer Science.
  Contact: Professor Achim Jung
  Tel: +44 (0)121 414 4776
  Fax: +44 (0)121 414 4281
  Email: a.jung@cs.bham.ac.uk (mailto:a.jung@cs.bham.ac.uk)

Related links

School of Computer Science website: www.cs.bham.ac.uk (http://www.cs.bham.ac.uk/)

Fees and funding

Standard fees (/postgraduate/dr-fees/tuition.aspx) apply.
Learn more about fees and funding (/postgraduate/dr-fees/index.aspx)

Scholarships and studentships
For information about research scholarships in Computer Science visit www.cs.bham.ac.uk/admissions/postgraduate-research/scholarships.php (http://www.cs.bham.ac.uk/admissions/postgraduate-research/scholarships.php) . Alternatively email sfo@contacts.bham.ac.uk (mailto:sfo@contacts.bham.ac.uk)

International students can often gain funding through overseas research scholarships, Commonwealth scholarships or their home government.

Entry requirements

Learn more about entry requirements (/postgraduate/requirements-dr/step1.aspx)

International students
We accept a range of qualifications from different countries – learn more about international entry requirements (/postgraduate/requirements-dr/step1.aspx)

Standard English language requirements (/postgraduate/requirements-pgt/international/index.aspx) apply

How to apply

Learn more about applying (/postgraduate/requirements-dr/index.aspx)

Apply now (https://pga.bham.ac.uk/lpages/EPS003.htm)

When clicking on the Apply Now button you will be directed to an application specifically designed for the programme you wish to apply for where you will create an account with the University application system and submit your application and supporting documents online. Further information regarding how to apply online can be found on the How to apply pages (http://www.birmingham.ac.uk/students/courses/postgraduate/apply-pg/index.aspx)

Apply now (https://pga.bham.ac.uk/lpages/EPS003.htm)

Related news and events

Birmingham computer scientists take part in national cyber security challenge (/news/latest/2013/01/24-Jan-13-Birmingham-computer-scientists-take-part-in-national-cyber-security-challenge.aspx)

Social media: why the case for teaching digital literacy is so compelling (/news/thebirminghambrief/items/2013/08/14-08-13Social-media-why-the-case-for-teaching-digital-literacy-is-so-compelling.aspx)

Research interests of staff

Our research lies mainly within the following themes and their sub-themes. There is a Grouping of academics associated with each sub-theme, but the groupings have a lot of overlap, and there are no formal boundaries.

In addition to the research groupings pages listed below, we also have **Research Blogs (http://researchblogs.cs.bham.ac.uk/)** on our work.

Nature-Inspired and Intelligent Computation (Including Artificial Intelligence and Cognitive Science)

- **Natural Computation (incl. Evolutionary and Neural Computation) (http://www.cs.bham.ac.uk/research/groupings/natural_computation/)**
- **Machine Learning (http://www.cs.bham.ac.uk/research/groupings/machine_learning/)**
- **Robotics (http://www.cs.bham.ac.uk/research/groupings/robotics/)**
- **Medical Image Interpretation (http://www.cs.bham.ac.uk/research/groupings/medical_image_interpretation/)**
- **Reasoning (http://www.cs.bham.ac.uk/research/groupings/reasoning/)**
- **Language and Interaction (http://www.cs.bham.ac.uk/research/groupings/language_and_interaction/)** incorporating:
  - **Advanced Interaction Group (http://www.cs.bham.ac.uk/research/groupings/language_and_interaction/human_computer_interaction/)**
  - **Natural Language Processing Group (http://www.cs.bham.ac.uk/research/groupings/language_and_interaction/natural_language_processing/)**
  - **Scientific Document Analysis Group (http://www.cs.bham.ac.uk/go/sdag)**

Computing Systems

- **Formal Verification and Security (groupings/formal_verification_and_security/)**
- **Parallel and Distributed Computing (groupings/parallel_and_distributed_computing/)**

Theoretical Computer Science

- **Mathematical Foundations of Computer Science (groupings/mathematics_foundations/)**
- **Principles of Programming (groupings/principles_of_programming/)**

Software Engineering

- **Software Engineering Research Group (groupings/software_engineering/)**

Research Centres

- **Centre of Excellence for Research in Computational Intelligence and Applications (centres/cercia/)**
- **Centre for Computational Neuroscience and Cognitive Robotics (centres/cncr/)**
- **Physical Sciences of Imaging in the Biomedical Sciences Doctoral Training Centre (http://www.psibs.bham.ac.uk/)**
- **HCI Centre (http://hci.bham.ac.uk/)**

PostgraduateResearch Degrees (PhD, MPhil) (http://www.cs.bham.ac.uk/admissions/postgraduate-research/)

Employability

University Careers Network

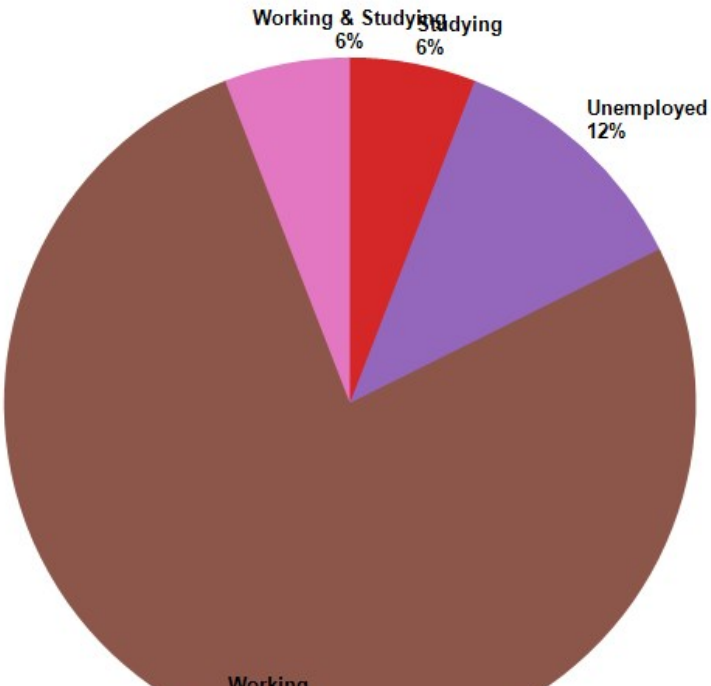
Preparation for your career should be one of the first things you think about as you start university. Whether you have a clear idea of where your future aspirations lie or want to consider the broad range of opportunities available once you have a Birmingham degree, our Careers Network can help you achieve your goal.

Our unique careers guidance service is tailored to your academic subject area, offering a specialised team (in each of the five academic colleges) who can give you expert advice. Our team source exclusive work experience opportunities to help you stand out amongst the competition, with mentoring, global internships and placements available to you. Once you have a career in your sights, one-to-one support with CVs and job applications will help give you the edge.

If you make the most of the **wide range of services (https://intranet.birmingham.ac.uk/as/employability/careers/college/eps/index.aspx)** you will be able to develop your career from the moment you arrive.

Destinations of Leavers from Higher Education (DLHE) 2011/12 (postgraduate taught graduates)

The DLHE survey is conducted 6 months after graduation.



Examples of employers

- Credit Suisse
- Innovise
- Atos
- BAe Systems
- Bank of America
- J.P. Morgan
- Logica
- Tessella
- Morgan Stanley
- QinetiQ

Examples of occupations

- Software Engineer
- Software Developer
- Technical Analyst
- Applications Developer
- Cyber Security Consultant
- Design Engineer
- Junior Programmer

- Software Consultant
- Technical Consultant
- Technology Analyst

Further study - examples of courses

- MSc Computer Security
- MSc International Business
- MEng Aeronautics & Astronautics
- MSc Computer Science
- MSc Artifical Intelligence
- MSc Operational Research
- MSc Imbedded Systems
- PhD - Physical Sciences in the Biomedical Imaging
- PhD - Computer Science

Visit the **Careers section of the University website (https://intranet.birmingham.ac.uk/as/employability/careers/college/eps/index.aspx)** for further information.

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