

**UNIVERSITY OF  
BIRMINGHAM**

**School of Computer Science**

**MSc. in Advanced Computer Science**

**Handbook  
2011-12**

This handbook has been prepared as a convenient summary of information you may need at the start of your degree programme. The School has endeavoured to ensure that it is correct at the time of preparation. However, if there are discrepancies, University Regulations always take precedence over the Handbook.

This handbook is prepared well in advance and there may be alterations to modules or facilities. You are strongly advised to consult the School's WWW server for the latest information.

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# Important dates and deadlines

## Academic Year 2011-12

26 <sup>th</sup> September 2011	Semester 1 and Autumn Term starts
28 <sup>th</sup> September 2011	Induction meeting for international students, 16.30-17.30, UG40, School of Computer Science
29 <sup>th</sup> September 2011	Reception for postgraduate students, 17.00-19.00, Atrium, School of Computer Science
7 <sup>th</sup> October 2011	Last date for changing first term modules
1600 hrs, 14th October 2011	Declaration of 1st semester mini-project
9th December 2011	Semester 1 and Autumn Term ends
9th January 2012	Semester 2 and Spring Term starts
1200 hrs, 9th January 2012	Hand in two copies of 1st mini-project report to School Office
1600 hrs, 20th January 2012	Declaration of 2nd semester module choice
1600 hrs, 20th January 2012	Declaration of 2nd semester mini-project
Week beginning 23rd January 2012	Meeting with academic advisor - 1st semester mini-project review
23 <sup>rd</sup> March 2012	Semester 2 and Spring Term ends
23 <sup>rd</sup> April 2012	Summer Term starts; Revision, Examination and Assessment Period starts
1200 hrs, 23rd April 2012	Hand in two copies of 2nd mini-project report to School Office
8 <sup>th</sup> May 2012	Semester 1 and 2 Examinations start
1 <sup>st</sup> June 2012	Revision, Examination and Assessment Period ends
Week beginning 11th June 2012	Meeting with academic advisor – examination & 2 <sup>nd</sup> mini-project review
1600 hrs, 15th June 2012	Declaration of summer project
15th June 2012	Summer Term ends
20 <sup>th</sup> August 2012	Supplementary (resit) Examinations start
31 <sup>st</sup> August 2012	Supplementary (resit) Examinations end
1200 hrs, 13th September 2012	Hand in two unbound copies of summer project report and a CD to School Office (UG45); end of programme
Week beginning 10 <sup>th</sup> September 2012	Summer project poster presentations
1200 hrs, 27th September 2012	Final cut-off date for MSc project reports
Mid November 2012	Final Science Graduate Board of Examiners
Mid December 2012	Degree Congregation

## Vital and useful sources of information and URLs

### *Regulations*

Your Degree Programme is governed by regulations that specify the requirements to pass, to pass with Merit and to pass with Distinction, amongst other things. You should read the regulations so that you know what is required of you.

<http://www.as.bham.ac.uk/legislation/>

### *Programme Descriptions*

The Programme Description for your programme includes a list of all modules, core and optional, and any conditions on progression, for instance any module you may have to pass before progressing to the summer project.

[www.cs.bham.ac.uk/internal/programmes/2011/MScACS.html](http://www.cs.bham.ac.uk/internal/programmes/2011/MScACS.html)

### *Registration*

You should register with the University online at:

<http://www.as.bham.ac.uk/faq/reg/>

### *Transcripts*

The University's page for official and unofficial transcripts is at:

<http://www.as.bham.ac.uk/faq/transcripts.shtml>

### *Timetables*

The School's timetables are at:

[www.cs.bham.ac.uk/internal/timetables/](http://www.cs.bham.ac.uk/internal/timetables/)

### *School of Computer Science Student Handbook*

[www.cs.bham.ac.uk/internal/students/handbook.html](http://www.cs.bham.ac.uk/internal/students/handbook.html)

### *Frequently Asked Questions for Academic Services*

<http://www.as.bham.ac.uk/faq/>

## Key staff

### *Head of School*

Professor Achim Jung

### *Head of Academic Programmes*

Dr Manfred Kerber

### *Director of Quality Assurance and Enhancement*

Dr John Bullinaria

### *Director of Postgraduate Studies*

Alan Sexton

Room 239

Availability: [www.cs.bham.ac.uk/~aps/timetable.html](http://www.cs.bham.ac.uk/~aps/timetable.html)

Email: [A.P.Sexton@cs.bham.ac.uk](mailto:A.P.Sexton@cs.bham.ac.uk)

### *Programme Director: MSc in Advanced Computer Science*

Bob Hendley

Room 236

Availability: [www.cs.bham.ac.uk/~rjh/timetable.html](http://www.cs.bham.ac.uk/~rjh/timetable.html)

Email: [R.J.Hendley@cs.bham.ac.uk](mailto:R.J.Hendley@cs.bham.ac.uk)

## Welfare Team

We use the term 'welfare matters' to cover all extenuating circumstances of a *non-academic* nature that interfere with your *academic* work, for example, illness, bereavement, family crises or financial problems. The School has a team of trained **Welfare Tutors** to give advice in such cases. It is important to note that only very rarely will they be able to address the cause of a welfare problem (they are not medical doctors, for example); instead their role is to *recommend professional help services* and, most importantly, to **limit the damage** that the problem could have on your studies. Thus they can arrange for a deadline to be extended for you, or for a particularly serious issue to be brought to the attention of the examination board.

It is your responsibility to inform the Welfare Team in a timely fashion of any welfare matter that might affect your studies. The Welfare Tutors will generally not be able to help you if informed too late.

To contact the Welfare Team begin by sending an e-mail to [welfare@cs.bham.ac.uk](mailto:welfare@cs.bham.ac.uk). Alternatively, attend the Welfare Hour of a member of the Welfare Team, which you will find on their office door. Up-to-date information is available at <http://www.cs.bham.ac.uk/internal/students/welfare/>

Our School's Welfare Team follows the University's Code of Practice on Extenuating Circumstances and Fit to Sit Procedure:

<http://www.birmingham.ac.uk/Documents/university/legal/extenuating-circumstances.pdf>

Changes of address and absences from the University *must* be reported to the School Office. We do need to know where you are, whether you are unwell, and so forth.

The School's International Student Tutor (currently Dr Ata Kaban) acts on a more informal basis as an additional Academic Advisor to international students in relation to academic and related issues. Students from Overseas have further support within the School, see

[www.cs.bham.ac.uk/resources/studentinfo/overseas.html](http://www.cs.bham.ac.uk/resources/studentinfo/overseas.html)

The English For International Students Unit (EISU) provides free English Language support to all registered students and staff at the University of Birmingham whose first language is not English, see

[www.eisu.bham.ac.uk/courses/insession/](http://www.eisu.bham.ac.uk/courses/insession/)

A detailed summary of the student support services offered by the University can be found at:

<http://www.as.bham.ac.uk/support/index.shtml>

## Requesting a deadline extension

This has to be authorised by a member of the Welfare Team. Inform the Welfare Team either by email or by seeing one of the Welfare Tutors. In general, to be granted a deadline extension you need to present contemporaneous supporting evidence from an independent third party, such as a note by a GP, a letter from a counsellor, or a death certificate. However, we allow for **one self-certified** illness per term, provided the illness only lasts up to 5 consecutive days and no major assessment is affected. You need to fill in and submit a medical self-certification which can be found at: [http://www.as.bham.ac.uk/sca/documents/ec\\_medical\\_form.pdf](http://www.as.bham.ac.uk/sca/documents/ec_medical_form.pdf)

together with the University guidelines for medical certificates:

[http://www.as.bham.ac.uk/sca/documents/ec\\_medical\\_guidelines.pdf](http://www.as.bham.ac.uk/sca/documents/ec_medical_guidelines.pdf).

The Welfare Team will advise relevant members of staff whether or not your claim can be accepted. The final decision on what action to take - whether to grant an extension up to a specified length of time or whether to take some other action - will be taken by the module lecturer, since it depends on further factors such as whether solutions have already been published.

All required supporting evidence or medical self-certification has to be received within 2 working days of a given extension, unless otherwise specified by a Welfare Tutor. We will not issue a reminder if no evidence has been submitted in time. We can also not make enquiries to obtain evidence on your behalf.

Some circumstances that will **not normally be considered** as Extenuating Circumstances and are therefore **not welfare matters** include:

1. minor illnesses (such as coughs and colds);
2. computer problems (we expect you to make adequate provisions for backing up your work) or inadequate planning preventing completion or submission of coursework;
3. stress and panic attacks caused by examinations that are not diagnosed as an illness or documented in a Student Support Agreement;
4. assessments or examinations scheduled close together;
5. personal or domestic events, such as moving house or attending a wedding;
6. holidays or travel arrangements;
7. consequences of paid employment;
8. sports activities.

See also the University's code of practice for more detail:

<http://www.birmingham.ac.uk/Documents/university/legal/extenuating-circumstances.pdf>.

## Extensions or deferral of projects

Final year or summer projects can only be extended or deferred in very exceptional circumstances. Your project plan should be flexible enough to allow for short periods that keep you from working due to welfare matters. Should you nevertheless have a welfare matter that seriously interferes with your project, it is your responsibility to inform the Welfare Team as soon as possible and provide appropriate evidence. The Welfare Team will generally not extend or defer a project if informed retrospectively only.

## Serious conditions that may interfere with your exam performance

In serious cases you may ask **before the exams take place** to postpone exams to the next possible resit opportunity. These requests have to be received by a nominated member of the Welfare Team either in person or in writing **before the exams take place** together with contemporaneous supporting evidence from an independent third party. The School's welfare tutor will then make a decision whether to accept or reject your application, or if additional evidence is required.

By being present at an examination you declare yourself 'Fit to Sit'. A subsequent request for deferral or other action by reason of Extenuating Circumstances will not normally be accepted.

Only in exceptional circumstances you can submit a case for consideration by the Extenuating Circumstances Panel. You must then provide reasoning for not applying for an extension during the term or a deferral of your exam at the appropriate time. The submission must be made known to the School **in writing**. A form for this purpose is available which you should submit to the School together with any supporting documentation: [http://www.as.bham.ac.uk/sca/documents/ec\\_student\\_form.pdf](http://www.as.bham.ac.uk/sca/documents/ec_student_form.pdf).

Note that it is not enough to have spoken to someone (be it your academic advisor or a member of the Welfare Team). The deadline for the submission to Extenuating Circumstances Panel will be announced via email and on the School's welfare pages (<http://www.cs.bham.ac.uk/internal/students/welfare/>).

The Extenuating Circumstances Panel will decide whether your application can be accepted. If accepted the panel will make a suggestion to the exam board how to handle your application and it is at the discretion of the exam board whether or not to follow this suggestion. It is also at the discretion of the exam board to allow you to take an examination again but as a 'first sit' (rather than a resit). For deriving the degree classification it is at the discretion of the exam board to disregard some results. However, please note that marks themselves will **not** be adjusted on the basis of extenuating circumstances.

After the examiners meeting has taken place, the School cannot take into consideration any additional new evidence that you may have. The only possibility then is to appeal (<http://www.cs.bham.ac.uk/internal/students/handbook/2011/#appeal>) against a decision. However, be advised that the regulations only allow truly exceptional circumstances to be admitted in an appeal. The message is that if you think that extenuating circumstances apply to you, you must not wait until the exam results are out, but have to submit them to the School before the examiners meeting.

More information on the University's extenuating circumstances and fit to sit procedure can be found at <http://www.as.bham.ac.uk/sca/extcirc/index.shtml>.

## Student Attendance

The University has a Code of Practice on Student Attendance and Reasonable Diligence: [http://www.as.bham.ac.uk/legislation/docs/COP\\_Student\\_Attendance\\_Reasonable\\_Diligence.pdf](http://www.as.bham.ac.uk/legislation/docs/COP_Student_Attendance_Reasonable_Diligence.pdf)

The School must check that every single student shows reasonable diligence. You are obliged to:

- Submit all your coursework. (If you can't finish it, submit what you have finished by the deadline. If you have not finished anything, submit a note saying so.)
- Attend all compulsory tutorials and laboratory sessions, etc.
- Attend all advisorial sessions (currently this mainly concerns first year undergraduate students), likewise progress tutorials.
- Attend all meetings with your final year project supervisor (at least every second week in person, other meetings may be replaced by other forms of contact such as email or phone call).
- Attend all other compulsory events.

The School has mechanisms in place to monitor your attendance. This includes taking registers of attendance at advisorial sessions, meetings with your project supervisor, and certain modules. As part of this, we will also monitor your attendance at 10 contact points over the academic year, as part of the University's obligations to monitor the attendance of non-EEA students in accordance with the Points-Based System.

If you do not show reasonable diligence as outlined in the Code of Practice, we will initiate the procedures set out in the Code of Practice, which might result in your being required to withdraw from your programme. For this reason, please:

- Inform the lecturer in charge if you miss a submission/compulsory event for good reason. Do this before the submission/event if at all possible. If the reason is illness, also inform the School office by getting a phone message to Sue Tippin on 0121 414 4782 or an email message to [S.Tippin@cs.bham.ac.uk](mailto:S.Tippin@cs.bham.ac.uk). Again, if at all possible, do this before the submission/event.

- Read your email on a daily basis and make sure that your postal address details are up to date on the student portal (my.bham.ac.uk).

For international students, the UK Border Agency stipulates that all educational institutions who are licensed to sponsor students that require a visa must monitor their students' engagement with their programmes of study. As such, the University has a legal duty to report international students with a visa who do not fully engage with their programme of study. Being reported to the UK Border Agency would have serious implications for a student's immigration status and their ability to remain in the UK. It is therefore essential that regular attendance and active engagement (as outlined above) is maintained throughout your programme of study.

If you are an international student, you are strongly advised to contact the International Students Advisory Service (ISAS) in the Aston Webb Building if you have any concerns about your visa or your immigration status. ISAS can be contacted at +44 (0)121 414 8464, or by email to [isas@contacts.bham.ac.uk](mailto:isas@contacts.bham.ac.uk).

## Complaints

If things go wrong, you have the right to complain. If possible, this should be done on an informal level as early as possible – before it can grow into a big problem. For instance, if it is about a particular lecture, contact the lecturer; if about a module, then contact the Module Examiner. If your complaint is about the Programme in general, then you should complain to the Programme Director.

If you are not satisfied by the action taken or if the nature of the problem is broader, you still have a number of options within the School. You can contact your representative on the Staff/Student Consultative Committee, discuss it with either your academic advisor or a member of the welfare team, or contact the Director of Postgraduate Studies.

If you are still unsatisfied, your next step should be to contact the Head of Academic Programmes or the Head of School.

If you still unhappy, then you have exhausted the complaints procedure within the School and you should follow the University's formal complaints procedure. The full procedure, as well as pointers to the forms to be filled in, can be found at:

<http://www.as.bham.ac.uk/legislation/complaints.shtml>

## Plagiarism

Plagiarism is taking someone else's thoughts or words and presenting them as your own. Weaker students are often tempted to copy one or more sentences from books or web pages into their project reports and essays. Occasionally students will use an author's words and change them to disguise that they have copied the author's ideas. Very occasionally, students try to copy programs from books and the web and pretend they have written the programs themselves.

Plagiarism – the copying of other people's ideas or words and pretending they are your own – is unacceptable. You must always reference your sources and place quotation marks when you copy other people's words. The key rule is: the reader should always be able to see what are your ideas and words and what are other people's.

The School of Computer Science and the University take plagiarism very seriously. In previous years, a small number of students have attempted to deceive by copying from books or the web. When a student has copied a small amount of text (for instance less than 50 words), they have had their mark reduced for the module. Where a student has copied larger amounts, the range of discipline measures have been from the failure of a whole module (with the student paying to repeat the module in the next academic year and receiving their degree late) to the student being required to leave the course with no degree and no return of fees.

**The simple message is: if it is not your idea, add a reference.**

## Key words and phrases

### *Academic Advisor*

Each member of a postgraduate course is assigned to an Academic Advisor. Your Advisor will review your academic progress and give you feedback at designated times during the year. Information about the allocation of students to Academic Advisors is given at:

[www.cs.bham.ac.uk/internal/students/handbook.html#PA](http://www.cs.bham.ac.uk/internal/students/handbook.html#PA)

### *Advisor*

Within the School, this usually means your Academic Advisor.

### *Atrium*

In the School of Computer Science, not the central courtyard of a Roman house nor a covered portico, but the large open space inside the Computer Science building's main doors.

### *Co-requisite*

A specification usually of another module that has to be taken at the same time. Co-requisites are specified in Module Descriptions.

### *Credit*

Each module has an associated "credit value" which is a measure of how much time and work is involved in studying for that module. Each MSc. programme consists of 180 credits, of which the summer project is 60 credits and the autumn and spring terms are each of 60 credits. Credits are used to weight marks when calculating a student's average for a programme, so a 20 credit module will contribute twice as much to a programme mark as a 10 credit module.

### *Degree Programme*

A group of modules which, together, make a coherent study package with sufficient credit to be awarded a qualification. An MSc., a Postgraduate Diploma and a Postgraduate Certificate are all examples of programmes.

### *JACS code*

This code is needed for those applying for a visa for employment after the completion of the programme. The JACS code is G400.

### *Level*

Each module is designed to reach a certain intellectual level. For postgraduate programmes, modules will be mostly Level M with a minority at Level 3/H or Level 2/I. Levels are important because it is necessary to pass enough Level M modules to be awarded a postgraduate degree, diploma or certificate.

### *Module*

The smallest unit from which a programme is constructed. Modules can be thought of as being about sub-parts of subjects, so Natural Language Processing is a sub-part of Artificial Intelligence or Cognitive Science.

### *Module Description*

A standard description of a module. These are best accessed from the your programme's Programme Description.

### *Module Examiner*

The person who is primarily responsible for a module. This is the person to contact if you need to find out about the content of a module, its availability etc. Module Descriptions give the name of module examiners.

### *Pre-requisite*

A specification of knowledge that is required before a module can be studied. Pre-requisites are specified in Module Descriptions.

### *Programme*

The better name for what is usually referred to as a Degree Programme (see above).

*Programme Description*

A description of a Degree Programme consisting mainly of the modules of which the programme consists. Programme Descriptions include essential information, such as special rules on progression, for instance by specifying that a particular module has to be passed before a project can be attempted.

*Reception*

The office at the west end of the Atrium in the Computer Science building. This is usually open from 9.00-12.30, 13.30-17.00, Mondays to Fridays.

*Restriction*

A specification of some limitation on the study of a module, for instance that it cannot be studied together with another named module. Restrictions are specified in Module Descriptions.

*Supervisor*

A member of academic staff who supervises you during your summer project.

## The structure of the degree programme

The MSc in Advanced Computer Science is an advanced graduate programme which aims to allow you to both broaden and deepen your knowledge of computer science. You can broaden your knowledge by studying advanced topics not studied as part of your first degree. The programme normally includes a substantial amount of individual project work which ensures that you deepen your knowledge of specific topics.

We have designed this advanced Masters programme for students who have completed an undergraduate degree in computer science, artificial intelligence or a closely related subject. Graduates from this programme have taken jobs in industry to work on advanced project development and in research sections of companies, or have moved into research for a doctorate. This programme's mixture of individual in-depth study and taught modules is an ideal preparation for these kinds of advanced work.

The programme runs for twelve months, organised into three parts. The normal structure (the 'research pathway') is described here:

### *Semester 1*

You have to study *Research Skills (06 06991)*, a mini-project and some taught modules chosen from the list given below

### *Semester 2*

You have to study some more taught modules and complete a second mini-project (provided you have passed the first semester mini-project). There is an examination period after the end of the semester.

### *Summer*

The final part of the programme is dedicated to the Summer project. The assessment is by the project report (see section on Projects below) and either by a poster presentation (Advanced MSc Project) or by demonstration (CompSci – MSc Project).

Exceptionally, there is a 'taught pathway' which is similar, except that in Semesters 1 and 2, the two mini-projects are replaced by further taught options.

### *Credits*

You have to gain credits from the two compulsory modules: Research Skills (10 credits) and the Summer project (60 credits). Most students will choose to do two mini-projects (each worth 30 credits). In addition you have to choose further 50 credits-worth of taught modules. Further information about choosing modules, mini-projects and a project is given below

## Taught Modules

In the 'research pathway', Part 1 of the programme consists of 60 credits of taught modules. There is one module, *Research Skills (06 06991)*, which all students of the MSc in Advanced Computer Science have to complete. This module is given in the first semester. The full list of modules is given on page 11 and is also available at [www.cs.bham.ac.uk/internal/programmes/2011/MScACS.html](http://www.cs.bham.ac.uk/internal/programmes/2011/MScACS.html).

You have to choose other modules to complete the remaining 50 credits of taught modules. In this section, we give you the answers to some frequently asked questions and some advice about selecting modules.

### Advice about choosing modules

In the 'research pathway', you have to choose 50 credits of taught modules from the list given below to complete Part 1 of the MSc in Advanced Computer Science. Please note that there is a possibility that timetable clashes may render some combinations impractical. This list gives brief details; full descriptions are given on the web at [www.cs.bham.ac.uk/resources/programmes/2011/MScACS.html](http://www.cs.bham.ac.uk/resources/programmes/2011/MScACS.html).

- The first consideration is your aim and objectives in studying for the MSc in Advanced Computer Science. Your choice should fit your desired specialisations in computer science.
- Some modules have prerequisites. You should examine the descriptions of prerequisites to ensure you have covered the material in previous modules, perhaps as part of your first degree. You should also consult the member of staff responsible for the module you wish to study to satisfy them that you have sufficient background knowledge.
- Some modules have co-requisites. You should ensure that you opt for these modules, unless you have previously studied the material. Again, contact the member of staff responsible for the module you wish to study to satisfy them that you have the required knowledge.
- When choosing your first semester modules, you should look at second semester modules to ensure that you study any prerequisites for the second semester.
- Talk to your proposed mini-project supervisor. Your mini-project supervisor may have a particular module he or she wants you to study to help you with your work. Ask your proposed supervisor if she or he has any advice, but make sure that the modules he or she suggests are on your list of modules!
- Try modules out. Use the first weeks to attend lectures in several modules to see which suits you best. You have about two weeks in which to decide which modules you intend to complete.
- Check that your choice of modules does not include a timetable clash.
- Finally, discuss your proposals with your Academic Advisor who will guide you through the programme.

### Declaring your taught modules

At the beginning of each semester, you must complete a taught module declaration form (see Appendix 2) **and get the signature of your Academic Advisor**. This form should be completed by the date given in the *Important Dates* section of this booklet and posted in the appropriate assessed work pigeon hole (next to the Reception).

The forms are available to be downloaded for editing and printing as follows:

[www.cs.bham.ac.uk/resources/programmes/postgraduate-taught/msc-ac/s/tm\\_1.pdf](http://www.cs.bham.ac.uk/resources/programmes/postgraduate-taught/msc-ac/s/tm_1.pdf)  
[www.cs.bham.ac.uk/resources/programmes/postgraduate-taught/msc-ac/s/tm\\_1.doc](http://www.cs.bham.ac.uk/resources/programmes/postgraduate-taught/msc-ac/s/tm_1.doc)  
[www.cs.bham.ac.uk/resources/programmes/postgraduate-taught/msc-ac/s/tm\\_2.pdf](http://www.cs.bham.ac.uk/resources/programmes/postgraduate-taught/msc-ac/s/tm_2.pdf)  
[www.cs.bham.ac.uk/resources/programmes/postgraduate-taught/msc-ac/s/tm\\_2.doc](http://www.cs.bham.ac.uk/resources/programmes/postgraduate-taught/msc-ac/s/tm_2.doc)

## Frequently asked questions about taught modules

- Q1. *Can I do any modules I like?*  
A. No. You have to choose from the list of modules given below. These have been selected to give the best combinations of advanced topics for the students who join this programme.
- Q2. *Can I do more modules than 50 credits worth?*  
A. No. You have to tell the School of Computer Science which modules you have chosen to be examined on. This must add up to exactly 50 credits plus *Research Skills (06 06991)*. You may sit in on extra modules if you wish, providing the lecturer agrees.
- Q3. *Can I do fewer than 50 credits worth of optional modules?*  
A. No. You have to do exactly 50 credits plus *Research Skills (06 06991)*. If you do not complete sufficient credits, you will not be able to pass or be awarded a degree.
- Q4. *Can I do all my 50 credits in one semester?*  
A. We are happy for students to study for 40 credits in one semester and 20 in the other. We do not approve programmes of study in which there are more than 40 credits of taught modules (including *Research Skills (06 06991)*) in one semester.
- Q5. *Are there any restrictions on which modules I select?*  
A. There are three restrictions on which modules you select:  
First: you have to choose modules that you have not studied at the same level in a previous degree programme;  
Second: you have to satisfy any prerequisites and co-requisites of the module;  
Third: you cannot choose modules which clash on the timetable.
- Q6. *The module I want to study lists a prerequisite module which I have not studied. Can I still study for this module?*  
A. Check with the lecturer responsible for the module that you have sufficient knowledge from your previous studies to be able to complete your chosen module. When you contact a member of staff for this purpose, clearly identify yourself as a member of the MSc. in Advanced Computer Science degree programme.
- Q7. *The module I want to study lists a co-requisite module. Do I have to take the co-requisite module?*  
A. Generally, yes. The exception is where you have previously studied the co-requisite module or a comparable module as part of a previous degree programme. Check with the lecturer responsible for the module you wish to study that you have sufficient knowledge from your previous studies to be able to complete your chosen module. When you contact a member of staff for this purpose, clearly identify yourself as a member of the MSc. in Advanced Computer Science programme.
- Q8. *If I decide that I don't like a module, can I change to another?*  
A. If you decide early enough, you can change. If you decide to change after the School has notified the University's examinations administration, then you cannot change modules. Most students sample many modules at the beginning of the semester and choose afterwards.
- Q9. *Can I take an extended version of a module that I have already taken at a lower level?*  
A. This should only apply to students who have already studied in the School. The answer is no.

## List of module options offered in 2011/12

The list of modules, together with the Option Checker, is available at:

[www.cs.bham.ac.uk/internal/programmes/2011/MScACS.html](http://www.cs.bham.ac.uk/internal/programmes/2011/MScACS.html).

On the above web page follow the link from the module code to see the full Syllabus Page for each of the modules.

Students take the following modules to an overall total of 180 credits.

Code	Module	Credits		
		Sem1	Sem2	Summer
<b>Compulsory Modules to a total of 10 credits</b>				
06 06991	Research Skills	10		
<b>Optional Modules to a total of 170 credits</b>				
<i>Either 0 or 30 credits chosen from:</i>				
06 07953	First semester mini-project	30		
<i>Either 0 or 30 credits chosen from:</i>				
06 07954	Second semester mini-project [Note 1]		30	
<i>Between 50 and 110 credits chosen from:</i>				
06 17442	Commercial Programming (Extended)	10		
06 15255	Compilers & Languages (Extended)		10	
06 18157	Component-based Software		10	
06 17417	Computer Security	20		
06 20008	Cryptography	10		
06 24229	Enterprise Systems		20	
0623856	Evaluation Methods and Statistics	10		
06 N0112	Networks and Distributed Systems	20		
06 21253	Human Computer Interaction (MSc) [Note 3]	10		
06 19009	Individual Study 2 [May be taken in either Sem1 or Sem2 but not both]	10	10	
06 20233	Intelligent Data Analysis (Extended)		10	
06 15267	Intelligent Robotics (Extended)	20		
06 22456	Internet Security Seminar		10	
06 22753	Introduction to Evolutionary Computation	10		
06 22457	Quantum Computing and Cryptography		10	
06 12412	Introduction to Neural Computation	10		
06 20236	Machine Learning (Extended)	10		
06 12418	Nature Inspired Design		10	
06 N0110	Operating Systems with C/C++ (Extended)	20		
06 20010	Secure Programming		10	
06 22755	Programming Massively Parallel Architectures [Note 6]		10	
06 20009	Network Security		20	
06 18158	Software Testing		10	
06 N0113	Research Seminar		10	
<i>60 credits chosen from:</i>				
06 02637	Project - Advanced MSc [Note 2]			60
06 18159	Project (CompSci - MSc)			60

### Notes

- Note that this module cannot be taken unless 06 07953 First semester mini-project has also been taken.
- Students must pass 06 07953 First semester mini-project and 06 07954 Second semester mini-project before being allowed to proceed to this project module.
- 06 21253 Human Computer Interaction (MSc) is intended for students for whom this subject is new.
- Not all options may be available in any particular year. Some option combinations are only available if the timetable permits. As students may have to make preliminary option choices before timetables are

available, changes may be needed later if there are clashes. In selecting options, students need to pay attention to pre- and co-requisites.

5. Students' individual programmes of study must be approved by the Programme Director (as the nominee of the Head of School).
6. For 2011/12, this module can only accommodate a certain maximum number of students, depending on how much equipment can be purchased. If too many students opt for this module, a test will be conducted to limit the numbers of students.

# Mini-projects

## What is a mini-project?

A mini-project should be a small time-scale piece of research in some area of Computer Science or Artificial Intelligence. It can be the preliminary work necessary to carry out a larger research project or it can be a small, complete piece of research in its own right. In either case, it must have the usual features of a research project such as: literature review, knowledge acquisition, critical analysis, etc. It should involve some or all of: hypothesis construction and testing, theoretical analysis, experimental development, or any other technique or practice common in research projects.

The mini-project is a small research project, with a potential to be extended to a full summer project. Whereas the summer project is weighted at 60 credits, a mini-project has 30 credits. Essentially, a mini-project functions as a full project, but on a smaller scale.

The two mini-projects are an essential part of the programme. Their purpose is to give you the opportunity to develop a number of skills and techniques:

- definition of aims, objectives and feasible working plans
- project management and time management skills
- systematic literature searching skills
- communication skills both in written reports and in verbal presentations to supervisors.

## How to choose a mini-project

There are many different ways in which students choose mini-projects. Here are some of the approaches that have been used previously and which you might use:

- you have an interest in a particular topic and want to study it in greater depth
- you want to be supervised by a particular member of staff and are willing to accept their topic interests
- you feel that you have not covered a topic in your previous studies and want to take the opportunity to study it now
- your sponsor requires you to develop expertise in a particular area
- by studying particular topics, you will be able to complement the taught modules you have chosen
- you have looked at previous mini-projects and found topics that have interested you.

Research interests of academic and research staff and mini-project and summer project topics are listed further on in this handbook.

## Defining your mini-project

Whatever the reason or reasons for choosing a particular topic, you need to negotiate a topic with your supervisor. You need to address the following points:

### *Aim*

Each mini-project must have a clearly articulated aim or aims. One way of thinking about aims is to think about why you are doing the project. For instance, your aim might be “to study neural networks in greater depth” or “to develop a knowledge of pragmatics in natural language processing”. Alternatively, the aim might be firmer: for instance “to develop a constraint logic programming-based parser for a unification grammar”.

In brief, your aims should be devised in such a way that you and your examiners are able to evaluate, in broad terms at least, whether you have met your aims.

### *Objectives*

Whatever your aim or aims, you should be able to define a number of things you will achieve on the way to completing your mini-project. Objectives differ from aims. At the end of the mini-project, it may be possible to

argue about whether or not you have satisfied your aims: you may or may not have succeeded in, for instance, achieving learning in depth when studying neural networks. However, it should be absolutely clear whether or not you have achieved each objective.

So, objectives should be activities that have a beginning and an end; for instance writing a particular piece of program code, to review a set of papers, or to install and use a piece of software. It follows from the setting down of clear objectives that you have the basis of a plan of work for the mini-project.

#### *Project management skills*

As part of the supervision process, you will be expected to devise a management plan and evaluate your progress against that plan.

#### *Systematic literature skills*

All mini-projects should include a substantial element of literature search. The amount of literature searching required will vary from project to project. For instance, if the aim is to gain a deep knowledge of a particular topic, then there is likely to be very extensive literature research. For mini-projects focused on a piece of software, there may be less.

The aim, of course, is not to build a collection of references. You should ensure that you can demonstrate that you have undertaken a thorough review of the relevant literature (or software etc.). Typically, this is through presenting a detailed analysis of this previous work which will then stand as a foundation for your own contribution.

#### *Communication skills*

A basic level of practice in these skills comes with the normal process of supervisory meetings and report writing. Students and supervisors are encouraged to consider making mini-project work the basis of presentations in one of the School's informal seminar series.

## **Writing-up your mini-project**

Guidance on writing mini-project reports is given separately (see [http://www.cs.bham.ac.uk/resources/programmes/postgraduate-taught/msc-accs/msc\\_acs\\_nc\\_project\\_writing.pdf](http://www.cs.bham.ac.uk/resources/programmes/postgraduate-taught/msc-accs/msc_acs_nc_project_writing.pdf)). You should also seek the advice of your supervisor.

Students are reminded that any form of plagiarism is taken extremely seriously and heavily penalised by the School. See page 5 for more information.

See also the School's online guidance notes on plagiarism, at:

<http://www.cs.bham.ac.uk/internal/students/handbook/current/#PLAG>  
<http://www.cs.bham.ac.uk/internal/students/plagiarism.htm>  
<http://www.cs.bham.ac.uk/internal/students/plag-policy.html>

## **Declaring your mini-project**

You need to complete a mini-project declaration form (see Appendix 2) and get the signature of your supervisor. This form should be completed by the date given in the *Important Dates* section of this booklet and posted in the appropriate assessed work pigeon hole (next to the Reception). **You must keep a copy of the form as it is required as an appendix in your mini-project report.**

The forms are available to be edited and printed as follows:

Mini-project 1: [www.cs.bham.ac.uk/resources/programmes/postgraduate-taught/msc-accs/mp\\_1.\[pdf|doc\]](http://www.cs.bham.ac.uk/resources/programmes/postgraduate-taught/msc-accs/mp_1.[pdf|doc])  
Mini-project 2: [www.cs.bham.ac.uk/resources/programmes/postgraduate-taught/msc-accs/mp\\_2.\[pdf|doc\]](http://www.cs.bham.ac.uk/resources/programmes/postgraduate-taught/msc-accs/mp_2.[pdf|doc])

## **Assessing your mini-project**

Your mini-project will be assessed by your supervisor and moderated by a member of the programme team. It will be assessed through both the inherent quality of your work and also the success you have had in meeting your

aim and objectives, and displaying research skills of project management, literature review and communication skills. You will be given feedback in the form of a brief written report and a grade. See Appendix 2 for a copy of a mini-project assessment form.

## Late submissions

The submission deadlines for mini-projects are listed on page 1 of this handbook. Should you experience significant medical problems or personal problems, you may apply for an extension. Extensions can only be granted with authorization by a member of the Welfare Team, who will require a written submission by the student on a standard form ([www.cs.bham.ac.uk/resources/studentinfo/welfare/extensions.pdf](http://www.cs.bham.ac.uk/resources/studentinfo/welfare/extensions.pdf)) with supporting evidence where appropriate. For details see the appropriate section of the Student Handbook (<http://www.cs.bham.ac.uk/internal/students/handbook.html#mitigating>). It is always a good idea to discuss any such application with your mini-project supervisor, Personal Advisor and / or the Programme Director.

If no extension has been granted, or there is not sufficiently good cause for work being submitted late, then a penalty of 5% on the mark actually achieved will be imposed for each day the assignment is late until 0% is reached.

## Frequently asked questions about mini-projects

- Q1. *Must I write a program as part of my mini-project?*  
A. Not necessarily. Some students work on purely theoretical topics; some write fragments of programs to help them investigate their topic; some use the mini-project to prepare for writing a larger program in the summer project.
- Q2. *Can I have the same supervisor for both mini-projects?*  
A. Only under exceptional circumstances. Part of the idea of two separate mini-projects is to allow you to benefit from the differing expertise of two supervisors.
- Q3. *Can I study the same subject for both mini-projects?*  
A. No. This would effectively convert the mini-projects into one year long project. Again, part of the idea of the mini-project is to give you the experience of carrying through two separate mini-projects.
- Q4. *Who can supervise mini-projects?*  
A. A list of those available to supervise is given in this handbook. Essentially, it includes research active members of staff of the School of Computer Science, both teaching staff and suitably qualified research staff.
- Q5. *Do I have to choose both my mini-projects at the beginning of the first semester?*  
A. No. Some students have attempted to organize their year of study as early as possible and obtained informal agreement for their second mini-project at the beginning of the year. This is generally a bad idea for a number of reasons. For instance, your interests may change while studying first semester modules; you may be influenced in your choice of topic or supervisor by comments from your colleagues during the first semester, and you may well change your ideas about what you wish to achieve from the degree programme during the first semester.
- Q6. *May I choose both my mini-projects at the beginning of the first semester?*  
A. Yes, but you will not be asked to declare your second semester mini-project until the second semester. Thus, any agreement with a supervisor for a second semester mini-project remains a private agreement until the time comes to declare your second mini-project.
- Q7. *Are there any restrictions on mini-project topics?*  
A. Mini-project topics must be approved by the Programme Director as being appropriate to the Aims and Learning Outcomes of the programme. Students' individual programmes of study must be approved by the Programme Director (as the nominee of the Head of School), who will take into account topics students have previously studied at undergraduate level, ensuring that key subjects have been covered.

## Projects - Advanced MSc

Students who passed both First semester mini-project (06 07953) and Second semester mini-project (06 07954) are allowed to proceed to this project module. All other students please see the notes on “Project CompSci MSc” below.

A summer project is a medium-scale research project in some area of Computer Science or Artificial Intelligence. It can be the preliminary work necessary to carry out a larger research project or it can be a small, complete piece of research in its own right. In both cases, it must have the usual features of a research project such as: literature review, knowledge acquisition, critical analysis, etc. It should involve some or all of: hypothesis construction and testing, theoretical analysis experimental development, or any other technique or practice common in research projects.

### How to choose a summer project

The summer project for the MSc in Advanced Computer Science should be, in some way, a continuation of one or both of the student’s mini-projects. The choice of a project topic is therefore considerably easier than with most degree programmes.

If you have difficulty deciding which of your two mini-projects to convert into your summer project, there are some questions you may wish to consider:

- can you see a way in which a mini-project could be extended into a larger piece of work?
- are you interested in one particular topic more than the other and do you want to study it in even greater depth?
- do you want to continue to be supervised by a particular member of staff?
- do you think that extending a particular mini-project would give you an advantage in your career, for instance lead you into a particular area of employment or onto a PhD topic?

### What is the difference between a summer project and a mini-project?

The essential difference is *scope*. You have longer to complete the summer project, you have already developed a knowledge of the topic in a mini-project and practised your research skills in two mini-projects. Thus, you can aim to produce a substantial piece of work of publishable standard. Indeed, previous students have published the results of their projects. For these reasons the format of the summer project report is different from a mini-project report, i.e. it must be presented as a journal article.

That apart, all the skills needed to produce a mini-project must be used in working for a summer project. So, you will be expected to demonstrate your repertoire of skills and techniques in:

- the definition of aims, objectives and feasible working plans
- project management and time management skills
- systematic literature searching skills
- communication skills both in written reports and in verbal presentations to supervisors.

### Defining your summer project

As with your mini-projects, you need to negotiate a topic with your supervisor. You need to address the following points:

#### *Aim*

A project must have a clearly articulated aim or aims. Your aims should be devised in such a way that you and your examiners are able to evaluate, in broad terms at least, whether you have met your aims.

#### *Objectives*

Whatever your aim or aims, you should be able to define a number of things you will achieve on the way to completing your project. Objectives should be activities that have a beginning and an end; for instance writing a particular piece of program code, to review a set of papers, or to install and use a piece of software. It follows from the setting down of clear objectives that you have the basis of a plan of work for the project.

### *Project management skills*

As part of the supervision process, you will be expected to devise a management plan and evaluate your progress against that plan.

### *Systematic literature skills*

All projects should be firmly based on the review of previous work included in the corresponding mini-project. The amount of new literature searching required will vary from project to project. If the project is mainly a critical review, then there is likely to be a large degree of literature searching.

### *Communication skills*

A basic level of practice in these skills comes with the normal process of supervisory meetings and report writing. Students and supervisors are encouraged to consider making project work the basis of publications in the School's technical report series.

## **Writing-up your summer project**

The summer project report is to be written in the form of a journal article; specific guidance is given separately (see

[http://www.cs.bham.ac.uk/resources/programmes/postgraduate-taught/msc-acsc/msc\\_acs\\_nc\\_project\\_writing.pdf](http://www.cs.bham.ac.uk/resources/programmes/postgraduate-taught/msc-acsc/msc_acs_nc_project_writing.pdf))

You should also seek the advice of your supervisor.

Students are reminded that any form of plagiarism is taken extremely seriously and heavily penalised by the School. See page 5 for more information.

See also the School's online guidance notes on plagiarism, at:

<http://www.cs.bham.ac.uk/internal/students/handbook/current/#PLAG>

<http://www.cs.bham.ac.uk/internal/students/plagiarism.htm>

<http://www.cs.bham.ac.uk/internal/students/plag-policy.html>

## **Declaring your project**

You need to complete a project declaration form (see Appendix 2) and get the signature of your supervisor. This form should be completed by the date given in the important dates section of this booklet and posted in the appropriate assessed work pigeon hole.

The form is available to be printed/edited as follows:

[www.cs.bham.ac.uk/resources/programmes/postgraduate-taught/msc-acsc/project.pdf](http://www.cs.bham.ac.uk/resources/programmes/postgraduate-taught/msc-acsc/project.pdf)

[www.cs.bham.ac.uk/resources/programmes/postgraduate-taught/msc-acsc/project.doc](http://www.cs.bham.ac.uk/resources/programmes/postgraduate-taught/msc-acsc/project.doc)

## **Assessing your project**

Your summer project will be assessed by your supervisor and another member of the academic staff with expertise in the area of your project. In addition to a written report you will be required to prepare and present a poster (see *Important Dates* section). The poster presentations will normally be arranged to coincide with an event which will bring external visitors to the school and is an essential part of the assessment of your project. Students who do not turn up for their presentation will receive a fail mark, unless proper mitigating circumstances have been submitted and accepted.

Your project will be assessed in part on the inherent quality of your work and in part on the success you have had in meeting your aim and objectives, and displaying research skills of project management, analysis of related work and communication skills. The two assessors will mark your work independently. They will discuss your work and provide a rationale for an agreed mark. If they are unable to agree then a third assessor will be appointed. You can inspect the assessment form at:

[www.cs.bham.ac.uk/resources/programmes/postgraduate-taught/msc-acsc/project\\_assessment\\_form.pdf](http://www.cs.bham.ac.uk/resources/programmes/postgraduate-taught/msc-acsc/project_assessment_form.pdf)

## Late submissions

The submission deadline for the summer project is listed on page 1 of this handbook. Should you experience significant medical problems or personal problems, you may apply for an extension. Extensions can only be granted with authorization by a member of the Welfare Team, who will require a written submission by the student on a standard form ([www.cs.bham.ac.uk/resources/studentinfo/welfare/extensions.pdf](http://www.cs.bham.ac.uk/resources/studentinfo/welfare/extensions.pdf)) with supporting evidence, where appropriate. For details see the appropriate section of the Student Handbook :

<http://www.cs.bham.ac.uk/internal/students/handbook/current#mitigating>

It is always a good idea to discuss any such application with your mini-project supervisor, Academic Advisor and/or the Programme Director. If no extension has been granted, or there is not sufficiently good cause for work being submitted late, then a penalty of 5 marks will be imposed for each working day of lateness, until the final Cut-Off Date. No project will be accepted after this cut-off date, and a zero mark will be recorded.

## Frequently asked questions about projects

Q1. *Must I write a program as part of my summer project?*

A. Not necessarily. Some students work on purely theoretical topics; some write fragments of programs to help them investigate their topic; some take the opportunity to develop the skills necessary in writing a large program.

Q2. *Can I have a different supervisor than the one I had for my mini-projects?*

A. Only under exceptional circumstances, for instance when a supervisor has left the University during your studies.

Q3. *Can I study a completely new topic for my summer project?*

A. Only under exceptional circumstances. Essentially, to get to an adequate level in the project you would have to cover all the work needed for a mini-project and the project itself in the time allowed for the project alone.

Q4. *When do I have to choose my summer project?*

A. After you have completed the second mini-project.

Q5. *May I work on a project outside the School or University?*

A. It is possible to work outside the School (e.g. for a project within another School) or even outside the University (for instance with a company). You must have a supervisor within the School who has agreed your project plan. You should also consider Q3. above.

Q5. *Will the School find a project outside the School or University for me?*

A. No. However, sometimes opportunities arise through collaboration between staff and outside people and you may be lucky.

Q6. *Are there any restrictions on the project topic?*

A. Project topics must be approved by the Programme Director as being appropriate to the Aims and Learning Outcomes of the programme.

Students' individual programmes of study must be approved by the Programme Director (as the nominee of the Head of School), who will take into account topics students have previously studied at undergraduate level, ensuring that key subjects have been covered.

## **Projects MSc. In Computer Science**

Students who have not passed both the First Semester Mini-project (06 07953) and the Second Semester Mini-project (06 07954) may proceed to this project module (subject to programme regulations). The project will enable the student to demonstrate professional competence in a substantial software-related task and to apply material learned in other components of the degree programme. Projects are chosen from staff suggestions or are developed from the student's original idea.

For further information please refer to the web page:

[www.cs.bham.ac.uk/internal/modules/2011/18159.html](http://www.cs.bham.ac.uk/internal/modules/2011/18159.html)

## Research interests of academic and research staff and mini-project and summer project topics

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### **Dr Rami Bahsoon**

Room: 112

Email: R.Bahsoon@cs.bham.ac.uk

I am looking for motivated students to conduct novel and timely research in the area of Software Engineering. Areas which I am interested in includes but not limited to: Requirements Engineering (e.g. Goal-oriented requirements engineering; i\*); relating non-functional requirements to software architectures; Software Architectures (architectural evaluation and selection, empirical studies, architectural performance, quality of service (QoS) and evolution; Components-Based Architectures, Service-Oriented Architectures (SOA), Model-Driven Architectures (MDA), Architectural Knowledge, distributed and mobile software architectures, architectural-guided testing, dependability issues in distributed and mobile software systems architectures, architectural investment decisions; Software Product Line Architectures (SPLA); testing and regression testing of distributed and mobile software systems; Empirical Software Engineering (e.g. empirical comparison of software engineering methods, metrics, and techniques); Automated Software Engineering (e.g. tool support for software engineers); Search-Based Software Engineering; Economics-Driven Software Engineering (e.g. application of theories from economics to software engineering); mining software repositories; software maintenance and evolution; Global Software Engineering; Application of Dynamic Data Driven Simulation systems to Software Engineering etc.

Examples of possible investigations includes but not limited to:

- Review of recent selective regression testing techniques,
- Empirical comparison of selective regression techniques,
- Economics-driven regression testing,
- Systematic reviews of architectural evaluation methods,
- Automation of chosen architectural evaluation methods,
- Tool support for architectural investments and knowledge,
- Quantifying architectural decisions with respect to QoS,
- Using technology road-mapping to predict patterns of architectural changes,
- Case studies on architectural evolution (e.g. changes upon moving from fixed distributed to mobile environment),
- Mining software repositories,
- Documenting architectural knowledge,
- Testing and regression testing of context-aware mobile applications,
- Testing Software Product Line Architectures,
- Architectural Driven testing and regression testing,
- Search-based architectural selection,
- Applying real options theory to architectural selection,
- Applying Dynamic Data Driven Simulation systems to reason about architectural dependability,
- Tool support for architecting and designing in Global Software Engineering,
- Software Process and Global Software Engineering etc.

Please be free to contact me to discuss other topics of interest and their relevance to your course of study. Alternatively, I am always interested to hear your suggestions for novel and timely research in Software Engineering.

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### **Professor John Barnden**

Room: 136

Email: J.A.Barnden@cs.bham.ac.uk

I am interested in the following main topics within AI and natural language processing :

- processing of metaphorical and other figurative utterances, and especially the complex reasoning needed in such processing;
- extracting value judgments and information about emotions, moods, etc. from natural language input, possibly for the purposes of implementing intelligent conversational agents;

- reasoning about mental states (beliefs, desires, intentions, etc.), largely (but not exclusively) for the purposes of natural language processing;
- analogy-based reasoning and case-based reasoning;
- diagrammatic reasoning, whether it involves manipulation of external diagrams or processing of internal, mental visual images that have a diagrammatic quality.

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## **Dr Russell Beale**

Room: G37

Email: R.Beale@cs.bham.ac.uk

### **Affective interaction**

The role of emotion, affect and personality in interactive systems is becoming more understood, but its effective utilisation is not. This research will investigate what and how affect can be effective in enhancing human interaction with systems.

### **Social signal processing**

The combined use of multimodal processing (speech, video, interaction analysis, social network analysis) can lead to a more complete understanding of how individuals and groups are reacting and interacting. The student will work alongside experts in these domains to develop concepts and theories for such an approach that can be tested and evaluated.

### **Interaction with multitouch**

This research will investigate the relationship between the different styles and type of interaction afforded by multitouch devices and interactive surfaces, and can look at a variety of things; for example, the nature of the supported interactions, the forms of visualisations used, how to interact with 3d touchtables, the relationship between collaborative multitouch and engagement.

### **Context-aware interaction**

The use of intelligent sensing, mobile and ambient, can be used to create more effective interactive system, whether they be location-aware social networks, contextually relevant visualisations, or pattern recognition systems that could negotiate lower costs for your health insurance as they notice you go to the gym regularly. This research will investigate this work in more detail.

### **Health**

We are interested in a number of health-related areas, from the use of monitoring technologies for assisted living through to developing and evaluate approaches to supporting rehabilitation and post-trauma recovery in real-time 3D virtual settings (using games engine technologies).

### **Ambient displays**

Ambient displays present artistic, visualisation design, and appropriateness challenges: what should they be used for, and how? How do people understand and interpret them? The work will investigate this in more detail.

### **Psychological principles**

Many concepts in Psychology, although highly relevant to HCI are not prominent in their application and investigation. Concepts such as syntactic and semantic alignment, social identity, visual processing and working memory all impact on our experiences with technologies as interactions move from the individual to the social and from the mouse and keyboard to more gestural and spatial methods of interaction. A PhD in this area would explore one of these concepts and its relevance and impact into HCI research over a range of modalities.

### **HCI4D**

Interactive systems have great potential to support the developing world, especially those focussed on mobile technologies. We are interested in research that supports this.

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**Dr Behzad Bordbar**

Room: 116

Email: B.Bordbar@cs.bham.ac.uk

My main interests are in Cloud computing and Service oriented Architectures.

**Security in Cloud**

Breaking into a Cloud (private, commercial or G-cloud) can have a high payload due to the large amount of data available to be exploited. Conventional security methods, which are used to protect small systems, are dwarfed by the sheer size and complexity of the Cloud. This project builds on the current collaboration with the HP to develop methods of monitoring of Cloud to identify malicious behaviour.

***Fault tolerance in Service oriented Architecture (SoA)***

We are increasingly reliant on SoA in the applications used on daily basis in e-business, social networking, financial and telecommunications systems. The aim of this research is to develop methods of creation of fault Diagnosers: software modules that identify if a failure has occurred in real-time or near-real-time. Diagnosers are often compared to sensors used in embedded applications. In this project, which build on current collaboration with BT, we will study existing methods of creation of Diagnosers and investigate their extensions.

***Analysis of the Service Level Agreements (SLAs) in Cloud***

There is a wide range of Cloud providers in the market. To choose a Cloud, the clients often study the SLAs. This projects investigates methods of formal analysis of the SLAs to identify advantages and disadvantages of given Cloud.

***Study and modelling of famous attacks***

Major security attacks such as Stuxnet, Conficker and Service-level attacks are complex. Often a wide range of software components and social engineering must come together to launch such attacks. The aim of this research is to model (part of) such attacks to understand them better and using Tools to identify their variants and involving components.

Feel free to contact me if you are interested in a topic related to any other theme from my research page ([www.cs.bham.ac.uk/~bxb/Research.html](http://www.cs.bham.ac.uk/~bxb/Research.html)) or ([www.cs.bham.ac.uk/~bxb/Software.html](http://www.cs.bham.ac.uk/~bxb/Software.html)).

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**Dr Christopher Bowers**

Room: 233

Email: C.P.Bowers@cs.bham.ac.uk

I am willing to supervise projects in the following topic areas:

- Mobile platforms (Android/iPhone)
- Collaborative interfaces
- Applications of evolutionary computation
- Nature inspired creative design
- Mass customisation
- Energy analysis/Demand management

Although I prefer students to propose their own project, here are some examples of projects I would be happy to supervise:

***Presenting search results using archetypal perspectives***

Search results are most commonly presented in the form of a ranked list using some measure of relevance to the search terms. However, when we look through such results we often see distinct themes and areas of commonality. Projects in this area should utilise this underlying structure to present search results in a novel way. Projects may concentrate on the text analytic techniques required to automatically cluster results and may evaluate the potential impact on such an approach on how users search.

***Application of Computational Intelligence to Energy Consumption Data***

With the increased use of smart meters there is a wealth of energy consumption data available. Primarily this data is used to inform the user of current and past energy consumption. Are there other ways that this data can be put to good use? Examples might include the generation of thermal models, disaggregation of consumption for individual devices, fault detection etc.

### ***Constrained Evolutionary Design***

Evolutionary design can be used as a creative tool to generate new artwork, jewellery, bridges, homes etc. However, the application of evolutionary design is often hampered by physical constraints when applied to real world products and manufacturing processes. Projects in this area would investigate the impact of such constraints on an evolutionary design system. Examples might include cost, mass, weight and material restrictions or constraints due to the manufacturing process such as the limitations of a CNC cutting machine.

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### **Dr John Bullinaria**

Room: 113      Email: [J.A.Bullinaria@cs.bham.ac.uk](mailto:J.A.Bullinaria@cs.bham.ac.uk)

I am happy to supervise any projects in the general area of natural computation (neural networks, evolutionary computation, particle swarm optimization, and such like). Generally, projects in this area can be quite mathematical, and are usually only feasible if you have already taken, or are planning to take, a relevant course/module.

Students with specific or vague project ideas of their own in these areas are welcome to talk to me about them, or I can offer suggestions to students who only have a general interest in a particular area. Some specific project areas, in which I have particular interests, are outlined below. These potential projects are 'real research' projects, but contain a large programming component. There will be opportunities for good students to end up with work worthy of publication in a conference proceedings.

#### *Neural Network Applications*

Neural Networks can be applied to a wide range of classification and regression problems. If you have a particular application area in mind, it will make an interesting project to determine an appropriate neural network approach (e.g. Multi-Layer Perceptron, Radial Basis Function Network, Kohonen Network) and build a working system based on it. Alternatively, you could attempt to build models of particular human psychological/cognitive abilities.

#### *Evolution of Complex Structures*

Evolutionary computation has been used to design many types of structure, ranging from sculptures of artistic merit, high performance turbine blades, to efficient electronic circuit layouts. Projects in many application areas are possible. A particularly interesting challenge is to evolve systems that grow, and can repair themselves when damaged, in the manner of biological systems.

#### *Evolving Neural Networks*

A big advantage that human brains have over artificial neural networks is that they have emerged as a result of evolution by natural selection to be particularly good at what they do. Modern computers are now powerful enough to implement an evolutionary process for artificial neural networks to produce systems that are far superior to those formulated by human researchers. There is much scope for using this approach to optimize all types of artificial neural network systems, and to better understand the evolution of biological neural networks.

#### *Ensembles / Committee Machines*

Often, ensembles or committees of models (such as neural networks) can work better than individual models on certain types of problem. There is scope for building systems to explore when, why and how this works. This could involve developing new algorithms for old problems, or testing old algorithms on new problems, or both.

#### *Artificial Life*

The field of Artificial Life covers all aspects of creating computer systems that mimic biological lifeforms, from the evolution of intelligent agents, through to the simulation of social interactions. Surprisingly complex behaviours can emerge from very simple systems. A range of projects are possible in this area.

#### *Particle Swarm Optimization*

This is a form of search algorithm based on a population of 'particles' swarming through parameter space in the manner of a flock of birds. There are a number of general aspects of this approach that could usefully be explored by explicit computer simulation, or it could be applied to particular application areas.

#### *Time Series Prediction / Computer Aided Gambling*

Can machine learning techniques like neural networks and evolutionary computation be used to predict share

prices, currency exchange rates, and so on? Can they predict odds better than bookmakers for horse races, football matches, snooker tournaments, and so on? Could they produce efficient strategies for playing online poker? I'd be surprised if a student could develop a system that was able to consistently make money in this way, but I would be willing to supervise students with *sensible* ideas in this area. There is also plenty of scope for more general explorations in time series prediction which will not require you to have studied a particular application area, and for applications that do not constitute gambling.

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**Dr Tom Chothia**

Room: 111      Email: T.P.Chothia@cs.bham.ac.uk

I would be happy to supervise any kind of project based on computer security. Some possible ideas, ranging from the most mathematical to the most hacky include:

- Definitions of security based on information theory.
- Modelling and verifying systems using formal methods.
- Passive fingerprinting of remote computers and networks.
- Analysing what anonymous communication systems are used for.
- Hacking BitTorrent trackers.

If you would like to discuss doing a project in this area, please e-mail me or drop by my office.

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**Professor Ela Claridge**

Room: 138      Email: E.Claridge@cs.bham.ac.uk

My research area is image understanding and computer vision, especially in application to medicine and biology. The projects on offer are all related to current research and would be an ideal introduction for students wishing to pursue doctoral studies in medical image analysis. Most projects involve mathematics and the students choosing them will have to be prepared to master the necessary background and techniques - if needed I shall provide support and guidance.

*Shape and appearance models*

By applying the principal component analysis (PCA) to data describing the shape or appearance of an object, it is possible to create its abstract representation (a model). This model can then be used to determine whether an unknown object is a valid member of a given class. This analysis can be applied to any class of consistent shapes. Currently we investigate their use for classification of proteins in microscopy images.

*Medical image analysis applications*

We collaborate with clinicians in a number of medical imaging areas, including x-ray mammography, MRI, skin cancer, eye diseases etc. Project work will contribute to the ongoing research of our group in these areas. Further information on current projects can be found at:

<http://www.cs.bham.ac.uk/~exc/Research/research.html>.

These projects will best suit students familiar with image analysis / computer vision techniques. Some examples are listed below.

*Tracking the movement of blood cells from video recordings*

Using high quality video camera and a microscope, bioscientists record the movement of the blood cells in the vein. Slowly moving cells may stick to the vein surface and eventually form a clot, which could be a health risk. It is therefore important to be able to track the individual cells, assess their speed, and establish whether there are any slow moving cells.

This project will involve image processing and analysis to detect all the cells in each video frame, and then to track each cell from frame to frame. From the change of the position in the frame and the speed of the recording the speed of the movement can then be computed.

*Assessing the fruit and plant health using multispectral imaging*

Familiar digital colour images represent colours using three broad bands: red, green and blue. This representation looks quite adequate to the human eye, but it does not always capture the subtle colouration of the real world objects. Multispectral images represent colours in up to hundreds of spectral bands and may record colour variations which are not detectable in standard digital images. This project will investigate the

use of multispectral imaging for the assessment of the health of fruits and plants, for example to detect early that they are dehydrated, malnourished or damaged.

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**Dr Ben Cowan**

Room: 223

Email: [B.R.Cowan@cs.bham.ac.uk](mailto:B.R.Cowan@cs.bham.ac.uk)

I am based in the Human Computer Interaction Research Centre and am therefore fundamentally interested in how humans interact with technology. I am interested in how psychological processes influence technology use and how technologies can influence behaviours, emotions and attitudes.

I am willing to supervise projects in the following subjects:

- How design influences anxiety towards computer interactions
- The effect of wiki site design on content quality and anxiety towards editing
- How to design effective social touchable interactions.
- The measurement and assessment of User Experience (UX) with technology
- Design of behaviour change technologies
- Working memory processes in human computer interaction
- Social system use and the effect of group dynamics on user behaviour and emotion
- The impact of open and closed social systems on user behaviour

I have two particular projects ongoing and described in more detail below:

***Syntactic alignment in human-computer dialogue interaction***

Alignment is a dynamic process reflecting the fact that when we speak to others they influence how we speak to others in terms of the words and grammar we use. Alignment is also seen as integral in successful communication. Recent interest in this area has shifted from observing this alignment effect within human dyads (conversational pairs) towards the influence and existence of alignment during human computer interactions. The HCI work in this area has shown that users tend to align more in computer interaction than in human interaction and that system presentation, functionality and interaction expectations affect the way that people align in human computer dialogue. Students would be expected to design and conduct an experiment looking into how the system impacts on such alignment processes.

***Social identity influences on social system online behaviour***

Although the social use of the Internet and the use of the crowd to source information are now commonplace very little is known about how traditional social psychological concepts impact or operate on these systems. This project would look to measure and assess the impact of how group processes such as in-group favouritism and group belongingness affect how people share information online and how they feel about sharing information with other groups of users.

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**Dr Hamid Dehgani**

Room: UG38

Email: [H.Deoghani@cs.bham.ac.uk](mailto:H.Deoghani@cs.bham.ac.uk)

I am interested in the application of physics based models for the study of human physiology and the application of image reconstruction algorithms in medical imaging. Specifically, I will be happy to supervise projects that are concerned with medical image formation, visualisation as well as novel computational frameworks in medical computation. Below is a list of possible projects that I am willing to supervise. If none of these project appeals to you, but you have an idea that you think may coincide with my interests, then come and see me - I'm always happy to consider student's own suggestions.

*3D model creation and visualisation:*

In medical imaging, we create a large number of reconstructed images, based on complex models of human anatomy and physiology. Most 3D visualisation toolboxes are complex and/or not free. I am interested in creating 3D visualisation tools that will take as input models and images created by our software ([www.nirfast.org](http://www.nirfast.org)) and creating a free, platform dependant add-ons that will allow easy, fast and robust visualisation and analysis.

*Cloud computing*

We have developed a set of models and image reconstruction algorithms for optical imaging, which can be used in MATLAB. One of the new directions is to create a toolbox of these algorithms that can be utilised under cloud computing to enable fast computational speed. This project will be to evaluate the possible options of creating a set of tools for our software to allow the user to run models and simulations under cloud computing.

*Parallel/GPU based matrix solvers in MATLAB:*

MATLAB is a user friendly software that allows fast prototyping of various algorithms and tools. However, it is not sophisticated enough to determine which type of solvers are best suited for various matrix algebra, under different platforms. This project will be focused on creating a set of rules that will allow MATLAB to determine the best matrix solvers, based on platform under which is being run as well as matrix size and property, to help novice users. Additionally, we will be interested in creating parallel and GPU based matrix solvers.

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**Dr Juhan Ernits**

Room: 232

Email: [J.Ernits@cs.bham.ac.uk](mailto:J.Ernits@cs.bham.ac.uk)

{semester 1 only}

I am interested in a range of problems, from fault diagnosis to model-based testing and software/hardware verification. Most of the projects involve experimentation which requires programming, mostly in C# or Java but in cases also in Matlab or C++. If you are interested in a related topic which is not listed below, do not hesitate to contact me.

*Model-based fault diagnosis of hybrid systems*

Hybrid systems are systems featuring continuous behaviour, e.g. controlling the speed of a robot, and mode switches, e.g. turning some actuator on or off. The goal of the project is to research the benefits of applying SAT modulo theory solvers for diagnosing such systems. Experiments can be performed on DXC2010 domains.

*Stochastic fault diagnosis in mobile robots with particle filters*

Build a particle filter based diagnosis system that can detect if a differential drive robot has fallen over, i.e. if one of its wheels is in the air. Ideally add an actuator that can remedy the situation.

*A unified Java API for using satisfiability modulo theory solvers*

Satisfiability modulo theory solvers (SMT solvers) are tools that can be used for wide range of purposes, from software analysis to consistency-based fault diagnosis. They differ from SAT solvers in that they have additional theories built in that enable direct representation of, e.g. linear arithmetic and pointer logic. The goal of this project is to have look at solvers, e.g. Yices, CVC3, Z3, and build a unified Java API that makes it possible to choose the actual solver at run time.

*Model-based testing of robots*

The aim of the project would be to formalise the requirements of the behaviour of a robot in NModel and use this formalisation for automatically generating stimuli to the robot and validating the steps the robot takes.

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**Dr Dan Ghica**

Room: G35

Email: D.R.Ghica@cs.bham.ac.uk

My research interests are in programming languages. I am interested in implementing (or re-implementing, or tweaking) algorithms that are (or can be) used in tools for program analysis and verification. I am also interested in using such tools in analysing or verifying realistic code, such as Linux device-drivers or kernel components. Another line of research is programming for hardware. A typical student project would be the development of a simple application (e.g. a game or a simple protocol) to run on a field-programmable gate array.

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**Dr Peter Hancox**

Room: 240

Email: P.J.Hancox@bham.ac.uk

I am interested in concurrent programming using constraints, particularly using the language Constraint Handling Rules (CHR). The following are starting points for project work.

*Java/CHR re-implementation of a Prolog/CHR meta-interpreter*

Meta-interpreters are compilers for a programming language written in that language itself. The point is that it allows changes in the behaviour of the programming language. There is a meta-interpreter for CHR that makes its concurrency more explicit by modelling an array of processors and scheduling processes to this array. It is written using the version of CHR that comes with SICStus and SWI Prolog. A re-implementation using the version of CHR developed for use with Java would give insights into implementing concurrency.

*Development of the Prolog/CHR meta-interpreter*

The meta-interpreter described above could be developed further in several ways. The model of the array of processors could be replaced (and extended) by using the Linda package bundled with SICStus Prolog. Alternatively, the scheduling model could be experimentally refined to allow exploration of the effects of differing scheduling algorithms.

*Parser-implementation using the CHR meta-interpreter*

There are many well-known parsing algorithms, many based around chart parsing. Some of these have been implemented in CHR; some await implementation.

Prolog/CHR and the CHR meta-interpreter run the same programs but their differing models of concurrency can produce different results. (For instance, the unordered merging of two lists always gives the output list in the same order in Prolog/CHR but the CHR meta-interpreter simulates processor load and so typically gives output lists of varying orders at different times.) Application-based projects could look at the differences in parsing caused by differing models of concurrency.

*Implementing Flat Concurrent Prolog in CHR*

There has been much work on implementations of concurrent Prolog. Flat Concurrent Prolog (FCP) is a family of concurrent Prolog languages that allows the exploration of some of the problems of concurrent programming. A compiler for the simplest version of FCP exists for the SICStus and SWI CHR implementations. Project work could either look at transferring this implementation to Java/CHR and/or explore adding extra functionality such as atomicity.

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**Dr Nick Hawes**

Room: 133

Email: n.a.hawes@cs.bham.ac.uk

I am happy to supervise projects in the fields of AI, robotics (we have access to a couple of robot platforms that you could use) and the simulation of behaviour. In general I prefer projects which are biased towards exploring problems through implementation and engineering (i.e. making things work) rather than working with formal descriptions. I am most likely to be interested in projects which either develop autonomous intelligent systems (robots, game or virtual world characters, desktop assistants, web crawlers, software agents), or apply AI

techniques to everyday situations (such as interfaces for phones and computers, productivity software, smart home devices, health care, security etc.). In addition to these I would be interested in supervising projects which use, or make major contributions to, existing toolkits for AI and robotics (e.g. our own CAST toolkit, Player/Stage, OpenCV, MS Robotics Studio, URBI, etc.). Some additional example project types/fields:

#### *Memory*

I am currently developing a interest in the role of memory in cognitive systems, and would like to supervise projects that develop implementations of memory models (short-term, long-term, episodic etc.) in an intelligent system.

#### *Modelling biological behaviours*

Implement a model of an aspect of animal behaviour or intelligence, such as flocking, path integration, hunting, or learning; a simulated animal (a crow, octopus, spider, crab); or some human kind of human behaviour (problem solving or learnt behaviour) using a model hypothesised by biologists or psychologists.

#### *Linking motivation, planning and execution*

Investigate ways that an autonomous system can generate their own goals then produce behaviour to satisfy them using deliberative or reactive planning approaches.

#### *Multi-modal or intelligent systems for your daily life*

Build a conversational or gesture interface to existing software or hardware. This could be a mobile phone, music player, linux command line, file manager, washing machine, toaster or your entire house. Create a robot for the home which could monitor an elderly person and call for help in case of emergencies.

#### *Cognitive Architectures*

Pick an existing, implemented model of human cognition (ACT-R, ICARUS, Soar etc.) and solve a problem with it. Or implement your interpretation of the work of your favourite cognitive scientist or philosopher (Andy Clark, Daniel Dennett, Michael Tomasello, Thomas Metzinger). You could even do this on one of our robots.

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### **Dr Shan He**

Room: 244

Email: S.He@cs.bham.ac.uk

I am happy to supervise MSc projects in the multidisciplinary areas of computational intelligence and computational systems biology. I am keen on working closely with motivated MSc students on the following projects:

#### *Subgroup discovery and its application to biomedical data analysis*

Subgroup discovery is a data mining technique that discovers characteristics of subgroups with respect to a specific property of interest. Its aim is to discover simple explicit symbolic rules that are meaningful to human users. In this project, we aim to develop a novel subgroup discovery algorithm based on evolutionary computation and ensemble learning techniques. The new algorithm will be applied to mass spectrometry proteomics and metabolomics data to discover interesting and biologically meaningful patterns that can be used for cancer diagnosis.

#### *Closed-loop evolutionary multi-objective optimisation for systems biology*

Recently, closed-loop evolutionary multi-objective optimisation algorithms have been applied to many areas of science such as evolutionary robotics, microbiology and biochemistry. This project will focus on the development of a closed-loop optimisation system for the automated control (and optimisation) of a mass spectrometer for measuring important biochemicals. This research is a very important component of the University of Birmingham's new £1m Systems Science for Health initiative. This project is challenging but offers a unique and exciting opportunity to get first-hand knowledge of a real-world application of computational intelligence to systems biology. This project will be co-supervised by Professor Mark Viant in the School of Biosciences and Ralf Weber in the Centre for Systems Biology.

#### *Development of a XML database system for systems biology*

In order to store large amounts of experimental data from systems biology experiments and subsequently to share them among the research community, it is necessary to build a database based on an open

source and standardised data format. This project provides an exciting opportunity to tackle this urgent need by developing a database system based on open source standardised data format XML and native XML database. This XML database system, once developed, will be used in the Centre for Systems Biology and by researchers involved with the University of Birmingham's new £1m Systems Science for Health initiative to store experimental data from "metabolomics" experiments. The knowledge and practical experience gained from this project would be valuable for the student's future career in IT and bioinformatics. This project will be co-supervised by Professor Mark Viant in the School of Biosciences and Ralf Weber in the Centre for Systems Biology. Due to the scale of this project it is open to TWO MSc students who will work together to develop different aspects of the database.

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**Bob Hendley**

Room: 236

Email: R.J.Hendley@cs.bham.ac.uk

My main interest is in intelligent and novel interactions between people and systems and how these can be made more intelligent, productive and natural. There are some underlying technologies on which I am working, such as:

- Visualization (e.g. of the web, phone calls etc)
- User modelling, system adaptation
- Agent systems and emergent behaviour

These techniques can be applied to many different areas, including Information browsing (WWW, document repositories ...), Knowledge discovery, Education and Learning and Creativity and Art

I've listed some ideas below but there are many more. These are open-ended projects.

1. GWAP (Games With A Purpose). The aim here is to turn the annotation task into a game that will challenge the annotator to more deeply explore the space of annotations so that they properly discriminate between competing descriptions (whereas they presently will come up with descriptions that are routine). It will involve building a web-based multi-user game framework and implementing a series of alternative approaches.
2. Challenging users. The aim here is similar to the previous project but with an intelligent agent that will reason over the annotation space to devise questions or tasks for the user that will force them to consider aspects that they had previously overlooked.
3. Extracting 'mood' from articles. Although most annotation systems focus on concrete information it is apparent that searches by journalists are often more likely to focus upon subjective information (I need a clip that includes wind farms with a dark or negative aspect). This project will focus upon the extraction of these more subjective features from video or text.
4. Annotation by analogy. Rather than annotate from scratch, how can we re-use information that is already available in similar or dissimilar articles? E.g. This article is very like this one in this area but unlike this one or this class. How can we enable the user to explain these relationships?
5. Visualisation of articles. Here we are interested in allowing a user to use a visualisation of the annotations. This may be during searching or within the annotation process. It is likely that that this will use a force based clustering model or an 'organix' like model based on our earlier work

Mini-projects that I supervise will probably include the application of one of these technologies into one of the application areas in which we are working. I would expect the projects to include a wide ranging survey of the state of the art, the development of a proposal to carry this forward and a prototype to demonstrate the feasibility of some of these ideas.

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**Professor Andrew Howes**

Room: 135

Email: A.howes@cs.bham.ac.uk

I am interested in Human-Computer Interaction and Cognitive Science. I enjoy supervising projects that investigate a wide range of questions (examples below) but I am flexible and like to start a supervision with a discussion of topics that are of mutual interest.

I currently collaborate with NASA and the Federal Aviation Administration (FAA). There are opportunities to collaborate on relevant projects.

Potential projects:

1. How to design consumer feedback mechanisms for e-commerce, e.g. eBay and Amazon?
2. How to design new equipment for high pressure environments such as cockpits?
3. How to design social network sites so that they respect the boundaries imposed by different social spheres (e.g. family, work, and friends)?
4. How to design for an internet in which personal information can be persistent, which can have both positive and negative consequences?

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**Professor Achim Jung**

Room: 213                      Email: A.Jung@cs.bham.ac.uk

I work in Theoretical Computer Science and my research interests are in Topology in Computer Science, Semantics of Programming Languages, Lambda Calculus. If you are mathematically minded and you are thinking about continuing your education with a PhD then I would be happy to offer a miniproject in a suitable area.

I am also very interested in Computing Education, and have over the years supervised a number of projects in this area, from Visualisation to Curriculum Design. If you are thinking about pursuing a career in teaching (either at school or at university level) then we can together work out a suitable and relevant project.

My research interests include Statistical Machine Learning and Natural Computation. Project suggestions:

#### *Algorithms for approximate volume computation*

Computing the volume of a  $d$ -dimensional body in polynomial time plays a fundamental role in, e.g. Bayesian inference, machine learning, econometrics and physics. Nature-inspired search algorithms have been very successful for finding the modes of a function, however they don't directly apply to computing the volume defined by the function. This project will seek to investigate whether (and how) mode searching can help volume computations. Existing hybrid MCMC techniques and population-MCMC may be reviewed as a starting point.

#### *Multi-task learning*

Most of the existing learning algorithms aim to learn from examples to perform one single task. However, one often needs to learn to perform several different tasks that might have something in common. How can we exploit similarities between tasks to increase the efficiency of learning? This project will investigate this question by a literature review and/or implementation of ideas.

#### *Distances in high dimensions*

In high dimensional spaces, the Euclidean distance suffers from a counter-intuitive phenomenon called 'concentration': As the dimension increases, the distances between any two points may become too similar. In consequence, distance-based methods (e.g.,  $k$ -means,  $k$ -nn) run into problems, often referred to as the 'curse of dimensionality'. This project will study the concentration effect in both classical and novel distance or dissimilarity definitions, in order to identify which are the ones better suited for high dimensional problems. Rank order distances could be a possible candidate.

#### *Dimension reduction by random projections*

The Johnson-Lindenstrauss lemma implies that a linear random mapping of high dimensional data on a much lower dimensional Euclidean space preserves much of the geometric structure of the data with high probability. It has been hence intriguing to exploit this as a cheap dimensionality reduction method for machine learning. However, the guarantees are probabilistic hence the quality of results is variable. This project aims to find ways to improve stability by appropriately taking account of the probabilistic nature of theoretic guarantees. Strategies to combine or select from several random projections may be investigated.

#### *Breakdown points in sparse learning machines*

In the new area called 'compressive sensing', there are precise results regarding the data characteristics that allow for exact reconstruction of sparse signals from their compressed versions. These are characterised by a phase-transition, beyond of which the reconstruction breaks down. There are reasons to believe that a similar behaviour is exhibited by sparse learning machines in terms of their generalisation performance. This project will verify this experimentally.

#### *Generative-discriminative tradeoff models*

In machine learning, generative models estimate the joint density of inputs and targets  $p(x,y)$ , from which they then obtain the predictive distribution  $p(y|x)$  by Bayes rule. By contrast, discriminative models approximate the predictive distribution  $p(y|x)$  directly. The debate as to which of these methodologies is preferable is a long standing one. This project is to look at a new modelling scheme that interpolates smoothly between these two model types. There are many opportunities for experimental or/ and theoretical work to determine the optimal tradeoff against varying data dimensionality and the sample size.

#### *Rotational invariance of learning methods*

A learning method is said to be rotationally invariant if upon an arbitrary rotation of the data (training set and test point) it produces the same result as on the original data. It has been shown that certain learning methods that are rotationally invariant exhibit a suboptimal worst-case sample complexity (i.e. they may require a lot of training examples). This project is to empirically assess to what extent is this a problem in practice.

You may also find ideas that could possibly be up-or-down-sized for an MSc (mini)-project on my publications page: <http://www.cs.bham.ac.uk/axk/papers.htm> or on the Machine Learning module's page: [http://www.cs.bham.ac.uk/axk/ML\\_new.htm](http://www.cs.bham.ac.uk/axk/ML_new.htm)

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**Dr Mark Lee**

Room: 110

Email: [M.G.Lee@cs.bham.ac.uk](mailto:M.G.Lee@cs.bham.ac.uk)

I am happy to supervise any project involving Natural Language Processing or Information Retrieval techniques. The following are a few concrete projects I have in mind but I am open to other ideas.

#### *Word Sense Disambiguation*

According to any dictionary, most words have more than one sense. For example, “bank” can refer to either a river bank or a money bank. Such ambiguity is not consistent across languages and so words must be tagged with their appropriate senses prior to Machine Translation. This project would involve implementing and testing various techniques for tagging words with dictionary definitions.

#### *Un-supervised Language Identification*

Given the following strings  
e pruebas bioquimica  
man immunodeficiency  
fairs se sont produi

It is hardly surprising that a person can identify the languages as Spanish, English, and French respectively. It isn't even surprising that somebody with essentially no knowledge of Spanish or French can distinguish between the two languages. However, what is interesting is whether a computer programme without using any hand-coded linguistic knowledge could be trained to do the same task using statistical methods.

#### *Language Detection*

Given a data sequence, how could we distinguish whether it was a natural language from random data or some mathematical series? Clearly there are features universal to all natural languages which do not necessarily occur in non-language data and it has been suggested that these could be used to distinguish natural languages from other types of data. However, this is not a trivial task. For example, there is wide debate about whether the Voynich manuscript is a secret natural language, a code or just random characters. This project would involve comparing an electronic transcription of the Voynich manuscript with other corpora using computational linguistic techniques.

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**Dr Peter Lewis**

Room: 244

Email: [P.R.Lewis@cs.bham.ac.uk](mailto:P.R.Lewis@cs.bham.ac.uk)

I am available to supervise projects and mini-projects in a range of areas related to natural computation and economics and social inspired computation.

You are welcome to come to me to discuss your own ideas. Alternatively, here are some of mine:

#### *Learning marketing or trading strategies for electronic marketplaces.*

The Internet is increasingly being populated by electronic markets, some based on human interaction (e.g. ebay) and others which are totally automated. In this project, a chosen auction mechanism would be implemented and computational intelligence techniques used to develop trading strategies which can maximise profit.

This could either involve the implementation of an auction and the trading strategies, or else build on previously existing code. In either case, the project should focus on comparing the strengths and weaknesses of the approaches taken and / or strategies developed.

#### *Multi-objective optimisation of strategies for self-aware computing systems.*

Self-aware computing systems self-adapt at runtime to changing environmental conditions and preferences over conflicting high level goals. As part of this, it is important to identify libraries of strategies which provide a range of efficient outcomes in terms of optimising this trade-off. This project would use multi-objective optimisation techniques to identify a non-dominated set of strategies in the context of a self-aware computing case study.

*Agent-based social modelling.*

Multi-agent systems are often used for modelling complex systems of interacting individuals, who make local decisions according to defined rules. Previous work has shown how this may be used to generate and explain globally observable behavioural patterns, such as social segregation, resource sharing, crowd movements and other social and economic phenomena. In a project of this type, a particular phenomenon would be investigated experimentally with the aim of developing insight into how to bring about or suppress certain global behaviours.

*Application of computational intelligence techniques to playing computer games.*

Computer games, which are often noisy and unpredictable provide an interesting test-bed for nature-inspired learning techniques. A number of games are typically used for this, including TORCS (car racing simulator), Ms Pacman and Unreal Tournament. The project would focus on writing software to interact with defined APIs for the chosen game and then learning high performing game-playing strategies using (e.g.) evolutionary computation or neural networks. Strong programming skills are essential for this project and the language to be used may be determined by the game to be studied.

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**Dr Paul Levy**

Room: 216

Email: P.B.Levy@cs.bham.ac.uk

My interests are in logic and semantics of programming languages.

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**Dr Mirco Musolesi**

Room: 138

Email: m.musolesi@cs.bham.ac.uk

The aim of my research work is to explore the design of efficient and intelligent systems that rely on novel theoretical models and algorithms, working at the interface of different areas - including computer networking, mobile systems, social computing, distributed systems, machine learning, data mining, mathematical modelling and complex networks.

More specifically, one of the main goals of my research work is to devise models as basis for the practical design and implementation of systems (in particular, mobile and social computing systems) that 1) are able to exploit the availability of the exponentially increasing amount of multi-dimensional information about users and their environment (such as location, personal profiles, social network data and so on) and 2) are based on the analysis and characterisation of the structure of the underlying networks (social, technological, etc.) and the dynamics of the processes happening over them, such as data and information exchange.

The scope of my research interests is fairly broad and rather interdisciplinary. A non-exhaustive list of topics I am working on (or I have been working on) includes:

- Social and ubiquitous computing
- Network science
- Network data mining and analytics, with a focus on data sources related to social networks, mobile networks and sensing systems
- Design, implementation and performance evaluation of mobile systems
- Sensing systems based on mobile phones
- Machine learning applied to mobile, sensing and socially-aware systems design
- Human mobility and connectivity models
- Algorithms and protocols for wireless, mobile, and sensor networks
- Delay Tolerant Networking (DTN)

I am happy to supervise projects in any of the areas listed above. The projects usually involve the application of mathematical/statistical models.

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**Prof. Uday Reddy**

Room: 210

Email: U.S.Reddy@cs.bham.ac.uk

My research interests are in tools and techniques for program analysis and program verification, which are

applicable to large and long-lived software systems. For this year, I am offering the following topics for mini-projects. Some background in programming language principles and functional programming are necessary to work on them:

#### *Effect systems*

In large software systems, it seems crucial to ensure that certain parts of programs do not have certain kinds of effects, such as changing crucial program variables or throwing undesired exceptions etc. Effect systems, invented by Gifford and Lucassen at MIT several years ago, present one way to deal with such issues. This project involves exploring the application of effect systems to ensure the desired properties about the effects of program parts.

#### *Separation Logic*

Separation Logic is a novel logic devised by John Reynolds, Peter O'Hearn and colleagues in 2000. It has enjoyed a tremendous success in a short span of time as a tool for verifying programs as well as for program analysis dealing with dynamic data structures. Projects in this area include (i) implementing analysers or provers for small parts of Separation Logic and (ii) proving the correctness of challenging algorithms using Separation Logic techniques. A specific implementation project here is to implement a verification system devised by John Reynolds and me this year for Concurrent Separation Logic based on Syntactic Control of Interference.

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#### **Dr Eike Ritter**

Room: 209

Email: [E.Ritter@cs.bham.ac.uk](mailto:E.Ritter@cs.bham.ac.uk)

#### *Automatic Program Verification*

I have developed and implemented new logics for program verification which makes it easier to construct the verification of large programs from the verification of its smaller components. I already have a preliminary implementation of this logic. Although the logic has been developed, a good way of annotating programs and verifying them automatically is missing. The mini-projects and projects would develop ways of doing this.

#### *Security*

I am happy to supervise projects in this area. Possible topics are intrusion detection (to detect irregular patterns of behaviour), protocol verification (is the given protocol safe against attacks) and verification of kernel code (illegal pointers, violation of semaphore conditions etc.)

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#### **Dr Mark Ryan**

Room: 237

Email: [M.D.Ryan@cs.bham.ac.uk](mailto:M.D.Ryan@cs.bham.ac.uk)

I am willing to supervise ambitious students interested in computer security, especially cloud-computing security, and cryptography

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#### **Alan Sexton**

Room: 239

Email: [A.P.Sexton@cs.bham.ac.uk](mailto:A.P.Sexton@cs.bham.ac.uk)

My research interest is in various forms of document image analysis, i.e. the analysis, recognition and understanding of documents from their images. This includes optical character recognition but also much more.

Documents to be analysed may be in bitmap image form or in a "born digital" form such as PDF or Postscript. They may come from printed documents, handwritten manuscripts, photographs of whiteboards or street signs or from online interactive sources such as tablet or pad computers or digital whiteboards. Each option provides different research problems.

The documents themselves may be historical (e.g. some 10th century manuscripts) or recent. Particular research problems involve recognising tables, mathematical formulae, diagrams or particular graphical notations such as music scores, electronic diagrams, Entity Relationship diagrams, UML diagrams etc.

The output of such document analysis systems is also a matter of research. For non-sighted users, rendering the documents recognised into speech using text to speech software is one target, although research on how to read out diagrams and mathematical formulae is very much still ongoing.

There are many specific areas of research: from low level image analysis algorithms such as noise reduction, binarization, de-warping and segmentation, to various pattern recognition and clustering problems, medium level tools such as word-spotting, and text line extraction, to higher level issues such as the design of tool sets to be used by non-computer scientist experts (such as historians and social scientists) who have a great interest in and knowledge about certain kinds of documents but not the computer science knowledge to understand and use complex image analysis tools properly.

This is a wide and active area which provides scope for a very broad range of research skills and interests.

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**Dr Volker Sorge**

Room: 207

Email: [V.Sorge@cs.bham.ac.uk](mailto:V.Sorge@cs.bham.ac.uk)

I am mainly interested in topics that are connected to various aspects of mathematics on computers. In particular I offer research oriented projects in the following areas:

*Automated Reasoning*

Automated Reasoning deals primarily with the formulation of mathematical problems in a logic formalisms and their solutions using automatic and interactive theorem proving techniques. Some background in logic as well as an interest in Mathematics is required for projects in this area.

*Computer Algebra*

Computer Algebra systems are powerful engines for the manipulation of symbolic mathematical expression. Projects I offer in this area are primarily concerned with representation issues and symbolic computation techniques for intuitive mathematical concepts. A project in this area will include working with mainstream computer algebra systems like Maple.

*Scientific Document Analysis*

Document analysis and optical character recognition for mathematical and scientific texts is genuinely different from standard text recognition due to the artefacts contained in scientific documents, such as formulas, diagrams, tables, etc. Projects in this area can range from low-level image analysis techniques (e.g., noise reduction, de-skewing) to high-level recognition approaches using grammars and semantic knowledge. The preferred programming language for these projects is OCAML, which will give you the opportunity to become familiar with a new and efficient functional programming language.

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**Rustam Stolkin**

Room: 232

Email: [R.Stolkin@cs.bham.ac.uk](mailto:R.Stolkin@cs.bham.ac.uk)

*Robotic vision for automatic target tracking*

I am looking for one or more students to work on a computer vision/robotics project from October for up to a year.

The project will involve computer vision based target tracking with a pan-tilt camera turret, with applications to smart surveillance and also guidance/navigation and short range weapons targeting for camera turrets mounted on a military robot.

Example videos from previous related work can be seen at:

<http://www.math.stevens.edu/~ifloresc/ABCshift.htm>

and also:

<http://www.stevens.edu/ses/ceoe/People/Stolkin/BoatTracking.html>

I need students who are:

- reasonably competent C++ hackers
- modestly numerate – some mathematical inclinations may be a help
- enthusiastic and willing to put in time on a rewarding project

Previous related projects have led to students publishing papers at top robotics conferences and co-authoring patent applications. It is hoped that this work could lead to a publication for the student.

### **Dr Iain Styles**

Room: 109

Email: I.B.Styles@cs.bham.ac.uk

My research interests lie in the field of medical image analysis and I am happy to supervise projects that relate to my work in this area. I also have some ideas for projects unrelated to my research which I would be happy to supervise. In order to help guide your choice, I have given each project ratings on a scale of 1 (very demanding) to 5 in three areas: programming skill (P); mathematical content (M) and creativity (C).

If none of these projects appeals to you, but you have an idea that you think may coincide with my interests, then come and see me - I'm always happy to consider student's own suggestions.

#### *Monte Carlo Simulation on GPUs*

Monte Carlo is a popular technique used for simulating the propagation of light within biological tissues. Unfortunately it is rather slow, but can be readily parallelised. In this project you will need to learn about the architecture of GPUs, and understand the Monte Carlo algorithm in sufficient detail to be able to reimplement it to take advantage of the parallel pipelines available in the GPU. Previous attempts indicate that this project is decidedly non-trivial! A successful implementation would be a substantial contribution to our work in this area. (P:2 M:3 C:3)

#### *Monte Carlo simulation in spherical geometries*

The most widely using form of the Monte Carlo light propagation algorithm assumes a flat slab-like geometry. In this project, \* you will re-implement the algorithm for a spherical geometry. This project has a direct connection with our work on retinal imaging, where the geometry is spherical. (P:2 M:2 C:3)

#### *Nature-inspired Image Analysis Techniques*

The ability to successfully identify features in images is very important - in medical images, the correct identification of important features can be an important stage of the diagnostic process. In this project you will investigate the use of nature-inspired techniques for identifying image features. (P:3 M:2 C:2)

#### *Retinal Image Visualiser*

Retinal images are usually displayed a simple two-dimensional image. In reality, of course, the eye is a three-dimensional object. In this project, you will develop software for displaying retinal images in a realistic geometry. (P:2 M:3 C:3)

### **Dr Hayo Thielecke**

Room: 208

Email: H.Thielecke@cs.bham.ac.uk

I am willing to supervise MSc in Advanced Computer Science projects and mini-projects in the areas of programming languages or software security. My project topic suggestions are mainly aimed at the MSc in Computer Security, but some of them are suitable for Advanced CS (mini-)projects, particularly the more theoretical ones. Some project topics require the Secure Programming module as a pre/co-requisite. [You might also look at <http://www.cs.bham.ac.uk/~hxt/advanced-computer-science.html> in case the suggestions below have been updated.]

#### *Regular expression matching and parsing*

Regular expressions (and their extensions) are everywhere, yet their implementation in Java is not anywhere as efficient as it could be. Projects in this area will leverage the large number of cores on a GPU (Graphics Processor) to match regular expressions in parallel. These techniques may also be extensible to parsing, such as XML parsing.

#### *Security of Javascript*

Javascript is widely used in web browsers, making users vulnerable to attacks from malicious mobile code. Various technologies are under development to defend against such attacks, in particular Google Caja and Microsoft web sandbox. Projects in this area could be case studies or critical evaluations of these defences, specifically in comparison to the Java security architecture.

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**Dr Peter Tiño**

Room: G33

Email: [P.Tino@cs.bham.ac.uk](mailto:P.Tino@cs.bham.ac.uk)

*[Note Peter Tino is only available in the second semester]*

In general, I am interested in machine learning, cognitive science and evolutionary computing. I have experience with practical and theoretical aspects of processing data with strong temporal component (well-formed sentences of a natural language, DNA or protein sequences, financial time series such as closing daily values of a financial index, inflation rates etc.). I am also interested in data visualisation and computer-aided art creation. Even though I am keen on supervising mini-projects/projects on the topics listed below, I am happy to interactively formulate other projects that would fit the individual student's interests.

***Data mining of structured data***

Vectorial data mining is well-developed and understood, because there are natural measures of data similarity for fixed-dimensionality vectors. The situation is much more complicated in the case of structured data (e.g. DNA or music sequences, web documents, graphs representing molecules etc.). We will work on methodologies to mine structured data in a consistent framework (e.g. probabilistic modelling). There is a possibility to work with real DNA/protein sequences, music sequences, EEG time series etc.

***Self-Organisation and optimisation***

There are several approaches to finding good solutions of difficult optimisation problems through self-organisation of partial solutions. These methods tend to work quite well, but involve one or several parameters that need to be set in an ad-hoc manner. We will work on methodologies for setting those parameters automatically. Also, we will extend/modify the basic set-up to accommodate different types of optimisation problems.

***Computational Finance - Inflation targeting***

Predicting inflation rates plays an important role in designing monetary policies. It has been long recognised that when predicting inflation rates on 2-4 quarters horizon, relatively simple (possibly non-linear) autoregressive models achieve respectable performances. It is an open and still unresolved question whether inflation rate predictions could be improved by considering past measures of supply and value of money. We will be investigating usefulness of different forms of money aggregation and so called divisia money indexes for predicting US inflation rates using methods of machine learning. We will work with real data in collaboration with Aston Business School.

***Evolutionary art***

There have been many nice evolutionary approaches to help artists in creating interesting and unorthodox pictures. Many extensions are possible, for example in modifying the vocabulary of basic transforms to allow for hierarchies of self-similar fractal-like objects, defining continuous mappings on such fractal- generating transformations etc. Other possibilities in music composition include e.g. helping a composer to create interesting new tunes, or given an existing melody, create an appealing counter melody.

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**Dr Steve Vickers**

Room: 214

Email: [S.J.Vickers@cs.bham.ac.uk](mailto:S.J.Vickers@cs.bham.ac.uk)

My research work is largely mathematical, on the interface of topology, logic, algebra and computer science, and I would be particularly interested in supervising projects that include some mathematics.

***Quantum theory***

A major new project of mine, funded by the Engineering and Physical Sciences Research Council with Research Fellow Bertfried Fauser, is to apply my favourite logic (the so-called "geometric logic") to some approaches to quantum theory that have been developed at Imperial College and at Nijmegen. Our aim is to develop more pictorial ways to understand the machinery of topos theory that they use. We would like also

to relate it to the vivid diagrammatic descriptions that the Oxford group (Abramsky, Coecke and others) are using to describe quantum protocols for message passing.

For further details of the project see:

<http://www.cs.bham.ac.uk/~sjv/geophysics.php>

(I shall also be teaching the Quantum Computation module this year, in Semester 2.)

I would warmly welcome any mini-project or project on these topics. You would also have the opportunity to see something of how the EPSRC project works.

#### *Other topics in theory*

If you look at my overall research website

<http://www.cs.bham.ac.uk/~sjv/research.php>

and my summary of papers

<http://www.cs.bham.ac.uk/~sjv/papers.php>

You can see more general topics that I am interested in. They revolve around the interaction between topology and logic, using techniques of algebra - in fact I wrote a book about this for computer scientists in an earlier century (1988), although the ideas have evolved enormously since then.

Again, I would welcome a mini-project or project for anyone who wishes to develop some understanding of these topics.

One that may be fairly practical would be to work with the "Cartesian theories" that I wrote on (with Erik Palmgren) in "Partial Horn logic and cartesian categories". This is a logical calculus that allows for the fact that sometimes you can write algebraic expressions  $e$  that may be "partial" - they don't always compute an answer. An example might be if a computation doesn't terminate or some preconditions aren't met. In our logic, you say  $e = e$  only if it does give an answer. Cartesian theories are where you say what the (possibly partial) operators are, and you say what equational implications they obey. These turn out to be of great importance in abstract algebra and it would be good to have some software support for manipulating them.

The project would be to develop some software that enables you to -

- store Cartesian theories as data
- prove well-definedness and equality in a theory
- construct new theories out of old ones
- translate from one format of theory to another

You would need to learn a little about logic, for example the notions of logical theory and of structure and model.

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### **Professor Xin Yao**

Room: 211

Email: [X.Yao@cs.bham.ac.uk](mailto:X.Yao@cs.bham.ac.uk)

My major research interests include evolutionary computation for optimisation, learning and design, and neural network ensembles. I am keen on real-world applications. I am willing to supervise any projects that have to do with evolutionary computation. The following is a partial list.

#### *(1) Co-evolutionary Optimisation*

Co-evolution has been used successfully in tackling large optimisation problems by decomposing them into smaller sub-problems. This could be regarded as an automatic divide-and-conquer approach to solving large and complex problems. This project will investigate different methods of decomposing a large problem into smaller sub-problems and different techniques for fitness evaluation. Although the existing work is mainly in numerical optimisation:

Z. Yang, K. Tang and X. Yao, "Large scale evolutionary optimization using cooperative coevolution," *Information Sciences*, 178(15):2985-2999, August 2008.

X. Li and X. Yao, "Tackling High Dimensional Nonseparable Optimization Problems by Cooperatively Coevolving Particle Swarms," *Proceedings of the 2009 IEEE Congress on Evolutionary Computation (CEC2009)*, Trondheim, Norway, 18-21 May 2009, IEEE Press, pp.1546-1553.

combinatorial optimisation can be considered too.

### *(2) Solving software engineering problems using meta-heuristic algorithms*

Many software engineering problems can be formulated as optimisation and search problems, such as testing, software module clustering, etc. As a result, modern meta-heuristic algorithms can be used to solve them automatically. One of the major advantages of such search-based software engineering is the automation of previously tedious and human-intensive process. Furthermore, meta-heuristic algorithms can provide novel approaches to tackle hard software engineering problems that are beyond human beings (given a limited amount of time). A good example of this is automatic software bug fixing.

A. Arcuri and X. Yao, "A Novel Co-Evolutionary Approach to Automatic Software Bug Fixing," *Proceedings of the 2008 IEEE Congress on Evolutionary Computation (CEC2008)*, Hong Kong, China, June 2008, IEEE Press, pp.162-168.

### *(3) Nature Inspired Creative Design for Textiles*

This project studies personalised (individualised) interactive design using nature inspired approaches, especially evolutionary approaches. The project will emphasise the applications and focus on the design aspects. In addition to research, an interactive web site that allows users to test and evaluate the algorithms and systems developed will be an integral part of the project. The initial focus of the project is on designing patterns for the textile industry. An initial system can be found at <http://imagebreeder.com/>.

This project can be taken by multiple students with different foci, e.g., personalised birthday cards, etc.

### *(4) Robust and dynamic optimisation through evolutionary computation*

Evolutionary Algorithms (EAs) have been applied successfully to a wide range of stationary optimisation problems. Many real-world problems, however, possess numerous time-variant attributes that require a continuous adaptation of the proposed solution. These dynamic attributes pose many new challenges and in this project, we will concentrate on the design and analysis of novel EAs for such dynamic optimisation problems (DOPs). Here are two references that give some background information:

S. Yang and X. Yao, "Population-Based Incremental Learning with Associative Memory for Dynamic Environments," *IEEE Transactions on Evolutionary Computation*, 12(5):542-561, October 2008.

P. Rohlfshagen and X. Yao, "Attributes of Dynamic Combinatorial Optimisation," *Proceedings of the Seventh International Conference on Simulated Evolution And Learning (SEAL'2008)*, Lecture Notes in Computer Science, Volume~5361, Springer-Verlag, Berlin, December 2008, pp.442-451.

### *(5) Real-world applications of neural network ensembles*

Negative correlation learning (NCL) is an efficient and effective ensemble learning algorithm. This project will investigate the novel application of NCL in solving challenging real-world problems in classification, recognition and prediction. You will need to suggest the problem that you are interested in working on

# **Appendix 1**

## **Regulations for the degree of MSc in Advanced Computer Science**

Please refer to <http://www.as.bham.ac.uk/cdu/students/> and follow the links “Programme Specifications”, “Computer Science” and then select “MSc Advanced Computer Science”, for details of the aims and regulations of this programme.

## Appendix 2

Forms:

- First semester taught module declaration form
- Second semester taught module declaration form
- First semester mini-project declaration form
- Second semester mini-project declaration form
- Summer project declaration form

# The University of Birmingham

School of Computer Science

## MSc. in Advanced Computer Science

### First semester taught modules

This form is to be used to declare your choice of modules in the first semester of the degree programme. Please complete this form, obtain the signature of your Academic Advisor and post it in the appropriate assessed work pigeon hole.

**Deadline: 16.00 hrs, 7th October 2011**

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Name:

Student number:

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Please list the modules you have chosen to follow this semester. You may list from 20 to 40 credits of modules (including 10 credits from 06 06991).

Code	Credits	Title
<i>06 06991</i>	<i>10</i>	<i>Research Skills</i>
Total credits this semester		

Signed (student)

Date:

Signed (Academic Advisor):

Date:

# The University of Birmingham

School of Computer Science

## MSc in Advanced Computer Science

### Second semester taught modules

This form is to be used to declare your choice of modules in the second semester of the degree programme. Please complete this form, obtain the signature of your Academic Advisor and post it in the appropriate assessed work pigeon hole.

**Deadline: 16.00 hrs, 20th January 2012**

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Name:

Student number:

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Please list:

- the modules you studied in the first semester;
- the modules you are studying in the second semester.

*Ensure that your total number of credits adds up to exactly 60 credits.*

Semester	Code	Credits	Title
1	06 06991	10	Research skills
Total credits this year must add up to:		60	

Signed (student)

Date:

Signed (Academic Advisor):

Date:

**The University of Birmingham**  
School of Computer Science

**MSc. in Advanced Computer Science**

**First semester mini-project**

This form is to be used to declare your choice of mini-project in the first semester of the degree programme. Please complete this form, obtain the signature of your supervisor and post it in the appropriate assessed work pigeon hole.

**Deadline: 16.00 hrs, 14th October 2011**

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Name:

Student number:

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*Mini-project title:*

*Mini-project supervisor:*

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The following questions should be answered in conjunction with a reading of the handbook.

<i>Aim of mini-project</i>	
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<i>Objectives to be achieved</i>	
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<p><i>Project management skills</i></p> <p><i>Briefly explain how you will devise a management plan to allow your supervisor to evaluate your progress</i></p>	
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<p><i>Systematic literature skills</i></p> <p><i>Briefly explain how you will find previous relevant work</i></p>	
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<p><i>Communication skills</i></p> <p><i>What communication skills will you practise during this mini-project?</i></p>	
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Signed (student)

Date:

Signed (supervisor):

Date:

**The University of Birmingham**  
School of Computer Science

**MSc. in Advanced Computer Science**

**Second semester mini-project**

This form is to be used to declare your choice of mini-project in the second semester of the degree programme. Please complete this form, obtain the signature of your supervisor and post it in the appropriate assessed work pigeon hole.

**Deadline: 16.00 hrs, 20th January 2012**

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Name:

Student number:

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*Mini-project title:*

*Mini-project supervisor:*

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The following questions should be answered in conjunction with a reading of the handbook.

<i>Aim of mini-project</i>	
----------------------------	--

<i>Objectives to be achieved</i>	
----------------------------------	--

<p><i>Project management skills</i></p> <p><i>Briefly explain how you will devise a management plan to allow your supervisor to evaluate your progress</i></p>	
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<p><i>Systematic literature skills</i></p> <p><i>Briefly explain how you will find previous relevant work</i></p>	
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<p><i>Communication skills</i></p> <p><i>What communication skills will you practise during this mini-project?</i></p>	
--	--

Signed (student)

Date:

Signed (supervisor):

Date:

**The University of Birmingham**  
School of Computer Science

**MSc. in Advanced Computer Science**

**Summer project**

This form is to be used to declare your choice of summer project in degree programme. Please complete this form, obtain the signature of your supervisor and post it in the appropriate assessed work pigeon hole.

**Deadline: 16.00 hrs, 15<sup>th</sup> June 2012**

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Name:

Student number:

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*Project title:*

*Project supervisor:*

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The following questions should be answered in conjunction with a reading of the handbook.

<i>Aim of project</i>	
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<i>Objectives to be achieved</i>	
----------------------------------	--

<p><i>Project management skills</i></p> <p><i>Briefly explain how you will devise a management plan to allow your supervisor to evaluate your progress</i></p>	
--	--

Signed (student)

Date:

Signed (supervisor):

Date: