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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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
Important dates and deadlines
Academic Year 2010-11

4th October 2010  Semester 1 and Autumn Term starts
4th October 2010  English test for international students, 14.00, Vaughan Jeffries Lecture Theatre, Education Building (campus map R19)
6th October 2010  Induction meeting for international students, 16.30-18.00, UG40, School of Computer Science
7th October 2010  Reception for postgraduate students, 17.00-19.00, Atrium, School of Computer Science
1600 hrs, 15th October 2010  Declaration of 1st semester module choice
1600 hrs, 28th October 2010  Declaration of 1st semester mini-project
17th December 2010  Semester 1 and Autumn Term ends
17th January 2011  Semester 2 and Spring Term starts
1200 hrs, 17th January 2011  Hand in two copies of 1st mini-project report to School Office
1600 hrs, 28th January 2011  Declaration of 2nd semester module choice
1600 hrs, 28th January 2011  Declaration of 2nd semester mini-project
Week beginning 31st January 2011  Meeting with academic advisor - 1st semester mini-project review
1st April 2011  Semester 2 and Spring Term ends
3rd May 2011  Summer Term starts; Revision, Examination and Assessment Period starts
1200 hrs, 3rd May 2011  Hand in two copies of 2nd mini-project report to School Office
16th May 2010  Semester 1 and 2 Examinations start
10th June 2010  Revision, Examination and Assessment Period ends
Week beginning 20th June 2011  Meeting with academic advisor – examination & 2nd mini-project review
1600 hrs, 24th June 2011  Declaration of summer project
24th June 2011  Summer Term ends
22nd August 2010  Supplementary (resit) Examinations start
2nd September 2010  Supplementary (resit) Examinations end
1200 hrs, 15th September 2011  Hand in two unbound copies of summer project report and a CD to School Office (UG45); end of programme*
Week beginning 12th September 2011  Summer project poster presentations
1200 hrs, 29th September 2011  Final cut-off date for MSc project reports
Mid November 2011  Final Science Graduate Board of Examiners
Mid December 2011  Degree Congregation

* Students are expected to be available until the end of the academic year (24 September) in case they are needed for a project viva.
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/2010/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/

School of Computer Science Student Handbook

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 Jon Rowe

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

Welfare Team

The School has welfare tutors (currently Dr Volker Sorge, Dr Nick Hawes, Dr Iain Styles, Dr Ata Kaban) who provide a welfare session each day during which time any student can drop in and have a chat; see:

http://www.cs.bham.ac.uk/internal/students/welfare/index.php

This page also has links to

- the School’s Student Handbook
- the University Student Support and Counselling Service
- the Advice and Representation Centre run by the Guild of Students.
- and copies of forms that you may need to fill

See the Welfare Team if you need a coursework extension or have personal problems that are interfering with your work. The Welfare Team is responsible for handling all requests for mitigation.

You must inform the Welfare Team if any special circumstances occur which might affect your ability to study.

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

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/index.shtml

Extensions

Extensions to deadlines for assessed work have to be authorised by a member of the Welfare Team. Print and fill the form:
and attach any supporting evidence where appropriate. Hand this to the School Office. 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.

**Mitigations**

Mitigating circumstances are serious conditions that may interfere with your examination or other performance. These must be made known to the School in writing. A form for this purpose is available at:

www.cs.bham.ac.uk/internal/students/welfare/mitigations.pdf

which you should submit to the School together with any supporting documentation. Note that it is not enough to have spoken to someone (be it your academic advisor or a member of the Welfare Team). The regulations of the University are very clear that only written (and signed) information can be taken into consideration by the Examination Board.

In serious cases you may ask (**before the examinations take place**) to postpone exams to the next possible resit opportunity. It is also at the discretion of the Examination 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 Examination Board to disregard some results. However, please note that marks themselves will not be adjusted on the basis of mitigating circumstances.

After the Examination Board has taken place, the School cannot take into consideration any additional new evidence that you may have. The only possibility then is to 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 mitigating circumstances apply to you, you must not wait until the examination results are out, but have to submit them to the School before the Examination Board.

The University guidelines for mitigating circumstances can be found at:

www.as.bham.ac.uk/study/support/sca/Documents/mitstudentguide.pdf

**Student Attendance**

The University has a Code of Practice on Student Attendance and Reasonable Diligence:

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 progress tutorials.
- Attend all meetings with your 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.

Out of these we have to make 10 random checks per academic year for each student. If you miss one without good reason you will get an email warning. If you miss two consecutive ones we have to initiate procedures according the Code of Practice to have you excluded.

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@bham.ac.uk. Again, if at all possible, do this before the submission/event. Again, if at all possible, do this before the submission/event.
• Read your email on a daily basis and keep your postal addresses with the office (term time and home address) up-to-date.

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

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:

www.as.bham.ac.uk/work/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

**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 short oral 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/2010/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/2010/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-acs/tm_1.pdf
www.cs.bham.ac.uk/resources/programmes/postgraduate-taught/msc-acs/tm_1.doc
www.cs.bham.ac.uk/resources/programmes/postgraduate-taught/msc-acs/tm_2.pdf
www.cs.bham.ac.uk/resources/programmes/postgraduate-taught/msc-acs/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 2010/11

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

www.cs.bham.ac.uk/internal/programmes/2010/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.

<table>
<thead>
<tr>
<th>Code</th>
<th>Module</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Compulsory Modules to a total of 10 credits</td>
<td></td>
</tr>
<tr>
<td>06 06991</td>
<td>Research Skills</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Optional Modules to a total of 170 credits</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Either 0 or 30 credits chosen from:</td>
<td></td>
</tr>
<tr>
<td>06 07953</td>
<td>First semester mini-project</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Either 0 or 30 credits chosen from:</td>
<td></td>
</tr>
<tr>
<td>06 07954</td>
<td>Second semester mini-project [Note 1]</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Between 50 and 110 credits chosen from:</td>
<td></td>
</tr>
<tr>
<td>06 17442</td>
<td>Commercial Programming (Extended)</td>
<td>10</td>
</tr>
<tr>
<td>06 15255</td>
<td>Compilers &amp; Languages (Extended)</td>
<td>10</td>
</tr>
<tr>
<td>06 18157</td>
<td>Component-based Software</td>
<td>10</td>
</tr>
<tr>
<td>06 17417</td>
<td>Computer Security</td>
<td>10</td>
</tr>
<tr>
<td>06 20008</td>
<td>Cryptography</td>
<td>10</td>
</tr>
<tr>
<td>06 N0112</td>
<td>Networks and Distributed Systems</td>
<td>20</td>
</tr>
<tr>
<td>06 21253</td>
<td>Human Computer Interaction (MSc)</td>
<td>10</td>
</tr>
<tr>
<td>06 19009</td>
<td>Individual Study 2 [May be taken in either Sem1 or Sem2 but not both]</td>
<td>10, 10</td>
</tr>
<tr>
<td>06 20233</td>
<td>Intelligent Data Analysis (Extended)</td>
<td>10</td>
</tr>
<tr>
<td>06 15267</td>
<td>Intelligent Robotics (Extended)</td>
<td>20</td>
</tr>
<tr>
<td>06 22753</td>
<td>Introduction to Evolutionary Computation</td>
<td>10</td>
</tr>
<tr>
<td>06 22457</td>
<td>Quantum Computing and Cryptography</td>
<td>10</td>
</tr>
<tr>
<td>06 12412</td>
<td>Introduction to Neural Computation</td>
<td>10</td>
</tr>
<tr>
<td>06 20236</td>
<td>Machine Learning (Extended)</td>
<td>10</td>
</tr>
<tr>
<td>06 12418</td>
<td>Nature Inspired Design</td>
<td>10</td>
</tr>
<tr>
<td>06 12416</td>
<td>Nature Inspired Optimisation</td>
<td>10</td>
</tr>
<tr>
<td>06 N0110</td>
<td>Operating Systems with C/C++ (Extended)</td>
<td>10</td>
</tr>
<tr>
<td>06 20234</td>
<td>Planning (Extended)</td>
<td>10</td>
</tr>
<tr>
<td>06 20010</td>
<td>Secure Programming</td>
<td>10</td>
</tr>
<tr>
<td>06 22755</td>
<td>Programming Massively Parallel Architectures [Note 6]</td>
<td>10</td>
</tr>
<tr>
<td>06 20009</td>
<td>Network Security</td>
<td>10</td>
</tr>
<tr>
<td>06 18158</td>
<td>Software Testing</td>
<td>10</td>
</tr>
<tr>
<td>06 N0113</td>
<td>Research Seminar</td>
<td>10</td>
</tr>
<tr>
<td>60 credits chosen from:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>06 02637</td>
<td>Project - Advanced MSc [Note 2]</td>
<td>60</td>
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<td>06 18159</td>
<td>Project (CompSci - MSc)</td>
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Notes
1. Note that this module cannot be taken unless 06 07953 First semester mini-project has also been taken.
2. 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.
3. 06 21253 Human Computer Interaction (MSc) is intended for students for whom this subject is new.
4. 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 2010/11, 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 you 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-acs/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-acs/mp_1.[pdf|doc]
Mini-project 2:  www.cs.bham.ac.uk/resources/programmes/postgraduate-taught/msc-acs/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) 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 you 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-acs/msc_acs_nc_project_writing.pdf) You should also seek the advice of your supervisor.

Students are reminded that at 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-acs/project.pdf
www.cs.bham.ac.uk/resources/programmes/postgraduate-taught/msc-acs/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-acs/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) 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/2010/18159.html
Research interests of academic and research staff and mini-project and summer project topics

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. too support for software engineers); Search-Based Software Engineering; Economics-Driven Software Engineering (e.g. application of theories from economies 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.

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.

Students interested in other aspects of AI are welcome to make suggestions.

Dr Russell Beale  
Room: G37  
Email: R.Beale@cs.bham.ac.uk  

All my projects aim to make computing easier, or more fun, for users - a few focus on individual characteristics of people that we could exploit to make better systems, though most are self-contained projects. These are all designed to be achievable by you, so you need to find the concept interesting, and we will then work on defining precisely the scope and shape of the project. Most require some programming, usually in Java but sometimes in J2ME (for mobile devices). Usually they have some small part of AI, or programming, some design or user interface work, and some testing of the idea/evaluation. All projects are research-oriented, in that you will be given freedom to follow your ideas, as well as the opportunity to work in a developing area and to create something new, contributing to the development of the field.

**Information without attention.**  
Change simple representations of information on a display and investigate how well people notice and quantify the change, when they are not consciously looking at it.

**Personality**  
Test various interfaces for personality traits; build an animated agent with particular personality and evaluate its use and effectiveness in interaction.

**Reference assistant**  
Takes a paper (pdf, html, or cut and pasted) identifies the references (or just takes them in the first place) for each ref submit to google scholar, find right (matching) ref in results returned from gs (usually the first), extract number of citations, proper citation in reference manager format (endnote, etc), link to the file produce file for import to ref manager with that info. Requires some parsing, some basic ai, some web scraping, and would be really helpful to researchers, allowing them to create a reference library from papers, and to see what refs are well cited can be done in java, or perl/ruby/whatever, or with mashups.

I want this app!

**Journal impact measurer**  
Research project to identify which journals have what impact factors uses google scholar to count how many articles are referenced from a particular journal on a particular timeframe. Provides up to date perspective on which journals are good to publish in, allowing free access ones to prosper soon (and this could be a very useful and popular and profile-raising project)

hard to do as google scholar doesn't have a journal: keyword, so needs lots of retrievals and parsing and analysis

**Paper geography mashup**  
Provides visualisation of which papers reference which, based on where the authors are based, drawn onto google maps e.g. bham paper references cmu paper which references auckland paper etc.

uses google maps, mashups, google scholar parsing, etc.

**Synaesthesia**  
Exploring what sort of dual-sense experiences people have, both in lab situations and via wide-ranging internet trials and questionnaires - some bg in psychology useful.

**Personality in interaction**  
Designing and running experiments to explore issues of personality in interfaces and interaction - why is the mac perceived as friendly? why is a windows machine not? where does linux fit in to this? ditto for
applications - and can we design for these personality traits ..... diy intelligent surface - building a touch-table ourselves - with webcams, projector, glass-topped ikea table, etc - expt to see if we can design and build appropriate tech for it, plus s/w to make it work. Some vr toolkits available to make programming it practicable

Reference extractor
Program either a standalone program or a plug-in for Word/Internet Explorer to analyse academic papers and extract the references from them, putting them into a database, to save lots of typing. Requires the application of a set of rules for formatting to be applied in reverse to understand what parts of a reference are which, and to parse the reference accordingly.

Wireless networking
Develop and implement algorithms for doing location in wireless network using signal strength, triangulation, comparison with previously stored data, and so on, to provide accurate system.

Intelligent browsing on mobile device
Build proxy to improve internet browsing on mobile devices - does look-ahead, caching, annotation of pages, etc.

Interactive art
Build abstract artwork that is responsive to movement (tracked by camera) and bluetooth interaction/smst messages, in which users send data which alters the art.

Informative art
Create changing mosaic of images from Flickr selected by extracting keywords from the BBC news feeds, to create an image representative of the news. Install it, and evaluate how well people understand it and how artistic it is.

Virtual pinball/football
Using a projected surface, the aim is to use video capture and processing to allow people to become active participants in a pinball or football game, where the games surfaces projected onto the floor, along with a virtual ‘ball’, and image capture and processing allow users to interact with it.

Supporting users in high tension situations.
The game Halo can be played in multi-player mode, requiring cooperation to defeat the monsters. We will try to understand what is happening to the players and how we can offer additional support to them in such stressful situations: the lessons from this can be carried forwards into other high-tension situations.

Clever searching.
Decent search is still the holy grail of the internet: using semantics as well as syntax is a promising approach, and this project will look at ways to understand the meaning of queries before reformulating them and presenting them to the search engines. A variety of approaches will be looked at, from the semantic web through to the abstraction of search terms.

Symbolic GAs.
Evolving understandable rules allows us to interpret the output of evolutionary systems more easily: this project will review the state of the art and work on approaches to create flexible systems that can act as components of a data mining or AI system. Ideally, the project will also develop the rest of the data mining system by integrating existing components with the GA.

Design

HCI design patterns
HCI design patterns are ways of expressing good approaches to solving interactive design issues: this project will collate numerous patterns and express them in UML or a similar modelling language, and then extend a tool to recognise and suggest appropriate patterns given a certain scenario. This is harder than it seems.....

Slanty design.
Investigate a newly-emerging design methodology, in which user- centred design meets the (sometimes different) needs of the organisation. Requires a lot of reading and research and awareness of design approaches.
Dr Behzad Bordbar
Room: 116 Email: B.Bordbar@cs.bham.ac.uk

[Note: These projects are only suitable for Advanced MSc. students.]

My main research interests are focused on two directions: Model-Based Software development and Fault diagnosis. Model-based software Development aims to produce techniques and methods for using modelling and software tools for writing better software. In particular, I am interested in techniques based on Model Driven Development (MDD) and their applications to modelling languages which are supported by consortiums such as OMG and W3C. In area of fault diagnosis my interests are in large systems, in particular telecommunication systems.

Process Mining tools and algorithms
Process mining techniques allow for the analysis of business processes based on event logs. PM has received considerable attention from the Telecommunication, Banking sectors and other sectors of industry which are based on Service oriented Architectures. There are currently over 30 process mining algorithms and process mining tools (for example http://ga1717.tm.tue.nl/wiki/). The following projects will be carried out in collaboration with our industrial partner a large Telecommunication company. Research into the:

*Project 1*: evaluation of Process Mining tools and algorithms
*Project 2*: methods of Visualisation of the result of the Process Mining from very large data-sets
*Project 3*: application of process mining to governance
*Project 4*: application of process mining to identify security violations

Fault tolerance in Service oriented Architecture (SoA)
We are increasingly reliant on the IT systems which consist of a number of services interacting with each other as a part of a Service oriented Architecture. There are a large number of e-business, social networking, financial and telecommunications systems which fall in such categories. Occurrences of faults in such systems are highly undesirable. In addition, because of the complexity of such systems, such an occurrence of failure is very hard to identify. These projects aim at automatic generation of new services called Diagnosers, which are deployed with the system to identify occurrences of failure so that suitable remedial courses of action can be adopted. *Project 1*: extension of an existing centralised diagnosis tool to speed up the fault detection. You will be introduced to fault diagnosis in Web services to extend our Toolset which is based on Oracle JDeveloper

*Project 2*: Decentralised diagnosis to improve existing methods
*Project 3*: application of diagnosability to identify violations of security
*Project 4*: fault specification language for web services

Analysis of UML models via tools
Unified Modelling Language (UML) is now widely accepted as the de-facto standard for the design, specification, documentation, automated implementation (via software tools) of the software models. This project makes use of the tools, such as UML2Alloy (http://www.cs.bham.ac.uk/~bxb/UML2Alloy/index.php) and UML2PN, developed in the School of Computer Science (SoCS), Birmingham University for the analysis of UML models. The student will study of the relevant application domains to produce models of challenging problems motivated by real-world examples. The tools will be used to analyse the created models. Research into using UML2Alloy/UML2PN for the analysis of:

*Project 1*: system security (Spatio-temporal access control)
*Project 2*: Extending UML2Alloy and UML2PN

Domain Specific Languages for the Cloud
If you haven't heard about the DSL a good place to start is either from the Wikipedia or read a nice article form by Juha-Pekka Tolvanen (http://www.devx.com/enterprise/Article/30550). This project aims to use DSL tools to develop languages and tools related programming of the Cloud

Model Driven Development
The Model Driven Architecture (MDA) and Model Driven Development (MDD) are very popular emerging technologies for software development. MDA/MDD promotes the automatic creation of models and code by a series of transformations. You can learn about the MDA in www.omg.org/mda/ or by checking Wikipedia.

*Project 1*: Research into the development of software via Model Driven Development. This is a golden
opportunity to learn about MDD and Model Transformation Frameworks to learn develop software in Service oriented Architecture (SOA), Web service technology and Embedded Systems. The following are examples of Model Transformation Frameworks
- OpenArchitectureWare
- KerMeta
- Xactium
- and our very own Simple Transformer (SiTra)

*Multi-objective model-based testing*

The aim of this research is to develop techniques for using models to automatically create testcases for complex systems. In this research you will extend existing model-based testing tools such as ModelJUnit to conduct efficient testing.

**Dr Christopher Bowers**  
Room: 106  
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:

*Mobile virtual sensors through data fusion*

New virtual sensors can be formed using existing sensor data available to mobile platforms. For example, sensors that detect that the phone is contained within a vehicle, or whether the carrier is walking, running, falling etc. I’m interested in projects that require the development of virtual sensors for practical applications.

*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 word 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.

**Dr John Bullinaria**  
Room: 113  
Email: 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.

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:
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.

Dr Marco Cova
Room: UG36  Email: M.Cova@cs.bham.ac.uk

I would be happy to supervise students interested in system security. Some possible project areas include:
• Analysis and detection of botnets
• Design of secure web applications
• Analysis of binary code and malware
• Detection of malicious/unwanted web content (spam, scam, etc.)

If you would like to discuss doing a project in these or related areas, please e-mail me or drop by my office.
I am interested in a broad range of AI topics, but primarily from the point of view of reasoning under uncertainty. This means that either the world isn't perfectly known, the effects of actions aren't deterministic, or some combination of these. I'm happy to supervise projects in a wide variety of areas, including decision-making, planning, tracking, probabilistic modelling and fault detection. Natural Computation students should be aware that while some of the techniques I use myself do not fall into the category of natural computation, I am happy to supervise a project that applies natural computation techniques to any of the problems discussed below, or suggest approaches such as Monte-Carlo techniques that could be interpreted as nature-inspired.

Possible topics might include:

- **Planning for autonomous operations**: how to choose actions when the environment is uncertain, and the effect of the actions is uncertain. For example, planning daily activities for Mars rovers, planning to extract information from the World Wide Web, etc.
- **Architectures for autonomy**: How to make planning, state estimation, and execution of plans work together to create a truly autonomous system.
- **Autonomous science**: how to autonomously collect data for scientists. This addresses issues such as how to represent science goals, and how to act given such goals, adapting behaviour over time, and how to "act like a scientist", for example by creating hypotheses about the world and then testing them.
- **Scheduling space telescopes**: optimising the use of on-board memory to take as many observations as possible.
- **Planning Mars rover or other spacecraft daily activities** (in simulation).
- **Robotic soccer or other robot decision-making**.
- **Intelligent opponents for computer games**

I am also involved in a number of ongoing research projects that could provide possible topics:

**The AFDA project** involves doing fault diagnosis on an autonomous underwater vehicle, Autosub 6000. Project topics include:

- **Hybrid diagnosis on Autosub data**: applying simple algorithms from the hybrid diagnosis community to data from the AUV to see how well they work.
- **Applying Livingstone 2 to a different diagnosis problem**: Livingstone 2 is the diagnosis engine we use. A reasonable project would be to apply it to a diagnosis problem such as one from the International Diagnosis Competition.
- Developing a new language for diagnosis models, or new algorithms for diagnosis: We are currently building a new diagnosis engine based around an SMT solver (a kind of theorem prover). There are lots of projects that could be involved in this, such as extending the modelling language, or creating new algorithms to take advantage of the new solver.
- **Other aspects of autonomy for AUVs**: Planning AUV activities, building a simulated AUV software architecture, getting involved in the SAUC-E student AUV competition.

**The CogX project** is concerned with developing intelligent robotic assistants. The work I am doing in the project is on planning and decision-making. Example project topics would include:

- **Planning observations to find things out**: This might include planning dialogue with a human, planning where to look in a scene, or which room to look in to find a particular object.
- **Motivation through oversubscribed planning**: people often have many objectives they want to achieve, and have to choose which ones to concentrate on. This project would involve using planning to select the best goals to pursue based on their value and also on the cost to achieve them.

**The GeRT project** involves learning models of the effects of actions from hand-built robot programs, and then using the models to plan to solve novel tasks. Example project topics include:

- **Combined path and task planning**: Build a planning system for actions such as “pick up the cup” that have both task-level preconditions and effects (“cup on table” and “holding the cup”), and geometric ones (the relationship between the hand and the cup that lets the “pick up the cup” action succeed). Solving a simpler example of this would make a good student project.

**The Multiple Particle PEPT project** involves tracking radioactive particles as they move around in a liquid to determine properties of the flow of the liquid. We hope to use the method to understand how impurities move in molten metal. Possible project topics might include:
• **Applying particle filtering algorithms to PEPT data:** this project involves applying existing algorithms to data we have collected, looking at how well different algorithms perform, and why.

Finally, for M.Sc. Computer Science students, and others with a background outside Computer Science, I am very keen to supervise projects that take techniques from Computer Science (particularly AI) and apply them to problems from other areas. For example, in the past I have supervised projects on reducing the amount of data produced by 3D laser scanners with Archaeologists, calibrating space-based gravity wave detectors with Cosmologists, and deciding whether individual neurons are firing in a coordinated way during epileptic fits with Neuroscientists.

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**Dr Hamid Dehghani**

Room: UG38  
Email: H.Dehghani@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

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 Martin Escardó**  
Room: 212  
Email: M.Escardo@cs.bham.ac.uk

I can supervise all sorts of topics, provided they are not too far from my expertise, and, preferably, if they are within my research interests (see below). I have supervised projects on mathematics (both applications of computer science to mathematics, and of mathematics to computer science), models of computation (automata, parsers, regular expressions), graphics (fractals, illumination models, realism), data structures and algorithms, system programming (operating systems, compilers, embedded systems, C, C++, file synchronization), computer aided design, functional programming (Haskell, ML), logic programming (Prolog), computer games, and many other things. (If you want to do a graphical computer game, you should be a very good and confident programmer.)

Whatever topic you choose, it has to have scope for doing non-trivial things and using your own imagination and self-learning, in addition to the material you have learned from us.

My current research interests include topological methods in the theory of computation (including topology in higher-type computability theory), algorithmic topology of program types, domains and continuous lattices in analysis and topology, effective and constructive real analysis, exact real-number computation, locale theory, programming language semantics, domain theory, lambda-calculus, functional programming. This may sound daunting, but I have in fact supervised students in this area and they have done rather well.

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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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**Charles Gretton**  
Room: 232  
Email: C.Gretton@bham.ac.uk

**Decision-Theoretic Planning using Boolean Satisfiability Procedures**

Recent research suggests that state-of-the-art decision procedures developed for solving Boolean satisfiability problems can be leveraged to find high quality solutions to optimisation problems. In this project a student shall explore how such procedures can be used to efficiently solve decision-theoretic planning problems that can be formally modelled as partially observable Markov decision problems. The student shall modify an existing automated planning system in order to explore this direction. That modified system shall be evaluated on planning problems that occur to embodied cognitive robots that are capable of demonstrating self-understanding and self-extension.
Candidates for this project should wish to pursue a research career in computer science or artificial intelligence. They should also be familiar with the C++ programming language and the GNU/Linux C++ development tools.

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 Prologs. 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.

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.
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 would be particularly interested in projects that would be related to the CASAM project. CASAM is an EU project which aims to annotate video news articles as a collaboration between a journalist and automated systems. The news articles are provided by our news agency partners. As part of this project there is an opportunity to work with the project team to explore some interesting ideas that have arisen that are outside the core of the project. I’ve listed some ideas below but there are many more. These are open-ended projects and will involve some collaboration with the project team.

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.

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

Achim Jung’s research interests are in the following areas: Topology in Computer Science, Programming Languages, Geographic databases, Support Tools, Teaching Support and Computing Education. I am also open to consider projects in other areas. Some specific project ideas follow below.

Visualisation
Some algorithms contain very clever ideas which are hard to explain on the basis of program code alone. In these cases a visualisation of how a data structure evolves over time can be helpful. Sometimes the core of the algorithm comes from a completely different area such as Geometry, Physics, or Combinatorics. With a visualisation we can then try to illustrate the connection between the program and the non-computing field.
If you are interested in this then I can easily come up with a concrete project idea for you and you can also suggest your own.

Requirements: Good programming skills are important but even more so a feeling for pedagogical concerns. Aesthetics is as important as technical correctness.

**Dataspaces**

Data can be stored in a variety of ways: databases, XML files, plain text files, etc, and these differ in their degree of "structuredness", or how uniform the format of individual entries is required to be. Relational databases, for example, are highly structured and consequently very efficient for storage and retrieval; web pages, on the other hand, are unstructured, yet still very efficient for search and retrieval, as Google is showing. In general, however, it is difficult to transform data from one paradigm into another and this makes it hard to adhere to the principle of a "single data source." Recently, this area has received some attention in the database community under the label "dataspaces". Possible projects in this area range from theoretical studies to usability considerations and to prototype implementations.

**Computing in Schools**

ICT is a compulsory topic at various levels in the British National Curriculum but rather than exciting students about the possibilities of computers it is now proven beyond doubt that it actually puts students off the idea of pursuing a career in computing. The question for educators then is, what could one do with children between the ages of 6 and 16 that would introduce them to the wonders of computing, yet be examinable in standardised tests. This is a hot topic around the world and there are plenty of pilot schemes being tested. As miniproject here it would be suitable for a student who is seriously thinking about becoming a school teacher, and who has ideas of his or her own as to what activities would suit a particular age group in the range between 6 and 16.

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**Dr Ata Kaban**  
Room: G32  
Email: A.Kaban@cs.bham.ac.uk  

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-Lindenstraus 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 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

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**Dr Mark Lee**

Room: 110  
Email: 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.

Dr Paul Levy
Room: 216 Email: P.B Levy@cs.bham.ac.uk

My interests are in logic and semantics of programming languages.

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.

Dr Elke Ritter
Room: 209 Email: 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.)

Dr Jon Rowe
Room: 238 Email: J.E.Rowe@cs.bham.ac.uk

**Modelling plant growth with L-systems**
L-systems are rather like “grammars” for specifying the rules of natural growth. They have been used to
build realistic graphics of plants and trees and other natural phenomena. This project would investigate a
range of applications of this representation scheme.
Spatial dynamics of disease transmission.
Standard models of disease transmission assume that anyone in a population can infect anyone else (perfect mixing). It is likely that, when a population is distributed so that people can only infect those nearest them, the way in which the disease spreads will be different. This project will be an empirical study of these effects.

Genetic representations and operators for combinatorial problems
A number of different representations and operators have been suggested for problems such as the Travelling Salesman Problem (TSP) but as yet there is no clear understanding of the best way to do this. This project would look at the TSP and other combinatorial problems and try to come up with a principled way of designing genetic operators for them, and perform empirical studies on their effectiveness.

Local search and distribution of optima
It is thought that the distribution of optimal points in a search space affects different local search algorithms in different ways. This project will investigate this relation by studying a number of optimisation problems and local search algorithms. The goal is to find a simple descriptor of a search space that correlates with the effectiveness of the algorithm.

Theory of evolutionary algorithms
I am happy to supervise projects that look at theoretical aspects of evolutionary algorithms. However, this will be very mathematical, in addition to requiring good programming skills. Only ask me about these if you are prepared to do the maths!

Dr Mark Ryan
Room: 237 Email: M.D.Ryan@cs.bham.ac.uk

[Note: These projects are only suitable for Advanced MSc students.]

I am willing to supervise ambitious students interested in computer security, especially students who think they might like to do a PhD in that area

Dr Thorsten Schnier
Room: 244 Email: T.Schnier@cs.bham.ac.uk

I have a wide range of interests, including nature-inspired approaches to computational art and design, general evolutionary projects, and evolvable hardware. I also have projects on analysis of real-world domestic and commercial energy consumption.

I am open to suggestions, if you have any ideas in any of these areas just come and talk to me.

Energy consumption
We have real-world data of domestic and industrial building energy consumption, which can be used for analysis and optimization, e.g.
• Analysis of domestic energy consumption patterns
• Energy saving through improved building heating control

Evolutionary Art and Design
I am interested in the application of evolutionary computing to Art and Design. A few suggested topics are:
• Fitness Function for Aesthetics
• Learning from Flickr
• Machine learning in Evolutionary Art

Evolvable Hardware
In Evolvable hardware, evolutionary computation is used to (analog and digital) design electronic circuits. I am particularly interested in fault tolerance and fault recovery.
• Optimal strategy for fault recovery
• Speeding fault recovery by seeding
• Using boolean algebra as genetic operators

Nature Inspired Design

I am also very interested in the following areas, but I don't currently have any prepared projects. If you have any ideas, I am happy to discuss them with you.

• Emergence
• Development
• Human Design/Creativity

Alan Sexton
Room: 239 Email: 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.

Dr Volker Sorge
Room: 207 Email: 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

**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](http://www.math.stevens.edu/~ifloresc/ABCshift.htm)
- [http://www.stevens.edu/ses/ceoe/People/Stolkin/BoatTracking.html](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.

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**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.]

**Security implications of Java RMI**

In Java, distributed systems can be programmed using Remote Method Invocation (RMI). As RMI can lead to dynamic class loading, there is a risk of malicious code injection, so that appropriate security checks need to be used. This project investigates techniques for doing so, focusing on passing remote and non-remote objects back and forth between client and server. A possible result of the project could be to identify Design Patterns for using RMI securely.

**Understanding Java stack inspection**

Stack inspection in Java is designed to prevent malicious code from mounting the "confused deputy" attack by calling methods to do its bidding. Stack inspection is a relatively new and in some ways ad-hoc mechanism. There is an active area of research that tries to put it into a more systematic framework for access control. The aim of this project is to review and build on this literature. Hence the project is largely dissertation, but it should include code examples.

**Stack inspection in Java, case studies**

Java gives fine-grained access via stack inspection. This security mechanism is quite involved, and some authors (Gordon et al) have argued that it is too complex and counter-intuitive. The aim of this project is to gain a better understanding of stack inspection and it usability for programmers. It should involve a substantial case study of using stack inspection, for instance by adding it to an existing open-source project to make it more secure. The outcome of this project should include a critical evaluation of stack inspection and related access control mechanisms.

**Security in on-line games**

Attacks on on-line games are predicted to be a growth area of computer insecurity. This project consists of cases studies of such attacks, focusing on the particular technical challenges of online games, such as distributed, highly concurrent software.

**Security risks of anti-virus software**

Anti-virus software is marketed aggressively, despite the fact that it is highly invasive (comparable to root kits) and so poses significant security risks itself. The recently published buffer overflow in Clam AV is a case in point. This project aims to assess the security risk (and other consequences) of AV software, ideally by auditing some open-source AV (as it may be unfeasible to find information on commercial products, although using a debugger is a possibility). It is not necessarily expected that an actual exploit is found, but that the risk is put in perspective.

**Aspect oriented programming for security**

Aspects can evidently be used for secure programming, such as adding access control to code. As aspects are a fairly new technology, it is not entirely clear how useable or scalable aspects are in this role. This projects examines some case studies of aspects for security and evaluates them. Ideally, aspects for security should also be compared to alternative forms of access control, such as Java stack inspection.
Secure programming in Cyclone
Cyclone is a research language aimed at making critical code of the kind traditionally written in (unsafe) C more secure. Specifically it prevents buffer overflows. The aim of this project is to use and evaluate Cyclone by implementing software in it, for instance by porting some operating system utility to it and thereby hardening it against attack.

Defending against command injection attacks
One of the main avenues of attack on web applications consists of injection of SQL statements. Some recent research has developed defences against such attacks, based on parsing to check whether the input violates assumptions made by the programmer. The aim of this project is to build on the research, and perhaps to apply it to other relevant web technologies, apart from SQL.

Secure programming and Python
Most of the literature on secure programming addresses problems in C and security mechanisms in Java. However, many applications use languages like Python. This project should investigate the security risks of using Python, preferably by auditing a real-world web application.

Secure coding workbench
There are various program analysis tools for finding security vulnerabilities in code. They still require a knowledgeable programmer to look at the code. This project is about extending some open-source IDE with features for security review of code, such as navigation and interfacing with security analysis tools.

Exception analysis for security
In languages like Java, improper handling of exceptions is a serious source of code defects, which may be exploitable. In particular, many APIs (even the simple one for sockets, say) require careful placing of exception handlers around any part of the code that may fail. The aim of this project is to assist the programmer in correctly placing exception handlers. The project should be integrated to work with the Secure Programming Workbench project.

Taint analysis for web software
Taint analysis traces malicious input through code to detect vulnerabilities like SQL injection. The aim of this project is to build such an analysis, ideally for a case that has not already been covered in the literature (perhaps some new XML-based technology). The project should be integrated to work with the Secure Programming Workbench project.

Java language features and security
Unlike C/C++, Java has a safe run-time system, preventing many classic attacks, like buffer overflows. However, Java also has constructs which are seen as security risks, specifically reflection and inner classes. This project investigates whether these Java features can be exploited in realistic settings. It should evaluate some cases studies (e.g., some open-source software) and experiments.

Mechanism design in software security
This project is theoretical and mainly dissertation. Some background in Economics would be an advantage. Its aim is to investigate the role of incentives for security in software development. Some security experts (Bruce Schneier and particularly Ross Anderson, see Economics of information security) argue that computer security defects are often due to economic factors, such as incentive incompatibility. For instance, developers may introduce security holes because it is the easiest option for them to do so, and someone else will bear the cost (users or other developers). Programming examples include the "ridiculous excuses" listed by Michael Howard in his "Secure Coding" book, such as "If we don't run as root, everything breaks". This project must have a significant software aspect to it, and so it should consider concrete steps that could increase software security, e.g. security contracts between modules and across trust boundaries, fail-safe error handling etc.

Vista and .NET security
Vista has a number of security technologies, such as defences against buffer overflows; see Michael Howard's recent book. Projects in this area would evaluate these mechanisms by case studies.

Object-oriented patterns applied to security
Object-oriented design patterns aim to promote understandable and reusable software. This project is about building a Patterns Workbench, a tool that assists a Java programmer in correctly using patterns.
The standard reference for design patterns is the book by Gamma, Helm, Johnson and Vlissides. There is also a lot of material, including tutorials, about design patterns on the Web. Modern frameworks, like those taught in the ISS MSc, use quite a few patterns.

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**Dr Peter Tiño**

Room: G33  
Email: 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 bellow, 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 tent 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.
Dr Steve Vickers  
Room: 214  
Email: 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.

Professor Xin Yao  
Room: 211  
Email: 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:


(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.


(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:


(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
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, 21st October 2010**

Name:

Student number:

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).

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<thead>
<tr>
<th>Code</th>
<th>Credits</th>
<th>Title</th>
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<tr>
<td>06 06991</td>
<td>10</td>
<td>Research Skills</td>
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Total credits this semester

Signed (student):

Date:

Signed (Academic Advisor):

Date:
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, 28th January 2011**

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**Name:**

**Student number:**

**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.*

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<thead>
<tr>
<th>Semester</th>
<th>Code</th>
<th>Credits</th>
<th>Title</th>
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<tr>
<td>1</td>
<td>06 06991</td>
<td>10</td>
<td>Research skills</td>
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</table>

Total credits this year must add up to: **60**

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Signed (student)

Date:

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Signed (Academic Advisor):

Date:
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, 28th October 2010**

Name:

__________________________

Student number:

__________________________

**Mini-project title:**

__________________________

**Mini-project supervisor:**

__________________________

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

<table>
<thead>
<tr>
<th><strong>Aim of mini-project</strong></th>
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<th><strong>Objectives to be achieved</strong></th>
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Signed (student)

Date:

Signed (supervisor):

Date:
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, 28th January 2011

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**Name:**

---

**Student number:**

---

**Mini-project title:**

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**Mini-project supervisor:**

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

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Signed (student)

Date:

Signed (supervisor):

Date:
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, 24th June 2009**

Name:

Student number:

**Project title:**

**Project supervisor:**

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

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