Department of Computer Science and Information Systems

Potential project supervisors, their interests and some project suggestions

This list of staff members' research interests, with some project suggestions, is intended to help you to decide whom to approach as a possible supervisor for your project.

Do not imagine that you have to choose a topic from this list. It is *your* project and you are encouraged to come up with your own ideas. The list is provided to help you to see who might be more appropriate as a supervisor. Don't be downhearted if you can't find a supervisor who seems to be an exact fit for your project idea; staff members are fully aware that they will have to supervise some projects remote from their own research interests.

If you are late getting started, it may be that some of the supervisors already have their full quota of students for this year, so it would be a good idea also to consult the supervisor-chart which lists the students that each member of staff has agreed to supervise.

Staff list

Andrea Cali

Trevor Fenner

Sergio Gutierrez

Roman Kontchakov

Oded Lachish

Mark Levene

George Magoulas

Keith Mannock

Nigel Martin

Steve Maybank

Szabolcs Mikulas

Alex Poulovassilis

Igor Razgon

George Roussos

David Weston

David Wilson

Peter Wood

Michael Zakharyaschev

Dell Zhang

Andrea Cali

Interests:

My main research interests include semantic information integration, logics and databases, ontologies and databases with emphasis on query answering and optimisation, Deep Web (the part of the Web that is stored in databases and accessible mainly through Web forms).

Project ideas:

1. Optimization of Deep Web queries, which are processed on a set of Web data sources. Run-time and compile-time algorithms exist in the literature, which should be tested in realistic scenarios.

2. Implementation and testing of query answering techniques in the presence of knowledge bases (ontologies) based on extension of Datalog. In particular, ontology rules are variants of Datalog rules enhanced with existential quantification. Test of inference/reasoning algorithms will be carried out.

3. Integration of the Deep Web with Linked Data (Web of Data), where the latter are machine-readable data sets which can be used, together with ontology querying techniques, to enhance structured queries on the Web. This research is at an early stage and a more theoretical/literature work is welcome, besides the testing of algorithms.

Andrea Cali's web pages

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Trevor Fenner

Interests:

My main research interests are in the general area of algorithms and data structures, particularly combinatorial algorithms and probabilistic algorithms - the latter being closely linked with collaborative work I have been involved in on random graphs and random graph algorithms.

I am also interested in programming and programming languages.

Recently I have been doing work on heuristic game playing, models for Web dynamics, and the development of algorithms for various problems in bioinformatics.

As well as in the aforementioned areas, I have published papers on numerical linear algebra, combinatorial matrix theory, matroid algorithms, and relational database theory.

Trevor Fenner's web pages

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Sergio Gutierrez

Interests:

Artificial Intelligence with applications to learning (helping learners)

Artificial Intelligence with applications to helping teachers

Data mining (especially educational data mining)

Distributed Systems, Emergent Behaviour, and Swarm Intelligence

Project ideas:

Helping teachers to make their systems more intelligent: non-programmatic extension of intelligent support in microworlds

Making dumb systems intelligent: addition of intelligent support to an existing microworld (examples include Scratch, Geogebra, Greenfoot, BlueJ, and others)

What should we do now? Analysis of interaction of students with a microworld

What is going on in my classroom? Development of assistance tools for teachers in the classroom

Commit and update: development of a platform for the distribution of interaction information based on version control (SVN, GIT)

Sergio Gutierrez' web pages

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Roman Kontchakov

Interests:

My main research interests are semantic data integration and ontology-based data access, ontology languages and description logics, the Semantic Web, and spatial and temporal

knowledge representation and reasoning. More specifically, I am interested in algorithms for reasoning in these formalisms, with particular regard to their computational complexity.

Roman Kontchakov's web pages

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Oded Lachish

Interests:

My area of research is algorithms and their applications, in particular sub-linear algorithms and property testing.

This line of research is focused on computation with extremely limited resources – when memory is scarce, or answers are required before there is time to read the whole input. Such scenarios are very common. For example, the financial sector deals with massive data sets and requires instant results; in computational biology, genetic code can be read, but only at a slow rate.

Oded Lachish's web pages

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Mark Levene

Interests:

My main research interests are in the areas of Web Search Engines and Web Mining.

Here there is scope to develop innovative web sites, web and search engine user interfaces, recommender systems, and more generally to use machine learning to improve Web Interaction.

I also have an interest in Machine learning in games such as Chess and Go and more generally in Game AI.

Project ideas:

1. State-of-the art move generation for strategic games such as (but not limited to) Chess or Go, according to the student's interests. New methods that we are developing will be tested against existing methods. There is also scope for parallelisation of the algorithms.
2. Testing reinforcement learning algorithms for the machine either to learn a user profile or to improve and adapt its play.
3. Developing game AI methods for either a strategic or a computer game.

Suggested reading:

An Introduction to Search Engines and Web Navigation, by Mark Levene, 2nd edition published by Wiley, 2010.

Artificial Intelligence for Games, by I. Millington and J. Funge, 2nd edition published by Morgan Kaufmann, 2009.

Mark Levene's web pages

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George Magoulas

Interests:

Modelling, Learning, Adaptation and Evolution in Complex Environments.
Adaptive Web-based Systems, Personalised Learning Environments, User Modelling.
Computational and Nature-inspired Approaches, Particle Swarm, Differential Evolution, Neural Networks.

Project ideas:

Neural networks for time-series analysis and forecasting
Backpropagation training and local minima

The use of neural networks in medical imaging

Texture recognition and classification using neural networks

Genetic algorithms for simulation optimisation

Knowledge-based neurocomputing in user-adaptive systems

Hybrid Genetic Algorithms in User-adaptive systems

Methods for improving generalisation

Data clustering with graph theory

Data Mining in Personalisation

Personalisation in e-commerce, e-health, digital libraries, e-learning, e-museums, TV, mobile computing (several projects)

For more detail on these projects, with suggested reading, see www.dcs.bbk.ac.uk/~gmagoulas/FyP_project_proposals.htm

George Magoulas' web pages

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Nigel Martin

Interests:

Information management, integration, analysis and mining, with a particular interest in bioinformatics and life sciences applications. While my own research has focussed on techniques appropriate for life sciences applications, I am interested in wider application areas and have supervised projects involving the management and analysis of data in areas such as archaeology, astronomy, geography and genealogy. As I enjoy music and play a number of instruments with enthusiasm if not great technique, I am always interested in applications involving music.

Project ideas:

Many approaches to the integration and analysis of genomic and associated biological data have been developed. Can you develop ways of linking such data to geographical maps and develop software to support the analysis and visualisation of that data in epidemiology studies?

Many applications require access to "related" data in different databases but it is not pre-defined what the relationships between the databases are as would be the case in a conventional data integration setting. Techniques are emerging to enable querying of linked databases where only partial information is available on the nature of the links, and this information is changing over time. Can you develop and implement techniques which support the querying and analysis of such linked data sources?

Alternatives to the classical relational database architecture, sometimes referred to as NoSQL, are often characterised by not having a fixed schema nor a record-oriented underlying structure. Traditional database capabilities such as querying, optimization, concurrency control, as well as more advanced capabilities such as database integration, are not supported in the same way as in conventional relational databases. Can you take a NoSQL architecture, a database capability and a suitable application area to enable you to assess different approaches to the implementation of that capability for the given architecture?

Nigel Martin's web pages

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Keith Mannock

Interests:

Software engineering with particular attention to object-oriented and multi-paradigm programming languages.

Web applications, Grails, Rails, Lift, Spring, JEE, etc.

Cloud computing, mobile apps, distributed systems.

Information retrieval with particular attention to content-based image indexing and retrieval.

For further advice on projects, see Keith Mannock's web pages

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Steve Maybank

Interests:

Computer vision and image processing, including properties of image pixel values, detection of structures in images such as lines and circles, stereo vision, the inference of the shapes of objects from image sequences and camera calibration.

Project ideas:

Investigation of the statistical properties of pixel values in natural images.
The use of probability density functions to record information about the shape or appearance of objects.
The matching of points between two images of the same scene.
Generation of computer graphics style object models from image sequences.

Suggested reading:

R.C. Gonzalez and R.E. Woods, *Digital Image Processing*, Prentice Hall, 2nd ed. 2002.

Any introductory text on probability or statistics. Try
http://www.sjsu.edu/faculty/gerstman/StatPrimer/Probability.PDF

and also the less introductory text: E. Jaynes *Probability theory: the logic of science.* Cambridge University Press, 2003.

Steve Maybank's web pages

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Szabolcs Mikulas

Interests:

My research interests include algebraic, modal, substructural and temporal logic. I am interested in supervising projects with a mathematical/logical aspect.

Project ideas:

Currently I teach two modules and I list two possible topics related to them.

Computer Systems: Interprocess communication, and concurrency in general, have some logical aspects (e.g., showing that proposed solutions meet the requirements). A simulation tool would be useful for demonstrating the complexities involved.

Knowledge Representation and Reasoning: Another direction is to use automated reasoning techniques for different logics. One option is to implement decision procedures resulting in automated theorem provers.

Szabolcs Mikulas' web page

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Alex Poulovassilis

Interests:

My research interests are in advanced data management techniques for querying, integrating and personalising distributed heterogeneous information, particularly as arising in the e-learning and e-science domains.

Project ideas:

Visual Schema Integration Tool:
This project will design and develop a visual tool to support the integration of heterogeneous database schemas into an integrated virtual global schema. The tool will build on and extend the existing functionality

of the AutoMed heterogeneous data integration toolkit. The tool will allow users to incrementally transform and integrate a set of source database schemas, and to validate the integrated schema produced after each iteration by seeing whether, and to what extent, it supports a required set of constraints supplied by the user.

Programme: AIS/IWT
Prerequisites: Advances in Data Management module
Suggested reading: see AutoMed web site
See also the technical report by Jianing Wang (this project would build on and extend software being developed by Jianing)

Semantic integration of distributed RDF data sources
Research into techniques for integrating distributed RDF Linked Data sources is still in its early stages and up to now only keyword search, link traversal and federated querying have been explored over such data sources. This project will design and develop a tool to support the semantic integration of RDF Linked Data sources supporting SPARQL endpoints, possibly building on the existing functionality of the AutoMed heterogeneous data integration toolkit and/or existing systems for query processing over RDF data.

Programme: AIS/IWT
Prerequisites: Advances in Data Management module
Suggested reading: see AutoMed web site

Visual tool for supporting lifelong learners
This tool will allow users to record information about their learning and work experiences to date, and future educational and career aspirations. This information will be stored in an RDF/S repository, and users will be able to submit queries to this database in order to find out what others with similar backgrounds to them have gone on to do in their educational and career choices. Flexible query processing techniques will be used in order to return a ranked list of answers to users' queries. This work builds on recent work in the MyPlan project, and also our work on flexible query processing over RDF data.

Programme: AIS/IWT/Learning Technologies
Suggested reading: see the presentation and MyPlan project website
Contact AP for more recent papers.

Visual teacher's tools for supporting exploratory learning
This project relates to the MiGen research project, which is building a pedagogical and technical environment to support 11-14 year-old students' learning of mathematical generalisation. The project is adopting a constructionist, exploratory approach, allowing students to create and manipulate patterns and algebraic expressions within a visual environment and to perceive the relationships between them. The exploratory nature of our learning environment requires that personalised feedback be provided to students by the system during their construction process. Also, since students are undertaking loosely-defined rather than structured tasks, teachers need to be assisted in monitoring their

students' actions and progress by appropriate visualisation and notification tools. This MSc project will involve adding new tools, targeted at the teacher, to the current suite of tools supported by the MiGen system.

Programme: AIS/IWT/Learning Technologies
Suggested reading: see presentation and MiGen project website
Contact AP for more recent papers.

Alex Poulovassilis' web pages

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Igor Razgon

Interests:

I am interested in supervision of BSc projects related to Artificial Intelligence. In particular:

Writing software for solving puzzles such as Sudoku or the Freecell Game.

Writing software for playing board games with open information (e.g. chess, checkers, go, wolf and sheep). I would not expect the resulting product to play stronger than a human player but it must be able to do things beyond just making a legal random move.

Writing software for playing games with partly closed information. My favourite game of this sort is 'Five or more'.

Igor Razgon's web pages

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George Roussos

Interests:

Pervasive and mobile computing i.e. deeply embedded network computing affecting all aspects of everyday life. My own work is in systems research and prototyping, as well as reality analytics and human dynamics observed through such technologies. I am also working with RFID in different situations.

Project ideas:

For some ideas, see http://www.dcs.bbk.ac.uk/~gr/muc/projects.html

Suggested reading:

George Roussos, *Networked RFID: Systems, Software and Services*, Springer, 2008.

V. Kostakos, E. O'Neill, A. Penn, G. Roussos and D. Papadogkonas, 2010, *Making sense of urban mobility and encounter data*, ACM Trans. CHI, http://www.dcs.bbk.ac.uk/~gr/pdf/tochi09.pdf

George's web pages: http://www.dcs.bbk.ac.uk/~gr/

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David Weston

Interests:

Spatial point pattern analysis.

Machine learning, data mining, outlier detection

Machine vision.

Computational Uses of space-filling curves.

For further advice on projects, with suggested topics and reading, see David Weston's web pages

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David Wilson

Interests:

The Information Systems Development (ISD) process. Strategic issues in Information Systems. Cross-cultural issues in Information Systems, Outsourcing & Off-shoring, Project Management in ISD.

Project ideas:

Most of the projects I supervise are social science case studies of the impacts of Information Systems on organisations, markets or societies. Students embarking on such projects, whether U/G or P/G should have taken the appropriate research methods module in the Department of Management. Access is usually vital in such studies and students should have clarified with candidate respondent organisations that they will be allowed to put their findings up for examiners' and preferably public scrutiny. A good case study will illustrate something that others may learn from, so, if you have worked on an innovative project, whether thought to be a success or failure, it may make a good case study. Alternatively, the impacts of an emerging technology may make the basis of a wider study, as would an historical study of an IS technology which was expected to take off but failed, e.g. compare the market acceptance of the Newton and the iPad.

I may also supervise implementation projects or systems definition projects, which deliver artefacts (e.g. working systems or detailed specifications) that I will find useful in my roles in the Department as Programme Director and Admissions Tutor.

Suggested reading:

Avison, D.E. and Fitzgerald, G. (2006) *Information Systems Development: Methodologies, Techniques And Tools*, 4th ed McGraw Hill

Checkland, P. (1981) *Systems Thinking, Systems Practice*, Wiley.

Dave Wilson�s web pages: www.dcs.bbk.ac.uk/~dave

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Peter Wood

Interests:

My main interest has always been in languages for querying data: their design, computational complexity and optimisation. In particular, I am interested in languages for querying graph-structured data, a topic which has seen renewed interest with the advent of the semantic web and social networks. (The language proposed for representing semantic web information, namely RDF, can be viewed as a language for defining graph structures. Similarly much social network data can naturally be seen as a graph of connections.) Other areas I have worked in include XML querying, active rule languages (similar to database triggers), deductive rule languages (e.g. Datalog), and compression techniques for XML. Most recently, I have been working on algorithms for combining recommendations from recommender systems as well as a query and transformation language for social network data.

Project ideas:

I'm interested in supervising projects in any of the above areas. In the past I have also supervised projects which build tools for XML development, such as authoring, validation, transformation or query optimisation tools. Another topic which might be suitable for projects is that of graph visualisation, i.e. how to display very large graphs so that users can browse them effectively.

Suggested reading:

My web pages (see link below) contain links to papers on many of the above topics.

Peter Wood's web pages

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Michael Zakharyaschev

Interests:

I am happy to supervise any project related to the Semantic Web, ontology development and maintenance, querying ontologies and databases, automated reasoning.

I am also interested in supervising projects in the following areas:

Automata (deterministic, non-deterministic, pushdown). For example, design and develop an animated visual simulator, together with a GUI suitable for using the simulator as an educational tool for beginners. A database of good examples (preferably in XML format) should also be constructed.

Equivalence-testing algorithms for finite automata. For example, understand, implement and compare several algorithms that determine whether two non-deterministic finite automata are equivalent or not. A friendly user interface, and an example-generator facilitating systematic testing would also be required.

Turmites implementation (see wikipedia page).

Michael Zakharyaschev's web pages

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Dell Zhang

Interests:

My main interests are in information retrieval, data mining and maching learning.

I am also interested in complex networks, such as social and economic networks.

For further advice on projects, with suggested topics and reading, see Dell Zhang's web pages

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