

SCHOOL OF ELECTRONIC ENGINEERING AND COMPUTER SCIENCE

STAFF PROJECTS AND AREAS OF EXPERTISE

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SUPPORTED BY THE

institute of
CODING

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DR ANNE HSU

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Areas of Expertise and Interests:

- Psychology
- Computer Science
- Mobile/Web App Development
- Interaction Design
- Natural Language Processing

Also see link for further info:

<https://intranet.eecs.qmul.ac.uk/courses/studentprojects/projects/type/msc/supervisor/23254>



General Info:

If you do your project with me these are things to know: **All these projects are for students with strong coding skills.** I won't be helping with any code implementation details or debugging code etc. Thus my projects are suitable for students who feel confident and proficient in their programming skills and ability to code independently. I will expect you to learn all programming needed your own or know how to do it already. There are lots of free online resources to learn any type of language and help on all sorts of coding problems. I will help you learn what it is to do a research project, and teach you about the research background related to the project.

Instructions for All students. IF YOU WANT TO APPLY, YOU MUST PROVIDE THE FOLLOWING INFORMATION:

1. Your name, and which project(s) you are interested in.
2. A short paragraph on why you are interested in your chosen project(s).
3. A list of the coding languages you know and your self-rated proficiency at coding in the language, rating from 1-5, where 1 is poor/weak and 5 is Excellent.
4. Your overall course marks last year.

Project Ideas

Software to support Diplomatic Communication API

I have a pre-made API that processes text and gives responses that helps people be diplomatic with their communication. This is a supervisor-led project where student will develop web/mobile/email or chat plugins to create useful apps using this API. An example of a web-based demo can be seen here:

<https://communication-helper.firebaseio.com/>

Natural Language Processing Model for specificity in communication

This is a supervisor led project. Here we want to compare/create different natural language processing and machine learning models that can rate how 'specific' a phrase, sentence or paragraph is. This is for the purpose of rating how unambiguous and clear communication is. The project will include doing a review of existing datasets and perhaps create novel ones suitable for modelling this.

Mobile/web app for anything you want

Create a mobile or web app to do whatever you'd like. The more sophisticated the better, but a key aspect of development is using agile technology and integrating design and development with lots of user testing. You may choose whatever tech stack you like. You will need to be able to design, develop, test, and user-test and follow good, principled software development methodology.

DR ARKAITZ ZUBIAGA

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Areas of Expertise and Interests:

- Natural Language Processing
- Social Media Mining
- Social Data Science

Also see link for further info:

<https://intranet.eecs.qmul.ac.uk/courses/studentprojects/projects/type/msc/supervisor/67304>



Project Ideas

Countering hate speech in social media

Social media has become a place for people to communicate with each other online. On the downside, this is also producing the proliferation of hate being spread across people with different opinions and backgrounds. Hate speech between online users is a big problem for social media, sometimes leading to mental health problems for people being attacked online, as well as leading to increase of violence in the streets. This project will consist in developing a system, using machine learning and natural language processing, to detect hate speech messages in social media.

Quantifying and visualising online bias

Society suffers from ideological biases, for instance when certain news or political issues are reported. As an example, terrorist attacks don't always get the same amount of coverage, depending on where they happen or who is affected, despite the actual damage of the events being similar.

The aim of this project is to develop a visualisation tool. The user can choose two topics of their interest (say 2 separate terrorist attacks). The tool will collect data associated with those two topics (e.g. from social media or news outlets) and will visualise different statistics associated with those two topics, e.g. volume of content, geographical distribution of the posts. This will allow the user visualise how two topics are treated differently, helping quantify the underlying bias.

PROFESSOR ARUMUGAM NALLANATHAN

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Areas of Expertise and Interests:

- Wireless Communications

Also see link for further info:

<https://intranet.eecs.qmul.ac.uk/courses/studentprojects/projects/type/msc/supervisor/54702>



Project Ideas

Deep learning for Internet of Things

NarrowBand-Internet of Things (NB-IoT) is an emerging cellular-based radio access technology, which offers a range of flexible configurations for different coverage enhancement (CE) groups to provide reliable uplink connections for massive IoT devices with diverse data traffic. To optimize the number of served IoT devices, the uplink resource configurations need to be adjusted in real-time according to the dynamic traffic, this brings the challenge of how to select the configurations at the Evolved Node B (eNB) in the multiple CE groups scenario with high-dimension and interdependency. In this project, Real-time optimization approaches for configuration selection will be developed.

Machine Learning in UAV

The UAV flies over a region from a starting point to a destination. During its flight, the UAV wants to communicate to the ground devices for maximizing the cumulative collected data by optimizing the trajectory of the UAV subject to its flight time constraint. Due to uncertainty in the locations of the ground devices and the communication dynamics, an accurate system model is difficult to acquire and maintain. In this project, with the help of stochastic modelling, a reinforcement learning based automated trajectory optimization algorithm will be developed.

DR ATHEN MA

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Areas of Expertise and Interests:

- Social networks
- AI and Climate Change

Also see link for further info:

<https://intranet.eecs.qmul.ac.uk/courses/studentprojects/projects/type/msc/supervisor/3158>



Project Ideas

Nature ecosystems, like social networks, consists of many nodes and links. Climate change does not only affect individual species but the entire ecosystem as a whole, but current understanding on the assembly of natural ecosystems and their whole-network level response is very limited. Advances in social network analysis and AI techniques can help us learn and reveal key properties in ecological networks and gauge the effects of climate change.

Social network analysis helps identify significant properties in large-scaled networks, such as motifs and communities which help disseminate ideas and maintain network integrity. Can we use these techniques to profile ecological networks and help us safeguard these precious ecosystems that we all depend on?

Issues on biomonitoring - Biomonitoring is often labour intensive as it involves taking samples from different physical sites. Can we use AI techniques (e.g. machine learning, recommendation techniques) to help generate realistic ecological networks and reduce the physical sampling effort that currently required?

With the emergence of IoT, can we develop portable toolkits that enable the general public to take part in biomonitoring?

Based on the areas mentioned above, please contact Athen if you would like to discuss project ideas.

MR BHUSAN CHETTRI

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Areas of Expertise and Interests:

- Machine Learning
- Deep Learning

Also see link for further info:

<https://intranet.eecs.qmul.ac.uk/courses/studentprojects/projects/type/msc/supervisor/51850>



Background: Voice biometric system and spoofing attacks

Voice biometric systems use automatic speaker verification (ASV) technology for user authentication. The main goal of an ASV system is to verify the identity of a claimed person using their voice characteristics. Even if it is among the most convenient means of biometric authentication, the robustness and security of ASV in the face of spoofing attacks (or presentation attacks) is of growing concern, and is now well acknowledged by the community. A spoofing attack involves illegitimate access to personal data of a targeted user. The vulnerability of ASV systems against spoofing attacks is an important problem to solve because it poses a serious threat to the security of such systems. When successful, a spoofing attack can grant unauthorized access of private and sensitive data. Spoofing attack methods include:

1. text-to-speech (TTS)
2. voice conversion (VC) techniques
3. impersonation
4. playing back speech recordings (Replay attack)

High-stakes ASV applications, therefore, demand trustworthy fail-safe mechanisms (countermeasures) against such attacks. A countermeasure (CM) or anti-spoofing system is defined as a binary classifier that aims at discriminating bonafide (human speech) utterances from spoofing attacks. To allow maximum re-usability across different applications, the ideal CM should generalise across environments, speakers, languages, channels, and attacks. In practice, this is not the case; CMs are prone to overfitting. This could be due to variations within the spoof class e.g. speech synthesizers or attack conditions not present in the training set, within the bonafide class e.g. due to content and speaker, or extrinsic nuisance factors e.g. background noise. Like any traditional machine learning classifier, a spoofing countermeasure typically consists of a frontend module (for feature extraction from raw speech signal), a backend module (classifier) and a decision logic (for the final classification based on a decision threshold).

The main aim, therefore, is to develop anti-spoofing solutions (frontend or backend or both in an end-to-end setting) using deep learning from different perspectives as outlined in the projects below.

Project 1: Deep learning for detecting fake speech generated using TTS and VC algorithms.
Dataset: Publicly available benchmark ASVspoof 2015 and ASVspoof 2019 LA datasets
Pre-requisites: Some basic knowledge on signal processing and interest in deep learning.

Project 2: Deep learning for fake speech detection: a case of stolen speech, replay attack
Dataset: Publicly available benchmark ASVspoof 2017 and ASVspoof 2019 PA datasets
Pre-requisites: Some basic knowledge on signal processing and interest in deep learning.

Project 3: Transfer learning for efficient spoofing detection

Aim: Can you transfer knowledge from anti-spoofing system trained to detect TTS and VC attacks for replay spoofing detection (and vice-versa)?
Dataset: Publicly available benchmark ASVspoof 2015 and ASVspoof 2019 LA datasets
Pre-requisites: Some basic knowledge on signal processing and interest in deep learning.

Project 4: Unsupervised learning for fake speech detection

Aim: use of auto-encoders (AE) and/or variational autoencoders (VAE) for spoofing detection. AE/VAE can be used either for effective feature learning (transforming high dimensional input to a lower dimensional latent space) or for model initialisation. If it is used for model initialisation, then discriminative models can be trained on top of it for classification. This can be discussed once project starts.

Dataset: Benchmark ASVspoof datasets.

Pre-requisites: Some basic knowledge on signal processing and interest in deep learning.

Project 5: End to end deep learning for audio spoofing detection

Aim: Learning both feature extractor and classifier from raw speech data in an end-to-end setting using 1D convolutional neural network.

Dataset: Benchmark ASVspoof datasets.

Pre-requisites: Some basic knowledge on signal processing and interest in deep learning.

Project 6: Fake speech detection - a multi-task deep learning approach

Aim: Investigating deep learning model to train more than one task where the primary task is to discriminate between bonafide and spoofed speech and secondary task could be for example detecting speakers? Choosing an appropriate secondary task is important. This can be discussed in more detail later during the project.

Dataset: Benchmark ASVspoof datasets.

Pre-requisites: Some basic knowledge on signal processing and interest in deep learning.

Project 7: Representation learning for spoofing detection

Aim: use deep learning methods to learn effective feature representation. Here the focus of the work would be on front-end (feature extraction). Having learned an efficient feature representation simple machine learning classifiers (for example Support Vector Machine) or even a shallow feed forward neural network could be trained for classification.

Dataset: Benchmark ASVspoof datasets.

Pre-requisites: Some basic knowledge on signal processing and interest in deep learning.

If you find these project ideas interesting please feel free to contact me: b.chettri@qmul.ac.uk
See also some of my papers here: <https://scholar.google.co.uk/citations?user=Ht6H2WgAAAAJ&hl=en>

MS BING HAN

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Areas of Expertise and Interests:

- Information Technology Management
- Supply Chain Management
- Innovation Management
- Business Process Transformation



Project Ideas

Social Media Marketing – New Applications

Social Media Marketing is changing the landscape of business, especially in the area of marketing. You might like to choose a small or medium-sized enterprise that you're familiar with, examine its existing marketing strategies and related technologies and propose some new marketing strategies based on the application of new technologies in the area of Social Media. Discuss the implementations as well as the impact.

A Case Study on the Creation of New Business Models using IoT, from the Perspective of SMEs

IoT is just the broad area that technologies are asserting impacts on the future of the business world. Choose a specific area that you're familiar with, examine its existing marketing or other business strategies and propose some new strategies based on the changes made by new technologies. Discuss the implementations as well as the impact.

AI Technology that Facilitates the Transformation of a Conventional Business Model – a Case Study

New developments in AI or Machine Learning are opening up new horizons for conventional business models, e.g. eMarketing, mobile technologies, online/virtual businesses. There have been transformations inside business organisations too, e.g. the shortened distance between customers and the suppliers using new algorithms; the extended information system that enhances the efficiency of the global supply chain. Pick an organisation that you're familiar with and examine how a traditional enterprise is and can be transformed.

New Application of Efficiency-enhancing Technologies in the Healthcare sector – a Case Study

The application of new technological development in cloud and other information technologies can enhance efficiencies in the service industries, especially in the healthcare processes. You'll need have familiarity with, and access to the existing business processes in the healthcare industry to take up this project.

Re-engineering of a Conventional Business Function/Process, e.g., in HRM, or Sales, etc.

Many traditional business functions/processes need to be redefined with the development of new technologies in the ICT sector, e.g., Salesforce. Can you provide a new/better solution for any of the business processes that are currently used in business organisations? You'll need to have access to a real business organisation to take on this project.

DR CHARALAMPOS SAITIS

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Areas of Expertise and Interests:

- Music information retrieval
- Digital musical instruments
- Computational acoustic modelling
- Musical haptics and audio-haptic interaction
- Crossmodal music cognition
- Semantic audio
- Biosignal information retrieval

Also see link for further info:

<https://intranet.eecs.qmul.ac.uk/courses/studentprojects/projects/type/msc/supervisor/67634>



Project Ideas

Based on the areas mentioned above, please contact Charis if you would like to discuss project ideas.

DR CHRIS PHILLIPS

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Areas of Expertise and Interests:

- Hardware design specially using 8051-based microcontrollers
- Network Protocols and Routing / Network Simulation
- Assembly Language

Also see link for further info:

<https://intranet.eecs.qmul.ac.uk/courses/studentprojects/projects/type/msc/supervisor/3139>



Project Ideas

Anything that involves the design, implementation and evaluation of the listed themes (areas of interest). It is highly desirable that have undertaken modules such as Digital Circuit Design, Microprocessor Systems Design, Communication Networks or similar.

DR DIEGO PEREZ-LIEBANA

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Areas of Expertise and Interests:

- Artificial Intelligence
- Games
- Search Methods for Game AI (tree search, evolutionary computation)
- Forward Model learning

Also see link for further info:

<https://intranet.eecs.qmul.ac.uk/courses/studentprojects/projects/type/msc/supervisor/54749>



Project Ideas

Based on the areas mentioned above, please contact Diego if you would like to discuss project ideas.

PROFESSOR EBROUL IZQUIERDO

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Areas of Expertise and Interests:

- Computer Vision
- Image Processing



Project Ideas

Based on the areas mentioned above, please contact Ebroul if you would like to discuss project ideas.

PROFESSOR EDMUND ROBINSON

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Areas of Expertise and Interests:

- Functional Programming
- Logic
- Category Theory
- Semantics

Also see link for further info:

<https://intranet.eecs.qmul.ac.uk/courses/studentprojects/projects/type/msc/supervisor/3060>



In my experience, trying to pick from a list of project selections is not necessarily the best way to decide on a project. I would be happy to talk with you about possible projects, but before doing that I would like to ask you to think about some questions first:

- What do you want to do when you finish your degree here?
- What skills or knowledge do you need in order to get the job you want?
- How much of those have you learnt, or will be learning through taught courses?
- Are there gaps that it would be useful to fill with skills learned on your project?
- Are there things that you may have studied briefly, or in isolation, but that would be useful to do in more depth on your project?
- If you imagine yourself in an interview, how would you like to be able to use your project to support your application?

Once you've thought through what you want to achieve, and how the project can help you, then it is a lot easier to find a suitable project.

Left to myself I am keen to supervise projects in functional programming, but I can also "business manage" projects across a wider area where I am not so expert.

DR ELIANE BODANESE

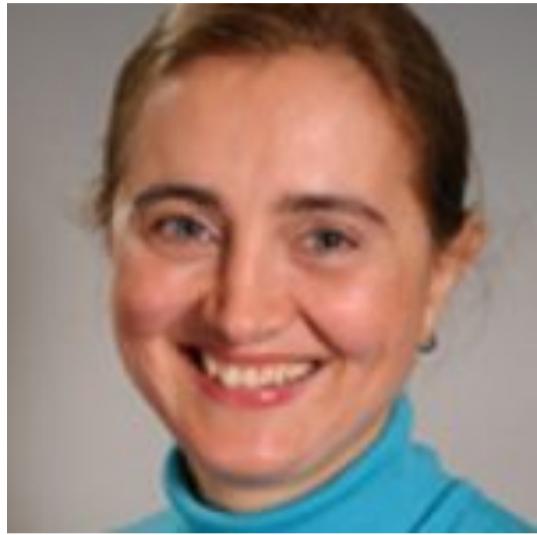
eliane.bodanese@qmul.ac.uk

Areas of Expertise and Interests:

- Wireless Networks
- Sensor Networks
- Distributed Systems
- Internet of Things
- Indoor Localisation
- ADL recognition
- Rescue Localisation
- Micro-Doppler Detection

Also see link for further info:

<https://intranet.eecs.qmul.ac.uk/courses/studentprojects/projects/type/msc/supervisor/3127>



Project Ideas

Based on the areas mentioned above, please contact Eliane if you would like to discuss project ideas.

DR ERANJAN PADUMADASA

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Areas of Expertise and Interests:

- Online Privacy
- Privacy Enhancing Technologies
- Social Media
- Internet User
- Decision Making

Also see link for further info:

<https://intranet.eecs.qmul.ac.uk/courses/studentprojects/projects/type/msc/supervisor/42696>



Project Ideas

Based on the areas mentioned above, please contact Eranjan if you would like to discuss project ideas.

DR FABRIZIO SMERALDI

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Areas of Expertise and Interests:

- Machine Learning
- Pattern Recognition
- Interactive Installations
- Computer Vision
- Text Processing
- Web Scraping
- Sensors
- Data Analysis

Also see link for further info:

<https://intranet.eecs.qmul.ac.uk/courses/studentprojects/projects/type/msc/supervisor/3025>



Project Ideas

Reaction time test

A reaction time test using a raspberry pi and existing dedicated hardware, for use in open days/science fairs.

An evolution simulator

Some web based software to simulate evolution of string sequences (in fact sentences), using various constraints. To use as an aid in teaching evolution.

DR FLYNN CASTLES

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Areas of Expertise and Interests:

- Electromagnetics
- Metamaterials
- Active materials
- 3D printing



Project Ideas

QMUL on the head of a pin

This project aims to use the world's highest resolution 3D printer (a Nanoscribe Photonic Professional GT2) to reproduce a 3D scale model of the Mile End campus on the head of a pin. Tasks will include sourcing/creating the necessary CAD file, operating the printer, transferring the print to the pin head, and imaging the print using optical and electron microscopy.

3D printing of diffractive optical elements

This project aims to use the world's highest resolution 3D printer (a Nanoscribe Photonic Professional GT2) to create diffractive optical elements that will project the QMUL logo, and other images, using a laser.

Levitation via control

Permanent magnets produce forces between themselves and other ferromagnetic bodies that are of sufficient magnitude to readily counteract the force of gravity (e.g., a paper clip will be lifted by a permanent magnet). However, a famous theorem in electromagnetism shows that one cannot use a static arrangement of permanent magnets to stably levitate another permanent magnet / ferromagnetic body in free space (e.g., one cannot get the paper clip to float in mid-air – it will always either stick to the magnet or drop). This project aims to employ concepts of control engineering (i.e., sensing and feedback) to generate stable levitation in free space using an electromagnet with a time-varying magnetic field.

The inverted pendulum

An inverted pendulum (a rod with a mass at the top and a pivot at the bottom, say) is inherently unstable: it tends to fall over under the action of gravity. This project aims to employ concepts of control engineering (i.e., sensing and feedback) to generate a stable inverted pendulum.

Modelling diamagnetic levitation

Permanent magnets produce forces between themselves and other ferromagnetic bodies that are of sufficient magnitude to readily counteract the force of gravity (e.g., a paper clip will be lifted by a permanent magnet). However, a famous theorem in electromagnetism shows that one cannot use a static arrangement of permanent magnets to stably levitate another permanent magnet / ferromagnetic body in free space (e.g., one cannot get the paper clip to float in mid-air – it will always either stick to the magnet or drop). On the other hand, the magnetic field created by static permanent magnets can be used to stably levitate a diamagnetic body such as a piece of pyrolytic carbon (see, e.g., <https://en.wikipedia.org/wiki/Diamagnetism>). This project aims to model theoretically such levitation and, using the insights gained, to optimise the experimental demonstration of the effect.

Levitating bubbles in a static electric field

It is well known that all materials experience a force in an inhomogeneous electric field. A famous theorem in electromagnetics shows that one cannot use this force, however, to stably levitate any passive material in free space using a static electric field. On the other hand, an insulating body can be levitated stably within another medium if the dielectric permittivity of the body is less than that of the surrounding medium. This project aims to demonstrate this effect for bubbles of one fluid contained within another.

Stability of active metamaterials with negative static electric susceptibility

Metamaterials are artificial materials that may be engineered to exhibit novel properties not seen in natural materials. Similarly, active materials (those that have an internal source of power) may exhibit properties that are fundamentally impossible in passive materials. Recent research has shown that by combining these concepts, active metamaterials may be created that exhibit negative static electric susceptibility—the hitherto missing electric analogue of diamagnetism (<https://doi.org/10.1002/adma.201904863>). These materials exhibit, or are expected to capable of exhibiting, a number of novel properties, with potential applications, for example, in quantum computing. However, many open questions remain about their stability with respect to self-induced polarisation. This project aims to investigate theoretically the stability of models of negative static electric susceptibility materials.

Low-frequency dielectric characterisation of 3D-printed BaTiO₃/ABS polymer composites

3D printing is used extensively in product prototyping and continues to emerge as a viable option for the direct manufacture of final parts. It is known that dielectric materials with relatively high real permittivity—which are required in important technology sectors such as electronics and communications—may be 3D printed using a variety of techniques. Among these, the fused deposition of polymer composites is particularly straightforward but the range of dielectric permittivities available through commercial feedstock materials is limited. This project aims to characterise the low-frequency dielectric permittivity of a series of 3D-printed composites composed of various loadings of BaTiO₃ microparticles in the polymer acrylonitrile butadiene styrene (ABS).

DR GIANNI ANTICHI

g.antichi@qmul.ac.uk

Areas of Expertise and Interests:

- Network Monitoring
- Networking Systems Performance Characterization
- Software Defined Networking
- Dataplane Programmability



Project Ideas

Based on the areas mentioned above, please contact Gianni if you would like to discuss project ideas.

DR GEORGE FAZEKAS

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Areas of Expertise and Interests:

- Music Apps
- Music Recommendation
- Retrieval, Similarity
- Semantic Web
- Databases and Ontologies

Also see link for further info:

<https://intranet.eecs.qmul.ac.uk/courses/studentprojects/projects/type/msc/supervisor/2917>



Project Ideas

1) Are you interested in creating cool music apps (desktop or mobile)?

Whether it is for mobile (so your friends can use it) or desktop, here are some ideas I'm interested in helping you:

- **Recommend music** based on similarity or mood (<http://eecs.qmul.ac.uk/~gyorgyf/research.html#musicmood>)
- **Intelligent music editing** and production (e.g. extend an audio editor or DAW like Audacity, Reaper or Ardour)
- **Create funky playlists** from your music collection
- **Music education apps**: help people learn an instrument
- **Music performance**: help the audience interact with musicians (<http://eecs.qmul.ac.uk/~gyorgyf/software.html#moodconductor>)
- **Intelligent digital audio effects** for music production: (see e.g. <http://eecs.qmul.ac.uk/~gyorgyf/software.html#semanticcompressor>)

2) Research and/or Apps using Semantic Web and Ontologies

The Semantic Web is the new intelligent web that supports machine understanding of web content (text, music, images, videos) and allows for finding things in more intuitive ways. Here are some possible projects in this area:

- Analyse text documents to extract relations and build ontologies using NLP techniques
- Music artist linking and recommendation using Semantic Web databases (such as DBpedia)
- Do music artists with more relations to each other also play music that sound similar?
- **Trending artists**: analyse social media and youtube to understand who is popular and why
- Applications of Web APIs and Semantic Web resources e.g. in music/media/finance/bioinformatics etc.

General skills required

- Be good at programming (preferably Python or C++) but otherwise know either of Matlab, R, Java, Javascript
- Be motivated and independent
- Be able to understand scientific literature and conduct literature review
- For app based projects: Understand what is needed to prove that your application is working
- For research projects: Understand how to evaluate algorithms and basic knowledge about statistics
- Ability to understand existing, complex software (and/or be an open-source enthusiast)
- Good time management and writing skills
- **Be motivated to write a short scientific publication** (e.g. workshop or conference paper)
- Ability to **start working on your project from day one**

Additional skills that help in my projects:

- **Digital Signal Processing** (particularly audio DSP, Fourier transform, audio feature extraction, etc.)
- **Music Information Retrieval** (see: <http://www.ismir.net/conferences.php>)
- **Data modelling skills**: e.g. in Resource Description Framework (RDF), Ontology Web Language (OWL)
- **Machine Learning / Deep Learning** (e.g. familiarity with NumPy, SciPy, Sci-kit Learn, Tensorflow, PyTorch, Keras)
- **Natural Language Processing** (e.g. NLPTK, sentiment analysis, etc.)
- **LaTex** (I recommend Overleaf: <overleaf.com>) for report/paper writing
- Web development skills, particularly Single Page Applications (e.g. Angular) and/or Python backends (PyFlask, Django)
- Analytical skills: basic statistics, probability, Bayesian inference, etc.
- Industry experience (e.g. internships, developer or research experience)
- Understanding software requirements and documentation

Contact (please follow the advice below before contacting me):

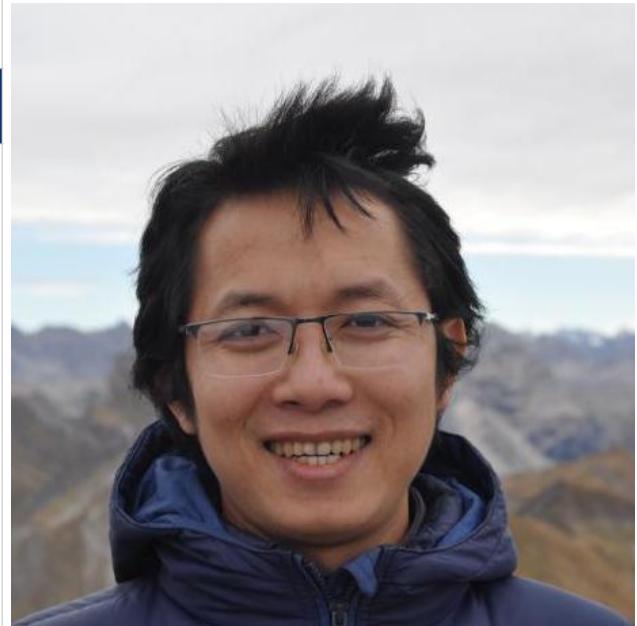
- **See my research first:** <http://eeecs.qmul.ac.uk/~gyorgyf/> (copy the link into your browser)
- **Contact by email:** g.fazekas@qmul.ac.uk
- **Put [UG Project] in the subject line**, followed by your intended email subject (I may miss your email otherwise!)
- My supervision slots are limited and tend to fill quickly. Contact early to set up an appointment.
- In your email, **describe your background**, and say a few words about **why would you want to choose a project** in the categories above
- I'm open to your own project ideas (as long as they are aligned with my research areas).
- **Think about your project** before contacting me about supervision. I'm likely to ask questions like these:
 1. How does the project idea fit with your background?
 2. What are the new skills and knowledge you would like to acquire?
 3. Have you read any papers related to the project you select or propose?
 4. Do you intend to focus on research or implementation and assessment?
 5. How will you prove (on paper) that your project was successful?
- **Please do not contact me while the answer to any of the above is "No" or "I don't know"**
.... (think first, set up appointment afterwards)

DR HUY PHAN

h.phan@qmul.ac.uk

Areas of Expertise and Interests:

- Audio signal processing
- Biosignal analysis
- Machine learning
- Deep learning



Project Ideas

I am interested in supervising projects in using machine learning/deep learning to analyse audio or biosignals (e.g. EEGs). In general, good programming skills (e.g. Python and Matlab) are required. The project work is expected to work with deep learning frameworks, such as Tensorflow.

Besides the projects below, you are welcome to suggest for other proposals. If you are interested in working with me, please contact me at <h.phan@qmul.ac.uk> indicating the project (or the description of your proposal), and a paragraph to explain your motivation and skills. Further information like grades in relevant modules would be helpful.

Small-footprint deep learning for audio event detection

Large deep-learning models, e.g. hundreds of thousands of parameters or more, are expensive in term of both memory and computation overhead whereas on-device audio event detection systems usually require models with small footprints due to their limited resources. This projects aims to explore quantization and pruning techniques to reduce model footprints and investigate how these techniques will affect the detection performance of a deep learning model.

Low-cost deep-learning acoustic sensor with Raspberry pi and Tensorflow

Setting up a deep-learning system for acoustic monitoring, e.g. in-home monitoring, is not straightforward. This projects aims to develop a sensor for low-cost on-device acoustic monitoring that requires minimal setup, i.e. plug-and-play, leveraging Raspberry pi and Tensorflow. Deployment of a simple audio event detection is also expected to demonstrate the usability of the sensor.

Automatic detection of sleep micro-event in EEGs

Sleep spindles and K-complexes are two important micro-events observed in electroencephalographic (EEG) recordings during sleep. They are hallmarks of sleep-related cognitive processes. Identifying these micro-events are important for sleep studies. However, manual identification is very tedious and time-consuming. The project aims to develop a machine learning algorithm, deep learning in particular, to detect these micro-events automatically that could provide valuable assistance to researchers and clinicians.

Is it possible to predict epileptic seizure in EEGs?

Seizures are transient aberrations in the brain's electrical activity. People with epilepsy suffer from recurrent seizures. The seizure events usually occurring at unpredictable times and without warning can result in a lapse of attention or a whole-body convulsion, increasing the risk of physical injuries. Automatic detection of seizure onset is common, it may be too late to react, e.g. delivering therapy or notifying a caregiver. This project aims to use machine learning and signal processing to analyze the electroencephalogram (EEG) signals before seizure onsets to predict seizure events before they take places.

DR IGNACIO CASTRO

i.castro@qmul.ac.uk

Areas of Expertise and Interests:

- Network economics
- Internet measurements
- Data science



Project Ideas

Based on the areas mentioned above, please contact Ignacio if you would like to discuss project ideas.

DR ILDAR FARKHATDINOV

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Areas of Expertise and Interests:

- Robotics
- Programming
- Electronics
- Modelling
- Control
- Sensors
- Motors
- Virtual Reality
- Human-Machine Interaction
-

Also see link for further info:

<https://intranet.eecs.qmul.ac.uk/courses/studentprojects/projects/type/msc/supervisor/54320>



Project Ideas

The following are quite general project titles. More specific tasks can be discussed individually. Most of the project proposals require some programming, electronics/mechatronics design and integration, modelling and experimentation.

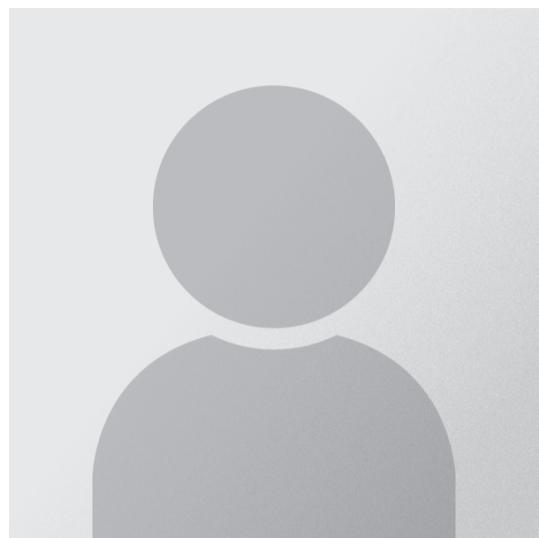
1. All-terrain mobile robot with hybrid legged-wheel structure. Modelling, design, build, control and testing of a mobile robot for different terrains.
2. Electronics and control system design for a tracked mobile robot.
3. Human-machine interfaces with haptic (force) feedback for remote control of mobile robots.
4. Human-friendly mobile robotic systems for disinfection (COVID-19 case).
5. Design of a portable robotic system for hand rehabilitation and biomechanics research.
6. Design and manufacturing of a wearable haptic interfaces based on particle jamming.
7. Development of an automatic system to test 3D printed prototypes for medical applications (COVID-19 case).
8. Computer vision for telerobotics in extreme environments. You will use computer vision to recognise mechanical fixtures in remote industrial facilities.
9. Soft robotic system for human ergonomics and posture control. You will design a robotic system to support human back (spine) posture.
10. Matlab based real time control of a rehabilitation robot.
11. Wearable robot to support human balancing during walking.
12. Robotic ankle platform for remote mobile robot control.
13. Human body augmentation with additional (supernumerary) robotic arms.
14. Wearable vibrotactile haptic feedback system based on wireless IoT solutions.
15. Seated robotic motion simulator for virtual reality.

MS JANE REID

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Areas of Expertise and Interests:

- Information Retrieval
- Distance Learning
- Human Computer Interaction



Project Ideas

Based on the areas mentioned above, please contact Jane if you would like to discuss project ideas.

DR JESUS REQUENA CARRION

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Areas of Expertise and Interests:

- Statistical Data and Signal Processing
- Data Science
- Modelling and Simulation
- Biomedical Engineering



Project Ideas

Based on the areas mentioned above, please contact Jesus if you would like to discuss project ideas.

DR JOHN SCHORMANS

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Areas of Expertise and Interests:

- Broadband Packet Networks
- Computer Simulation
- Packet Network Analysis and Measurements
- Networks and Computer Systems Scheduling



Also see link for further info:

<https://intranet.eecs.qmul.ac.uk/courses/studentprojects/projects/type/msc/supervisor/3142>

Project Ideas

Simulation of different computer / network scheduling schemes in the presence varying job length distribution, using MATLAB.

Scheduling, the decision process by which the order in which jobs will be worked on, is a critical element in CPU operation and in router operation in packet networks. This project aims to evaluate key metrics, e.g. waiting times, and use these as a means to compare effectiveness.

Stability of QoE prediction for networks.

User Quality of Experience, QoE, is a new way of measuring the effectiveness of a broadband network, uniquely in terms of what the user sees. Algorithmically, QoE is evaluated as a function of various QoS metrics, e.g. delay, jitter and loss.

Statistical investigation of packet delay distribution in mobile broadband networks.

User Quality of Experience, QoE, is a new way of measuring the effectiveness of a broadband network, uniquely in terms of what the user sees. In mobile network, packet delay distribution has been used as a very simple proxy measure for QoE. It is currently unclear what kinds of distributions these networks create for the packets that pass through them. Statistical tests can be used to test various hypotheses.

Effectiveness of packet probing as a QoS measurement tool in broadband packet networks, using MATLAB or equivalent.

Packet probes (small, dedicated packets) are used to sample the performance measures associated with broadband packet networking – delay, jitter and loss. It is unclear how effective this is, given for example the high variability in load on such networks. This project aims to address this issue using MATLAB to build a model of such a network, and evaluate probing effectiveness in terms of accuracy and precision.

Investigation into the effectiveness of network emulation as a tool for evaluating application quality in broadband packet networks.

A recent addition to the analysis and simulation of packet networks has been the emulation of packet networks' performance. Uniquely emulation allows real applications to be tested under real-life conditions by the artificial addition of loss, delay and jitter. There are a number of emulators available, and all have limitations.

DR JOSEPH DOYLE

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Areas of Expertise and Interests:

- Cloud Computing
- Green Computing
- Containerization
- Control Theory

Also see link for further info:

<https://intranet.eecs.qmul.ac.uk/courses/studentprojects/projects/type/msc/supervisor/59745>



Project Ideas

Based on the areas mentioned above, please contact Joseph if you would like to discuss project ideas.

PROFESSOR JOSHUA REISS

joshua.reiss@qmul.ac.uk

Areas of Expertise and Interests:

- Audio and Music Technology

Also see link for further info:

<https://intranet.eecs.qmul.ac.uk/courses/studentprojects/projects/type/msc/supervisor/3141>



Project Ideas

Sound Effect Synthesis

This project involves procedural audio and physical modeling techniques to create sound effects (explosions, rain, engines...) used in games and film.

DR JULIAN HOUGH

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Areas of Expertise and Interests:

- Natural Language Processing
- Human-Robot Interaction
- Multimodal Processing
- Dialogue Systems
- Chatbots
- Virtual Agents

Also see link for further info:

<https://intranet.eecs.qmul.ac.uk/courses/studentprojects/projects/type/msc/supervisor/16558>



Project Ideas

IT Service Chatbot Development from real user data

The project involves developing and evaluating a chatbot for a real-world scenario- that of an IT services chat helpline at Queen Mary which answers visitor and student queries about IT problems. Chat data is currently being collected continuously from the IT services team, and this will form the basis for developing the chatbot, using different Natural Language Processing machine learning techniques. The chatbot developed will be evaluated with human users and will feature in the next version of the ITS chatbot if improvements are made. This is a chance to become involved in a real-world chatbot development team.

Object Tracking and Property Classification for an Interactive Robot

The project involves the development of an object tracking system from a video stream for a robot with manipulation abilities which responds to voice commands. The system built will track the positions of real-world objects from a camera feed and also classify each object as having several properties (such as 'roundness') in real time. The success of the system built will be measured in terms of how well it performs in a pipeline used in an interactive robot- specifically how successfully the robot understands spoken commands referencing the objects in the scene such as 'put the red ball in front of the hat'.

Natural Language Understanding for an Interactive Robot

The project will involve working on an existing Natural Language Understanding (NLU) framework, the DyLan dialogue system, in an effort to improve the ability of an interactive robot to correctly identify objects and understand instructions to move objects from spoken voice commands. There will be flexibility allowed as to which part of the system to work on (from extending computer vision capabilities to extending the natural language parser).

Developing a Robot Simulation Environment

The project will involve building a 3D framework for robot simulation using Unity to test a user perception of different movements by virtual robots. A desired outcome will be for at least one simple existing robot to be implemented as a simulation, being capable of a number of different tasks and testing the perception of those movements in an evaluation study.

Laughter Detection from Audio and Visual information

In the quest to make virtual agents more likeable and human-like, detecting when a user is laughing is an incredibly important sub-task. This project will involve building a laughter detection system from a dataset of face-to-face interactions from both audio data from microphones and visual information from the video feed.

DR KAMYAR MEHRAN

k.mehran@qmul.ac.uk

Areas of Expertise and Interests:

- Power Electronic
- Renewable Energy
- Storage Technology
- Electrical Grid
- Electrical Vehicles
- Control Engineering

Also see link for further info:

<https://intranet.eecs.qmul.ac.uk/courses/studentprojects/projects/type/msc/supervisor/45897>



Project Ideas

To find suggested project topics for undergraduate and MSc project, please refer to this link <http://kamyarmehrani.eecs.qmul.ac.uk/join-our-team/> in Kamyar's laboratory.

This by no means is an exhaustive list and I am always open to novel project ideas proposed by prospective project students if the topics are inline with the research field of RPCS lab. Based on our established research track-record and industrial collaboration, I have listed some suggested topics below.

Project Ideas - ENERGY STORAGE and POWER ELECTRONICS

Equivalent circuit modelling (ECM) and state-of-charge (SoC) estimation of Li-ion batteries (LiBs)

Project objectives:

- Develop realistic ECM of LiBs to show the battery dynamics like SoC and temperature variation
- Developing state-of-charge estimation algorithms using Adaptive Filtering Algorithms such Kalman Filter, Extended Kalman Filters, etc

Physics modelling of the Li-ion batteries (LiBs) for battery electric vehicles

Project objectives:

- Develop Pseudo-2-dimensional (P2D) modelling of batteries to represent all the electrochemical reaction in the batteries during charge/discharge and dynamics like heat transfer and capacity fade

Multi-physics modelling of the Li-ion batteries (LiBs)

Project objectives:

- Develop Pseudo-2-dimensional (P2D) electro-chemical models of LiB cells to represent all important dynamics including charge/discharge, capacity fade, heat transfer, parasitic reactions between electrode and electrolyte, etc.
- Develop current density and magnetic field models of the LiB electrolyte using COMSOL multi-physics software.
- Validate the current density models using disruptive Graphene-based magnetometer sensors for the online monitoring of the in-situ current flow within individual Li-ion pouch cells
- Develop thermal gradient models of the LiB cells using internal resistance of the individual battery cells
- Develop an effective strategy to calculate the capacity fade of in the individual cells using the multi-physics models

Condition Monitoring of the Silicon Carbide (SiC)-based power electronic converter in electric vehicles using machine learning

Description: Power electronic converters (PECs) underpins modern electric and hybrid vehicles allowing efficient energy transfer between the vehicle battery system and the drive motors. To simplify construction, reduce costs and increase reliability, manufacturers are seeking ever-tighter system integration. However, this level of integration poses a number of significant challenges including interlinked heat transfer paths, bond wire lift-off and unwanted thermal stresses.

Project objectives:

- Investigate a multi-physics sensor fusion technique to provide accurate prognostics for highly integrated SiC-based PECs.
- Develop machine learning techniques to find correlation between seemingly different type of data , i.e. temperature, electrical quantities (V , I , Z) and mechanical displacement (wire bond movement/device deformity) on the power module.

Thermal characterisation of the Silicon Carbide (SiC)-based power electronic converter using multi-physics modelling

Project objectives:

- Develop Magnetic field (current density) modelling of the power modules using COMSOL multi-physics software
- Develop thermal characterisation models using current density models and heat flux analysis to represent all the temperature gradients accurately in the power module

High Efficiency Power Electronic interface for Vehicle-to-grid (V2G) application

Description: The use of Electrical Vehicle (EV) battery pack to supply power to the grid (V2G) increases reliability and consistency in the grid as the renewable source, e.g. wind, solar, undergoes its natural fluctuations. Furthermore, power quality can be increased with having battery storage for charging/discharging electricity to the grid. V2G operation is generally using power electronic converters (dc-dc & VSC) and inverters to act as a bidirectional charger capable of charging and discharging the battery on demand while complying with grid standards. Commercial bidirectional chargers typically use conventional 2-level silicon-based PWM converter topologies able to switch at relatively low frequencies. As a result, compared to the size of the battery or EV, they are relatively bulky and suffering from significant power losses.

Project objectives:

- Modelling and designing more efficient power converters based on Silicon-carbide switching devices to reduce the size of bidirectional chargers and reduce the power losses.
- Developing novel converter topologies and control strategies for the rapid response (low latency with high switching frequency) to the grid demand.

Stability analysis of the battery pack and bi-directional charger for Vehicle-to-grid (V2G) application

Battery energy storage system (BESS) increases reliability and consistency of the supplied power in the grid as the renewable source, e.g. wind power, solar panel, undergoes its natural fluctuations. Furthermore, power quality can be increased with having battery storage for charging and discharging electricity to the grid. However, the capital cost of battery packs is a major obstacle and one solution is to use aged battery packs from electrical vehicle (EV). Aging can change characteristics such as the internal resistance, capacity and efficiency of the battery pack. Bi-directional dc-dc converters and voltage source converters (VSCs) used to connect the battery pack to the rest of the system may become unstable as well.

Project objectives:

- Stability analysis of the power electronic converter subject to variation in internal voltage and resistance of the battery pack.
- Simulation of the integrated system (battery pack, converter) using Matlab/Simulink

Silicon-Carbide-Based Power Electronics for Wave Energy Converters

Unlike fossil fuels, wave energy is clean, sustainable and causes no air pollution and noise. Compared with wind, solar and other RES, wave energy is also more steadily available and has denser energy concentration, which can be captured by wave energy converters (WECs). This project is industrially sponsored by EcoWavePower Ltd (<https://www.ecowavepower.com/>) developed ground-breaking on-shore economical WEC systems.

Project objectives:

- Develop novel control approaches and state-of-the-art WEC power electronics to significantly improve the WEC overall performance so that LCOE of wave can be close to or even lower than that of solar.
- An integrated WEC design using silicon carbide devices to increase switching speed (20KHz), blocking voltage capabilities and tolerance to junction temperature and the efficiency of the power output (> %98.5). The design must simplify the construction, reduce costs and increase temperature reliability (+40°C) using a novel package.

Hypeloop - the next generation of public transport

Description: The Hyperloop is an open-source idea proposed by the futurist and founder of Tesla, SpaceX, Elon Musk as an alternative mode of transportation to the California High Speed rail project to significantly reduce the travel time and cost of inter-city journeys. The first Hyperloop will be between Los Angeles and San Francisco reducing the travel time to only 30 minutes with a total estimation of 840 passengers per hour. Currently many organizations, private companies, government agencies, universities and student group have formed R&D projects and competitions based on this concept which resulted in multiple variation of the Hyperloop system ranging from the use of the original concept of "Air Bearings" to the use "Electromagnetic suspension".

Virgin Hyperloop One is the company which builds the first real prototype of Hyperloop (<https://hyperloop-one.com/>). This project is for building a miniature system demonstrating the Hyperloop concept and find an innovative solution for challenging air resistance and pressure through the Hyperloop pod to achieve an aircushion lift and proportion to minimize friction and resistance in motion within a low pressure or near vacuum tubing. This project is a well-rounded engineering project that students need to demonstrate different skills and knowledge including planning and cost estimation.

Project objectives:

- Develop MATLAB simulation models for an electro-mechanical propulsion system, i.e. a motor system, to achieve levitation and propulsion through either Air Bearings or Electromagnetic Levitation.
- Develop a motor controller to regulate the motor system through a control panel/program communicating with the capsule via wireless communications (TCP).
- Develop motor drive control system design using a micro-controller
- Design and Develop software GUI for controlling the motor and communication system
- Mechanical design/3D printing of the hyper-loop capsule and tube

Fully Battery-powered Electric Propulsion System for Small Marine Boats

Description: In UK small marine vessels vastly outnumber large marine vessels and collectively create far more pollution on a par with that from the respective Heavy Goods Vehicle population. Large marine vessels have already started benefitting from electric drivetrains reducing emissions and costs. However, the sector of smaller vessels has not adopted the technology due to the hurdle of 'no Regenerative Braking', well-known in Automotive Electric Vehicles. Moreover, the transient dynamics caused by large load variations in small ships seriously reduce the efficiency of the electric drivetrain and need specialised torque measurement techniques. This project is industrially sponsored with the DuodriveTrain, <http://www.duodrivetrain.uk/>, and have the following objectives:

Project objectives:

- Develop a mathematical modelling framework in MATLAB/Simulink for the mechanical marine propulsion system with the associated electric drive system (including electric motors) to create a complete electric drive system energised by batteries.
- Develop novel predictive control/optimisation approaches using (DuodriveTrain's patented direct torque & thrust measurement technique to remove the transient dynamics in the electric drive trains including the electric machines,
- Increase the electric drive propulsion efficiency in conventional as well as autonomous surface vessels, and improve battery life using optimisation techniques

Project Ideas - ENERGY EFFICIENCY IN BUILDING ENVIRONMENT

Residential Load Forecasting for Individual Appliances: Machine Learning Approach

Energy companies and government face challenges in successful smart meters roll-out where only ~50% of the planned smart meters are installed in homes in UK. Companies can hardly give any estimation to their customers or users that how much energy they will save in the future, and how they can translate the saving to money. This project is industrially sponsored by Voltaware Ltd (<https://voltaware.com/>)

Project objectives:

- Develop machine learning techniques for the prediction of power consumption by the individual home appliances.
- Developing state-of-the-art real-time monitoring tools using their disaggregated power consumption data collected from three countries UK, Italy and France and several households.

Wireless Intelligent agent for Energy Management in Home Environment using Situational Awareness algorithms

Description: Low-cost monitoring of energy usage and providing energy efficiency by a home energy management system (HEMS) is still a challenging problem considering the rise of household energy cost. Algorithms like situational awareness (SA) can be employed for the real-time scheduling, power distribution, and automation of wireless sensor network (WSNs) of home appliances/renewables. Such algorithms can provide a vision of the network events before the event occurs in a distributed fashion.

Project objectives:

- Develop machine learning (ML) techniques to learn the behaviour of home users using energy usage pattern data
- Implement an intelligent agent for the SA-based HEMS system. The agent will make automated decisions to control the home renewable sources (wind/solar + batteries).
- Design suitable communication system for the SA-based system architecture including appropriate Communication protocol, security algorithms,
- Selection of an appropriate Ad-hoc network (MAC layer, Physical layer)
- Develop optimal Control/Adaptive Dynamic Programming (ADP) for optimising the wireless sensor networks (WSNs).

Project Ideas - WIRELESS ENGINE MONITORING

Onboard calibration of diesel engines using wireless sensor networks for emission reduction and performance boost in small marine boats

Description: One of the significant challenges in small and mid-size Marine Vessels is cutting the Fossil fuel use & air pollution generated by the current marine diesel engines. This project is industrially sponsored with the DuodriveTrain, <http://www.duodrivetrain.uk/>, and have the following objectives:

- Develop an integrated energy monitoring system using an engine wireless sensor network (eWSN) and a propeller cartridge to enable torque & thrust data (with position/speed) readings and remote monitoring.
- Investigate a specialised and modern sensors (ultrasonic, optical, ...) to acquire the measurements in the harsh environment like ship's engine.
- Design the sensor network (different locations of sensors and the proximities to the marine engine) for the patented award-wining propeller cartridge, TorqueFlange® to send an accurate monitoring data to the engine.
- Develop an advanced sensor fusion technique to significantly reduce the probability of measurement error using signal processing, ML and AI techniques.

Wireless sensor networks for the monitoring of the diesel engines in small marine boats using beam-forming techniques

Description: Beamforming can provide narrow beams with significant gains, and directional and secure transmissions with high spectral efficiency. This project is industrially sponsored with the DuodriveTrain, <http://www.duodrivetrain.uk/>, and have the following objectives:

Project objectives:

- Design an antenna array with directional radio links (beam-forming) for the sensors to communicate in real-time with the engine control unit.
- Carry out Link-budget study and ray-trace testing to calculate the power loss in transmission and determine the best sensor location.

PROFESSOR KASPAR ALTHOEFER

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Areas of Expertise and Interests:

- Force and Tactile Sensing for Robotics
- Soft and Stiffness-controllable Robot Structures
- Neuro-Fuzzy Techniques for the Classification of Sensor Signals
- Intelligent Techniques for the Interpretation of Quadrupole Resonance Signals
- Manipulation and Grasping
- Haptics

Also see link for further info:

<https://intranet.eecs.qmul.ac.uk/courses/studentprojects/projects/type/msc/supervisor/50798>



Project Ideas

Based on the areas mentioned above, please contact Kaspar if you would like to discuss project ideas.

DR LAURISSA TOKARCHUK

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Areas of Expertise and Interests:

- Mobile and social sensing
- Machine learning
- Games
- Augmented reality
- Mixed reality
- PCG

Also see link for further info:

<https://intranet.eecs.qmul.ac.uk/courses/studentprojects/projects/type/msc/supervisor/3143>



Project Ideas

If you are interested please book an appointment (<https://laurissat.youcanbook.me>) or email me (if you can't get one).

Title 1: Exploring player behaviour in desktop vs augmented reality.

Title 2: Classifying player behavioural characteristics in augmented reality

Title 3: PCG for level generation in augmented reality games.

Title 4: Exploring diversity using Novelty based algorithm for PCG (in games?).

Title 5: Designing game and gesture interaction for mobile augmented reality.

Title 6: Pitch your idea: Mobile sensing/augmented reality game

Title 7: Pitch your idea: Procedural Content Generation in games

Title 8: Pitch your idea: Augmented Reality

Title 9: Pitch your idea: Mobile sensing for understanding every day behaviour

*some of these ideas are more formed than others...

**as a further note I am not particularly interested in FPGs so unlikely to seriously consider projects that pitch FPG study.

Exploring player behaviour in desktop vs augmented reality.

Search-based procedural content generation has enabled video games to tailor content dynamically with-out much burden on the developer. In recent years techniques such as Compositional Pattern Producing Networks (CPPNs) have enabled the evolution of a diverse range of game content such as guns in a shooter game and flowers in a digital garden. This project will explore the potential of similar techniques to evolve interesting behaviours of agents in an augmented reality (AR) game. For example, these techniques can be applied to an AR Butterfly Catch game where the behaviour of the butterflies is generated dynamically. This project could then be extended with a user study that compares a player's behaviour in the AR Butterfly Catch game vs a non-AR counterpart of the game in order to investigate to what extent player behaviour is different in AR games.

Reading:

Risi, Sebastian, et al. "Combining Search-Based Procedural Content Generation and Social Gaming in the Petalz Video Game." Aiide. 2012.

Hastings, Erin Jonathan, Ratan K. Guha, and Kenneth O. Stanley. "Automatic content generation in the galactic arms race video game." IEEE Transactions on Computational Intelligence and AI in Games 1.4 (2009): 245-263.

Classifying player behavioural characteristics in augmented reality

This research based project involves investigating the types of player experience questionnaires (PEQ) available currently and AR games. Specifically it will address whether or not there are specific things that these questionnaires don't capture. It will classify the existing AR games and study at least one classification in terms of testing the PEQ. Following that you would explore whether the player behaviours detected can be mapped to existing taxonomies like the Bartle types.

<https://dl.acm.org/citation.cfm?doid=2967934.2968095>

https://www.gamasutra.com/view/feature/6474/personality_and_play_styles_a_.php?print=1

PCG for level generation in augmented reality games

Explore concepts around how to generate content and levels for augmented reality games. Develop a basic AR game and apply techniques for automatically creating levels.

Some relevant reading:

<https://www.cc.gatech.edu/~riedl/pubs/aiide-exag16.pdf>

<https://web.media.mit.edu/~sra/papers/procedurally-generated.pdf>

<https://dl.acm.org/citation.cfm?id=2908920>

<https://ieeexplore.ieee.org/abstract/document/6633633/>

Exploring diversity using Novelty based algorithm for PCG (in games?)

Searching for the objective in many problems fails to find interesting or sometimes even solutions in many deceptive domains. Novelty based algorithms help us explore the search space and find solutions. A challenge of these algorithms is that they find a lot of garbage as well. Many techniques have been used to find techniques for directing the novelty without hampering the more "creative" output. Apply these techniques to an area that requires creative or challenging solutions. I suggest exploring PCG for challenging but playable levels in games like Mario or Angry Birds, but am open to proposals.

Suggested reading:

<https://ieeexplore.ieee.org/abstract/document/7860408/>

http://cognet.mit.edu/journal/10.1162/evco_a_00123

Designing game and gesture interaction for mobile augmented reality

What kind of gestures or physical movements could be incorporated in augmented reality interactions? Think of this project as looking at interaction design for new class of AR games. Rather than flick an image of a ball on a phone with physical gestures (that the phone can detect and that wouldn't destroy it), would allow the same types of interaction..

Mobile sensing/augmented reality game

I have supervised a variety of Mobile Sensing/Augmented mobile reality games including "Assassin", Capture the flag, Hot potato, etc. You could look at whole game development or you could look at particular aspects of the interaction/design (such as project 5) - do you have your own idea in this area? Come talk to me!

Procedural Content Generation in games

Procedural content generation in games covers more than just levels, however here are a few of things I have been interested in recently:

Experience Driven PCG

<http://yannakakis.net/wp-content/uploads/2015/11/PID3821875.pdf>

<http://pcgbook.com/wp-content/uploads/chapter10.pdf>

PCG using Quality Diversity

http://www.eecs.qmul.ac.uk/~laurissa/Laurissas_Pages/Publications_files/paper_196.pdf

<http://delivery.acm.org/10.1145/3210000/3205470/p1047-khalifa.pdf?ip=161.23.71.241&id=3205470&acc=ACTIVE%20SERVICE&key=BF07A2EE685417C5%2E53A024A4F41048F4%2E4D4702B0C3E38B35%2E4D4702B0C3E38B35&acm=156984722994e838a62d855c9d4d14901abc646a30>

<https://arxiv.org/abs/1907.04053>

Pitch your idea: Mobile sensing for understanding every day behaviour

The rapid rise in the variety of available smartphones today as well as their wide range of embedded sensors give the researchers unique opportunities for data collection. While the first mobiles were primarily used as communication devices, modern smartphones have now got additional abilities such sensing Motion, Orientation and Location of the individual. Mobile sensing is the research area that uses mobile sensors collectively from an individual or across multiple scales to obtain information about the human characteristics and behaviour [1].

SensingKit [2] is an open-source mobile sensing framework that was developed in Queen Mary University of London. It enables capturing motion, orientation, location, proximity between devices as well as environmental data from all available sensors inside a smartphone device. For more information about SensingKit framework visit <https://www.sensingkit.org>.

Several mobile sensing related works have been published recently, with researchers inferring human emotions with the use of a smartphone app. Pielot et al. [3] were capable of inferring boredom from mobile phone usage data. They also discovered that people are more likely to engage with recommended content when they feel bored. For more information about this study, please visit:

<http://pielot.org/2015/08/when-attention-is-not-scarce/>. More recently, Canzian and Musolesi [4] used mobility (GPS) traces collected by an Android app to predict depressive mood of 28 people with an accuracy of 74%.

The aim of this project is to explore the behavioural patterns of users (conversational engagement, relation to other psychological traits - people have studied depression, perhaps you want to look at personality types or the like) with the use of a smartphone app that opportunistically collects sensor data such as social data (number of calls, SMS's, notifications from WhatsApp), mobility data (GPS, Wi-Fi, Bluetooth), and data related to phone usage (Apps used, time spent in specific category of apps etc).

The student will also have the chance to be part of SensingKit open-source community by adding additional features such as support for new mobile sensors (e.g. SMS logs, Call logs, Notifications, Ringer Mode, App Usage, Data Logs, Wi-Fi), or different ways of data collection (e.g opportunistic sampling).

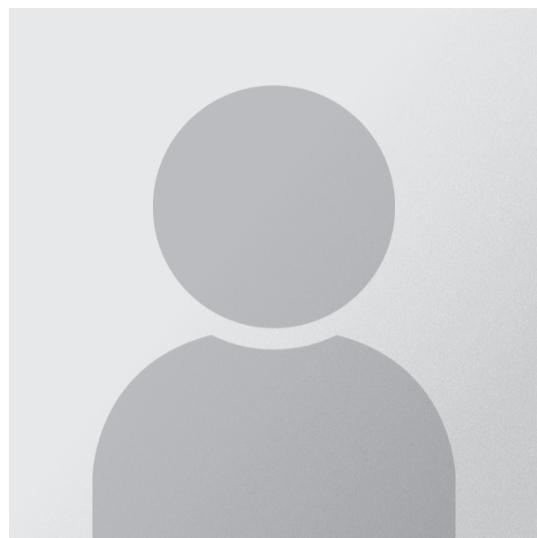
Good object-oriented design and implementation skills in Java are required by this project.

DR LIN WANG

lin.wang@qmul.ac.uk

Areas of Expertise and Interests:

- Audio Signal Processing
- Machine Learning



Project Ideas

Noise reduction for smartphone recording

Smartphone is increasingly used for personal sound recording at home environment or lecture hall. However, the recording is sometime of poor quality due to the influence of environment noise or reverberation. The project aims to develop signal processing and machine learning algorithms to reduce the environment noise from smartphone recordings.

Speech dereverberation for smartphone recording

Smartphone is increasingly used for personal sound recording at home environment or lecture hall. However, the recording is sometime of poor quality due to the influence of environment noise or reverberation. In particular, the recording is highly reverberated if the target sound source is far from the microphone. The project aims to develop signal processing and machine learning algorithms to dereverberate the smartphone recording and improve the speech intelligibility.

Speech enhancement via smartphone network

Smartphone is increasingly used for personal sound recording at home environment or lecture hall. However, the recording is sometime of poor quality due to the influence of environment noise or reverberation. When multiple people use smartphones to record the same event, the smartphones construct an ad-hoc sensor network. The project aims to develop signal processing and machine learning algorithms to enhance the smartphone recording through jointly processing the recordings from multiple devices.

Drone sound detection for safety and security

Mini-drones become prevalent in our daily life and brings some safety and security problems in public area, e.g. near the airport. An early detection of the drone nearly helps safety security control. The project aims to develop signal processing and machine learning algorithm to detect the presence of the drone sound from urban recording.

Transportation mode detection from smartphone devices

Transportation mode conveys an important context information of users during travel, e.g. riding a bicycle or taking a bus. The project aims to develop machine learning algorithms to detect the transportation mode from the multimodal smartphone sensors, including accelerometer, gyroscope, magnetometer and GPS.

DR LORENZO JAMONE

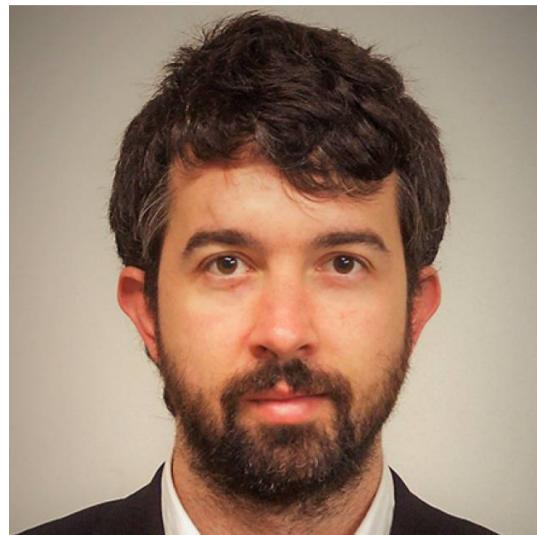
l.jamone@qmul.ac.uk

Areas of Expertise and Interests:

- Robotics
- Signal Processing
- Statistics and Machine Learning
- Software Development
- C++ or Python Programming
- ROS and OpenCV
- Electronics
- Virtual Reality
- Haptics

Also see link for further info:

<https://intranet.eecs.qmul.ac.uk/courses/studentprojects/projects/type/msc/supervisor/54343>



Project Ideas

Social Human-Robot interaction for the future of education

Do you want a robot teacher? This project is about creating the artificial intelligence and motion control of a teacher robot that can adapt its behaviour to the students' behaviour. You will use computer vision technology (either with RGB or RGB-D cameras) for detecting human movements, behaviours and emotions. Humans sometimes feel emotions by looking at objects, animals, or people (e.g. "that flower makes me feel happy!", or "that animal scares me!", or "the tears on that face make me sad"). These "emotional values" or "emotional affordances" are related to both physical attributes and social symbols/concepts, that can be inferred by vision. A good robot teacher (or, in general, a good social robot) should be able to adapt its own behaviour and actions to what the audience feels and shows.

First, you will collect behavioural data in classrooms at QMUL using cameras, observations and interviews. Then, you will develop a software tool for automated and quantified behavioural analysis of the data and create models of the teaching styles and their relationship with students' behaviours and emotions. Finally, you will deploy the models in a social robot (available in the robotics lab). The project should result in a teaching robot that can deliver a lecture (of a few minutes duration) and adapt the delivery of the lecture to the real time detected changes in the audience behaviour.

Software modules will be developed and integrated, using OpenCV, ROS and other existing software libraries. The project requires very good programming (e.g. Python, Matlab, possibly C++ as well) and software development skills, as well as basic knowledge of statistics and probability theory (possibly also machine learning). Basic knowledge of computer vision algorithms would be also helpful.

Robotic Understanding of Object Affordances through Robotic perception and Human-Robot dialogues

John: "What is that object for? What actions can I do with it? I think it can be used for cutting... isn't it?". Sharon: "No, you cannot use that for cutting, is not sharp enough... but you can use that for scooping, probably, or maybe for spreading butter...". Understanding the possible uses of objects (i.e. the object affordances) is one of the cornerstones of human intelligence. We humans learn from our own individual experiences, but also by communicating with other people. The robots of the future, that will be employed in social situations alongside humans, will need to possess these abilities, that are currently very limited in artificial systems.

In this project the student will develop an intelligent system in which a robot (i.e. a UR5 collaborative robot arm equipped with a 4-fingers robot hand with tactile sensors) equipped with both 3D vision (using RGB-D Microsoft Kinect sensor) and speech understanding (i.e. ASR) capabilities will learn the affordances of objects through visual or tactile perception and through a dialogue with a human tutor/helper. The robot should become able to predict the possible affordances of never-seen-before objects, by vision/tactile sensing and by spoken interaction with a human (i.e. a dialogue). Software modules will be developed and integrated, using OpenCV, ROS and other existing software libraries; C++ or Python programming will be needed. The project requires very good programming and software development skills, as well as good knowledge of statistics and probability theory (possibly also machine learning).

Programming by demonstration of human-robot collaborative tasks

The robots of the future will collaborate with humans in different tasks, both in industry and in more unstructured scenarios (e.g. home, hospitals). As of today, programming by demonstration has been used, both in robotics research and industrial applications, only to teach simple tasks to robots (e.g. repetition of a specific arm movement, with simple interaction with the surrounding environment, e.g. autonomous robotic painting of car parts): a big challenge, looking forward at Industry 4.0, is to teach human-robot collaborative tasks, in a natural manner.

In this project, the student will work with a UR5 collaborative robot arm, equipped with a dexterous robotic hand. The objective is to develop software modules (using ROS and other existing software libraries) for natural programming by demonstration of object manipulation tasks, and in particular of tasks that have to be done in collaboration between a human and a robot (e.g. collaborative pick and place of different objects from different locations). The human user should teach robot movements just by moving in front of the robot; the motion of the human will be recorded with a motion tracking system (e.g. RGB-D Kinect sensors, wearable IMUs), and should be adapted to the robot kinematics and used to control the robot motion, using a smart ROS-based software interface.

The project requires very good programming and software development skills, good system integration skills, and basic knowledge of mathematics and statistics (possibly also machine learning).

A robotic sense of touch

The capability to grasp and manipulate objects in a flexible and adaptive manner is the next evolution of robotic hands and grippers, needed to manipulate a number of objects that are currently very difficult to handle (e.g. delicate objects, deformable objects): this evolution targets an enormous market, which includes food industry, manufacturing and medical applications. This require a robotic sense of touch!

In this project, the student will develop a soft tactile/force sensor based on recently developed technology, using of-the-shelf magnetic-sensing chips and magnets embedded in soft materials (i.e. silicone elastomer). Sensors will be mounted on a robotic hand or gripper (available in the robotics lab). Software modules will be developed to read, broadcast and visualize the sensor measurements appropriately. The sensors should be able to measure the force applied to the object, but also information about the texture of the objects, their surface friction, etc... Such information can be used to manipulate the objects, but also to classify/recognize them just by touching them!

Electronic system integration and very good programming skills are required for this task, in addition to good knowledge of signal processing, mathematics and statistics (possibly also machine learning).

Dataglove with fingers tracking and tactile feedback for fully immersive VR and telerobotics applications

With the booming interest in VR and robotics, wearable input devices for human-computer interaction are rapidly evolving; however, solutions to provide fingers tracking and tactile feedback to the human user are costly and not always very effective, ending up in expensive and/or cumbersome devices.

This project will explore novel technologies and design solutions to create a comfortable and nice-looking dataglove that can measure human finger movements (i.e. to interact with a virtual space or to remotely control a robotic hand) and provide tactile feedback to the user (i.e. stimulation of the inner fingers and palm, upon contacts with the virtual or robot environment). Electronics integration and basic programming skills are required for this task.

DR LUK ARNAUT

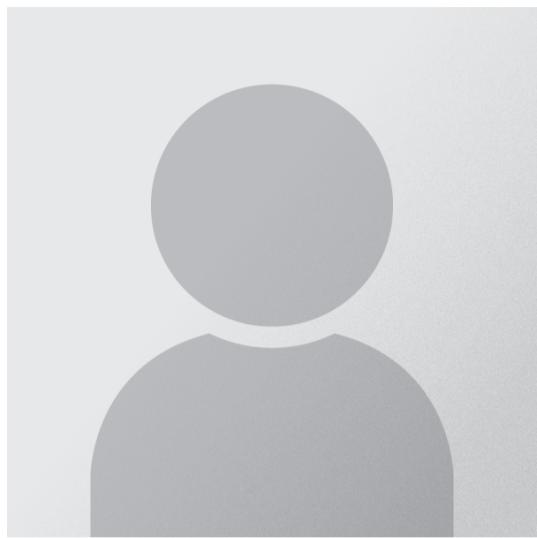
l.arnaut@qmul.ac.uk

Areas of Expertise and Interests:

- Statistical Electromagnetics
- EMC
- Dynamic Multipath Propagation
- Uncertainty Quantification
- Stochastic Processes
- Risk Analysis
- Time Series Analysis

Also see link for further info:

<https://intranet.eecs.qmul.ac.uk/courses/studentprojects/projects/type/msc/supervisor/42790>



Instructions:

If you are interested in any of the listed topics, please contact Luk via e-mail (l.arnaut@qmul.ac.uk) with your CV attached and including a short statement of motivation and why you believe you have suitable background to engage in this topic.

Project Ideas

Passive and active navigation methods for assisted driving

Traditional transmission and reflection off vehicles and obstacles are useful for traffic management and awareness. In addition, purpose signals and data generated and broadcast may reduce latency and anticipate vehicle or obstacle movement before taking place. In this project, active and passive techniques will be investigated for increasing mobility and safety in complex traffic scenarios with a view to increase capacity and mitigate risk.

Electromagnetic sensing for drone navigation

Unlike roadside traffic management, 3-D traffic in built environments such as through street canyons typically needs to be more self-reliant because of sparsity of beacons or scatterers and additional height control. In this project, 3-D navigation based on Doppler and other techniques will be studied for a representative flight path and propagation scenario.

Level crossings and excursions in time series and stochastic systems

Extreme values are ubiquitous in finance and engineering, e.g., MIMO mobile fading channels, subsecond algorithmic trading at the Stock Exchange, etc. Their accurate estimation and characterization is challenging when only single-run data sets are available, as is typically the case. In this project, spectral analysis techniques will be used and extended for reducing uncertainty associated with (A) the duration, frequency and depth of signal fades, or (B) up- and downturns of stock markets, FX trading or other financial data.

Propagation of uncertainty in full-wave simulation based on polynomial chaos expansion

The quantification of uncertainty (UQ) in simulators based on finite-difference equations (representing filtering) is typically based on Monte Carlo methods. Its slow reduction of the standard error makes the technique impractical for the estimation of confidence intervals where each iteration (simulation) is itself already time consuming. In this project, the use of polynomial chaos expansion for the direct estimation of the probability distribution and correlation function (rather than the physical random variable itself, or its moments) will be investigated.

Source reconstruction from near-field scanning of printed circuit boards

The unintentional radiated emissions from printed circuit boards (PCBs) provided information about the proper or malfunction of the circuit. The high density of electronic components and subsystems also raises issues of signal integrity and power integrity (SIPI) and coexistence with other electronic devices in the near vicinity (RF desense and immunity). In this project, near field scan data will be analyzed to image the PCB to extract information on the on-board sources of radiation and their frequency characteristics.

DR MAGED ELKASHLAN

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Areas of Expertise and Interests:

- Cooperative communication
- MIMO systems
- Cognitive radio
- Wireless security
- Millimeter wave communications
- 5G Technologies



Project Ideas

Based on the areas mentioned above, please contact Maged if you would like to discuss project ideas.

DR MAHESHA SAMARATUNGA

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Areas of Expertise and Interests:

- Business and Technology solutions for competitive advantage
- Any business related topic
- Human Resource Management
- Business Modelling
- Marketing



Project Ideas

Based on the areas mentioned above, please contact Mahesha if you would like to discuss project ideas.

DR MARCUS PEARCE

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Areas of Expertise and Interests:

- Music Cognition
- Empirical Aesthetics and Neuroaesthetics
- Emotion and Music
- Auditory Perception
- Statistical Learning
- Expectation and Prediction

Also see link for further info:

<https://intranet.eecs.qmul.ac.uk/courses/studentprojects/projects/type/msc/supervisor/20961>



Project Ideas

Based on the areas mentioned above, please contact Marcus if you would like to discuss project ideas.

PROFESSOR MARTIN NEIL

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Areas of Expertise and Interests:

- Bayesian Modelling
- Risk Quantification
- Machine Learning

Also see link for further info:

<https://intranet.eecs.qmul.ac.uk/courses/studentprojects/projects/type/msc/supervisor/3013>



Project Ideas

Based on the areas mentioned above, please contact Martin if you would like to discuss project ideas.

DR MATHIEU BARTHET

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Areas of Expertise and Interests:

- Music Information Research
- Internet Of Musical Things
- Extended Reality
- Music Perception And Interaction
- Semantic Audio

Also see link for further info:

<https://intranet.eecs.qmul.ac.uk/courses/studentprojects/projects/type/msc/supervisor/4808>



Project Ideas

Smart Guitar

This project aims at developing technologies to extend the playing possibilities of the traditional electric or acoustic guitar. The approach will be to design software and/or hardware audio and sensor technologies that can be embedded on the guitar. User studies with guitarists will be conducted to design and evaluate the system. Possible directions are provided below:

- new controls for guitarists (example of application: inertial measurement unit system to control audio effects such as wah-wah or distortion, or to predicting performers' gestures to generate visualisation in real-time)
- embedded looper or sampler
- sound processing algorithm to extract information from the six strings (example of application: spatialisation of the guitar sound using multichannel systems)
- systems to support networked interactions between performers and audiences.

Music Exploration, Production, or Sonification with Audio Commons

Vast amounts of Creative Commons (CC) digital audio content is legally shared and accessible via the web. The Audio Commons Initiative (audiocommons.org) provides technologies to search and reuse CC audio content. This project aims at developing an innovative interface exploiting Audio Commons content, for example to:

- produce new music from existing samples (e.g. Freesound, <https://freesound.org/>)
- explore Audio Commons content through perceptually-meaningful visualisations
- sonify/"musify" data streams (e.g. weather forecast)

The interface will be evaluated with users using human computer interaction methods.

Perceptual Analysis of Music Production for Automated Assistance

This project aims to investigate how music production decisions influence our perception to inform the design of systems to assist sound engineers or musicians. Example of directions that can be taken are provided below:

- understanding the important dimensions of a mix and their relation to listeners' emotional response (e.g. using psychoacoustics tests)
- developing assistant technology for recording engineers (e.g. to select and position microphones)
- ethnographic studies of musicians/sound engineers (e.g. to analyse how different digital audio workstations or plugins influence creativity).

Performer and Audience Mood Visualiser

The project aims to develop an emotion sensing system to predict the mood of an audience during a live music performance. Various sensors will be considered such as motion detection and biosensors. The predictions will be processed to generate creative visualisations accompanying the music in real time.

Example of desirable skills: client-server development, Processing programming language for visualisation, Eclipse Android Developer Toolkit, human computer interaction, music background

Links:

<http://www.isophonics.net/content/moodvisualiser>
<http://www.qmul.ac.uk/media/news/items/se/137807.html>

Mood Conductor for DJs

Mood Conductor is a system allowing audience members to participate in the musical creations from performers during live performances. The Mood Conductor app (bit.ly/moodxp2) let audience members communicate emotional intentions to performers using mobile devices. The audience's intentions are visualised in real time and projected on screens both for the audience and the performers.

This project will look at adapting the Mood Conductor system for DJs. One of the key challenges for DJs is to find music that suits the need of an audience at a given moment in time. Why not helping them by giving them some feedback during their sets? The Mood Conductor for DJs framework will include a mobile app allowing users to select the type of music they want to listen to and a visualisation system to represent the intentions of the crowd. It will rely on a client/server architecture as established for the Mood Conductor project. Interviews with DJs and club goers can be conducted to determine what type of music parameters users are interested in (tempo, genre, etc.). A partnership with a music venue can be established to test the system in a real situation at the end of the project.

Example of desirable skills: client-server development, JavaScript, HTML5, Python, human computer interaction, music background

Links:

<https://www.flickr.com/photos/matdiffusion/sets/72157634162667686/>
<https://www.youtube.com/watch?v=zHBhidkGypU>

Vocal-based Retrieval of Sound Design Library Sound and Effect

It is often tedious for sound designers to find the sound they have in mind in digital collections of thousands of sounds and effects. This project aims at developing algorithms to automatically retrieve sounds from within a library using vocal imitations. A machine learning approach will be followed using audio-based feature extraction algorithms. A prototype will be implemented using e.g. the BBC Sound Library or Audio Commons content (<https://www.audiocommons.org/>). Development of a plugin compatible with standard digital audio workstation will be considered, e.g using Juce (<https://juce.com/>) and Reaper (<http://www.reaper.fm/>).

Mood-based Music Recommendation

This project aims to develop new music recommendation system using moods expressed by music. A music emotion recognition model will be developed using AI techniques. Access to large-scale commercial or production music collections will be possible for testing and prototyping.

DR MATTHEW HUNTBACH

matthew.huntbach@qmul.ac.uk

Areas of Expertise and Interests:

- Programming languages
- Artificial Intelligence

Also see link for further info:

<https://intranet.eecs.qmul.ac.uk/courses/studentprojects/projects/type/msc/supervisor/3002>



Project Ideas

Abstract Programming Language

This is a general term for programming language based on an abstract model, that is, some sort of data structure which is manipulated by a fixed set of rules. A programming language may be completely defined by a translation to such a model. This is in contrast to conventional programming languages which are converted to machine code and so are only properly defined in terms of how the machine code works. Abstract programming languages cover functional programming languages based on the lambda calculus (examples include Lisp and Haskell), and logic programming languages based on predicate logic (the most well known example is Prolog). There are also some experimental languages based on other models. Your task is to study such a language and make an implementation of the abstract model, possibly also the converter from the language to the abstract model. Your implementation could be in a standard programming language like Java. Good programming skills and confidence with discrete structures are required for a project in this topic, though allowances will be made for the fact that most students in Computer Science at Queen Mary won't have had any formal tuition in programming language theory.

Algorithmic Program Debugging and Synthesis

A method consists of some code structure in which method calls may occur. For any arguments to a method, there will be an expected return value. Suppose you have a method which for some arguments gives the wrong return value. If you execute the method with these arguments and make a record of the arguments to each method call it makes and its return value, you will find either at least one of these method calls has the wrong return value for its argument, or they all give the correct return value for their argument. If they all give the correct return value, the error must occur in the code for the initial method. If one of the method calls gives a wrong return value, then there must be an error in its code or in the code of a method it calls, so you could apply the same technique to locate it until you find the actual faulty method. This is the basis of algorithmic program debugging, a systematic way of debugging code by asking the developer queries about expected return values given arguments to method. Automatic program synthesis takes this further by making modifications to the code of the method identified as faulty and seeing if this produces code which works correctly for all examples given so far.

Two-player Board Games

There is a well-known technique, the alpha-beta algorithm, for getting computers to work out a good next move in a game like chess, that is one with a fixed board and pieces, fixed set of rules, no random elements, two players take it in turn to use a rule to move a piece on the board, and each player can see all of the board and pieces. An essential part of this project would be to understand this algorithm and implement it for some game. There are then various ways of extending this to make a worthwhile project. You could concentrate on building a good interface to make a system where humans play against the computer. You could consider making it a distributed implementation, so a player could interact with the computer player over a network connection. You could investigate variations of the alpha-beta algorithm to see which gives the best computer play. This is a common Computer Science project, but good marks could be obtained by finding some element of originality you can add to it.

Please note, "computer games" of a sort which involve graphics and human players interacting in real time are a completely different sort of thing to this.

Artificial Life

This is another side to artificial intelligence, taking a different approach to the logic and search based techniques of traditional artificial intelligence, of which games-playing programs are a good example. With artificial life, there is no central controller. Instead independent agents each work according to their own rules, and interact with each other. One way in which this is used is to simulate the behaviour of a community of simple animals, such as ants. The idea is to try and find rules which result in behaviour similar to that observed in nature. Another way of using this idea is as a problem-solving technique. There has been a lot of work done in this area, so there are a wide range of topics you could pick from it and try to develop. I don't have any direct suggestion for projects in this area, so it would be up to you to look at the literature and find something you think you can work on and which would make a worthwhile project.

Election Campaign Manager

In this cases, a good project would involve not only a fair amount of software development, but also the ability to look beyond the technology and consider human needs and the impact the technology could have on them.

This is a practical database with interface project: there are existing systems which do this job, and a good potential niche market for anyone who could build a better one. Such a system would keep the records gained from knocking on doors and asking for votes, and produce reports enabling campaign activists to distribute literature and do election-day door-knocking with maximum effect.

Thomas Hare's Electoral System

In this cases, a good project would involve not only a fair amount of software development, but also the ability to look beyond the technology and consider human needs and the impact the technology could have on them.

Divide the number of seats in Parliament by the number of electors in the country to get a figure, the "quota" Q. Anyone who wants to stand for Parliament and can get Q people to agree to support him or her gets elected. Thomas Hare proposed this idea in the 19th century, but practical considerations meant it was never used in this pure form. The "Single Transferrable Vote" system is an attempt to adapt it to paper based voting with voter secrecy maintained. Could we use computer technology to build something closer to Hare's ideal in the 21st century? Remember, maintaining confidentiality and security is vital in using computers to record and count votes in public elections. This project is more experimental than the previous one, to do it well would require a lot of research and original thinking.

DR MATTHEW PURVER

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Areas of Expertise and Interests:

- Natural Language Processing
- Computational Linguistics



Also see link for further info:

<https://intranet.eecs.qmul.ac.uk/courses/studentprojects/projects/type/msc/supervisor/3081>

Project Ideas

Detecting mental states from language/social media

There's a range of projects that could be done here - see my intranet page for a list of more specific suggestions. Possible areas are detecting people's sentiment, emotions or attitudes towards some event (e.g. CoVid-19 lockdown restrictions?), socially important phenomenon (food, fashion), product or service and how they change; detecting and tracking mental health; or investigating how they relate to gender biases and political affiliations.

DR MILES HANSARD

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Areas of Expertise and Interests:

- Computer Vision
- Computer Graphics
- Machine Learning
- Data Visualization
- Human Visual Perception
- Geometry

Also see link for further info:

<https://intranet.eecs.qmul.ac.uk/courses/studentprojects/projects/type/msc/supervisor/20967>



Project Ideas

Processing and rendering of 3D lidar scan data

High quality 3D scans, including colour, can be captured by lidar (laser) based systems. However, if the scanner location is fixed, then the scene is only captured from one viewpoint. This means that holes will appear in the final 3D visualization, if it is viewed from another direction. This project will implement and test some hole-filling methods for outdoor lidar data.

<http://pointclouds.org/>

<http://www.open3d.org/>

<https://link.springer.com/article/10.1007/s00371-016-1316-y>

<https://ieeexplore.ieee.org/document/6238916/>

<https://ieeexplore.ieee.org/document/5457441/>

<https://www.sciencedirect.com/science/article/pii/S0097849318300219>

3D mapping of features inside gemstones

This is a potential industrial project, in conjunction with De Beers, and tomography experts in QMUL School of Dentistry. Further details on application.

Artistic 3D graphics in WebGL

Cel shading (also called toon shading) is a type of 3D graphics that produces cartoon-like images. This is achieved by rendering an ordinary 3D model with modified shaders, which introduce artistic effects. For example, instead of a smooth shadow boundary, the shader may impose a hard boundary, so that the image looks as though it was painted by hand. The project will be done in WebGL, which will require JavaScript and GLSL graphics programming. The results will be evaluated in a perceptual experiment.

https://en.wikipedia.org/wiki/Cel_shading

https://en.wikibooks.org/wiki/GLSL_Programming/Unity/Toon_Shading

<http://rbwhitaker.wikidot.com/toon-shader>

<https://webglsamples.org/toon-shading/toon-shading.html>

Single-view scene reconstruction by Deep Learning

Traditional methods of 3D scene reconstruction are based on multiple views (e.g. stereo vision), or active sensors (e.g. time-of-flight or structured light). However, recent work has shown that it is possible to learn the relationship between ordinary images, and corresponding ground truth depth maps. Given a new image, these systems are able to predict the unknown scene depth, with surprising accuracy. This project will configure a single view reconstruction system, and explore its performance on an outdoor data set. It will also be interesting to investigate whether learning can transfer from indoor to outdoor data, and vice versa.

<https://arxiv.org/abs/1411.6387>

<https://arxiv.org/abs/1411.4734>

Self-localization and mapping (SLAM) with commodity scanners

SLAM is the process of reconstructing the layout (e.g. floor-plan) of the environment, while also estimating the current position and orientation of the mobile sensor. This project will investigate the performance of one of the new generation of cheap lidar (laser) scanners (as used on domestic robots and drones). In particular, the project will address the problems that occur when the sensor is rapidly rotated, which can cause the mapping to fail.

https://en.wikipedia.org/wiki/Simultaneous_localization_and_mapping

http://wiki.ros.org/hector_mapping

DR MUSTAFA BOZKURT

m.bozkurt@qmul.ac.uk

Areas of Expertise and Interests:

- Software testing (inc. mobile and web apps)
- Requirements Capture,
- Mobile and Web apps

Also see link for further info:

<https://intranet.eecs.qmul.ac.uk/courses/studentprojects/projects/type/msc/supervisor/42788>



Project Ideas

Based on the areas mentioned above, please contact Mustafa if you would like to discuss project ideas.

PROFESSOR NICK BRYAN-KINS

n.bryan-kinns@qmul.ac.uk

Areas of Expertise and Interests:

- Interaction Design

Also see link for further info:

<https://intranet.eecs.qmul.ac.uk/courses/studentprojects/projects/type/ug/supervisor/3013/year/next>



Project Ideas

Based on the areas mentioned above, please contact Nick if you would like to discuss project ideas.

PROFESSOR NORMAN FENTON

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Areas of Expertise and Interests:

- Risk Assessment
- Bayesian Networks

Also see link for further info:

<https://intranet.eecs.qmul.ac.uk/courses/studentprojects/projects/type/ug/supervisor/20959/year/next>



Project Ideas

Based on the areas mentioned above, please contact Norman if you would like to discuss project ideas.

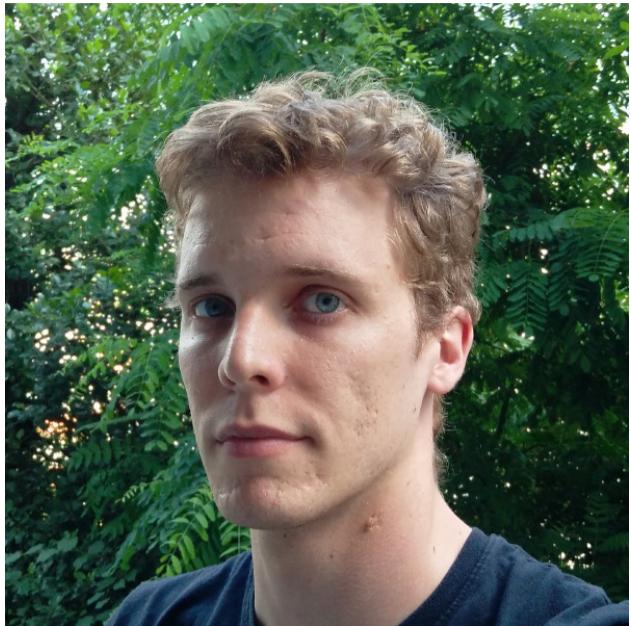
DR PAULO RAUBER

p.rauber@qmul.ac.uk

Areas of Expertise and Interests:

- Artificial Intelligence
- Machine Learning
- Reinforcement Learning
- Recurrent Neural Networks.

I am particularly interested in studying four major challenges that must be addressed efficiently by reinforcement learning agents: building models that enable reliable planning; exploring environments systematically; learning state representations; and generalizing desirable behavior. Please contact me if you have similar interests.



Also see link for further info:

<https://intranet.eecs.qmul.ac.uk/courses/studentprojects/projects/type/msc/supervisor/76086>

Project Ideas

Comparing posterior sampling with model-free reinforcement learning methods

In a typical sparse-reward environment, a reinforcement learning agent receives a non-zero reward only after taking a long sequence of appropriate actions. Sparse-reward environments are one of the greatest challenges for reinforcement learning algorithms.

Posterior sampling (Thompson sampling) is a statistically and computationally efficient Bayesian reinforcement learning algorithm that simultaneously learns a policy and a model of the environment. This algorithm is capable of learning in sparse-reward tabular environments that elude traditional model-free reinforcement learning algorithms [1].

In this project, you will contribute to the understanding of posterior sampling by implementing comparisons with traditional model-free reinforcement learning methods.

[1] Osband, Ian. "Deep Exploration via Randomized Value Functions." PhD thesis, Stanford University, 2016.

Implementing a simplified version of MuZero

Deep reinforcement learning has received significant attention since DeepMind researchers first showed that agents can learn to play many ATARI games directly from images [1, 2]. Since then, among other successes, deep reinforcement learning has been applied to teach agents to play Chess [3], Go [3], Dota 2 [4], and StarCraft II [5].

MuZero was the first algorithm to combine a tree-based search with a learned model to achieve good performance in several of these domains [1]. Notably, its learned model represents states in a way that is not required to match observed states, which enables highly efficient planning.

In this project, you will implement a simplified version of the MuZero algorithm to study its behavior in toy problems.

[1] Mnih, Volodymyr, et al. "Playing Atari with deep reinforcement learning." arXiv preprint arXiv:1312.5602 (2013).

[2] Mnih, Volodymyr, et al. "Human-level control through deep reinforcement learning." Nature 518.7540 (2015): 529-533.

[3] Silver, David, et al. "A general reinforcement learning algorithm that masters chess, shogi, and Go through self-play." Science 362.6419 (2018): 1140-1144.

[4] Berner, Christopher, et al. "Dota 2 with Large Scale Deep Reinforcement Learning." arXiv preprint arXiv:1912.06680 (2019).

[5] Vinyals, Oriol, et al. "Grandmaster level in StarCraft II using multi-agent reinforcement learning." Nature 575.7782 (2019): 350-354.

[6] Schrittwieser, Julian, et al. "Mastering ATARI, Go, Chess and Shogi by Planning with a Learned Model." arXiv preprint arXiv:1911.08265 (2019).

Comparing Bayesian neural networks for recurrent posterior sampling

Multi-armed bandit problems are used as models in systems that manage product recommendations, medical trials, and financial portfolios [1].

An agent in a non-stationary multi-armed bandit problem should balance between exploration and the exploitation of (periodical or structural) patterns present in its previous experiences. Current successful agents require a handcrafted context that allows treating a non-stationary problem as a contextual multi-armed bandit problem.

Recurrent neural-linear posterior sampling is a recent approach that learns to make decisions based solely on the raw history of interactions between the agent and the environment [2].

In this project, you will study different Bayesian neural network approaches [3], and test whether they can be used to improve recurrent posterior sampling.

[1] Bouneffouf, Djallel, and Irina Rish. "A survey on practical applications of multi-armed and contextual bandits." arXiv preprint arXiv:1904.10040 (2019).

[2] Rauber, P., A. Ramesh, and J. Schmidhuber, "Recurrent Neural-Linear Posterior Sampling for Non-Stationary Bandits." NeurIPS Deep Reinforcement Learning and Bayesian Deep Learning Workshops, 2019.

[3] Riquelme, Carlos, George Tucker, and Jasper Snoek. "Deep Bayesian bandits showdown: An empirical comparison of bayesian deep networks for Thompson sampling." arXiv preprint arXiv:1802.09127 (2018).

Generating features that enable learning to play ATARI games by linear value function approximation

Deep reinforcement learning has received significant attention since DeepMind researchers first showed that agents can learn to play many Atari games directly from images [1, 2]. Since then, among other successes, deep reinforcement learning has been applied to teach agents to play Chess [3], Go [3], Dota 2 [4], and StarCraft II [5].

However, it has been shown recently that a simple random search method is capable of learning linear policies that match state-of-the-art deep reinforcement learning on the widely used MuJoCo benchmark [6], which ultimately brings into question whether the performance of deep reinforcement learning algorithms is adequately understood.

In this project, you will study whether the widely used Atari benchmark [2] is adequate to evaluate the performance of reinforcement learning algorithms. You will test whether convolutional neural networks can be used to extract feature vectors for pairs of states and actions that enable learning using linear value function approximation [7], a more traditional (as opposed to deep) reinforcement learning method.

This project is also loosely related to a recent hypothesis stating that a randomly initialized feedforward network contains subnetworks that, when trained in isolation, reach test accuracy comparable to the original network in a similar number of iterations [8].

This project has potential to be the first step towards a scientific paper.

- [1] Mnih, Volodymyr, et al. "Playing Atari with deep reinforcement learning." arXiv preprint arXiv:1312.5602 (2013).
- [2] Mnih, Volodymyr, et al. "Human-level control through deep reinforcement learning." Nature 518.7540 (2015): 529-533.
- [3] Silver, David, et al. "A general reinforcement learning algorithm that masters chess, shogi, and Go through self-play." Science 362.6419 (2018): 1140-1144.
- [4] Berner, Christopher, et al. "Dota 2 with Large Scale Deep Reinforcement Learning." arXiv preprint arXiv:1912.06680 (2019).
- [5] Vinyals, Oriol, et al. "Grandmaster level in StarCraft II using multi-agent reinforcement learning." Nature 575.7782 (2019): 350-354.
- [6] Mania, Horia, Aurelia Guy, and Benjamin Recht. "Simple random search provides a competitive approach to reinforcement learning." arXiv preprint arXiv:1803.07055 (2018).
- [7] Sutton, Richard S., and Andrew G. Barto. Reinforcement learning: An introduction. MIT press, 2018.
- [8] Frankle, Jonathan, and Michael Carbin. "The lottery ticket hypothesis: Finding sparse, trainable neural networks." arXiv preprint arXiv:1803.03635 (2018).

Implementing hindsight policy gradients for environments with continuous action spaces

In a typical sparse-reward environment, a reinforcement learning agent receives a non-zero reward only after taking a long sequence of appropriate actions. Sparse-reward environments are one of the greatest challenges for reinforcement learning algorithms.

If a reinforcement learning agent needs to pursue different goals across episodes, the capacity to exploit information about the degree to which an arbitrary goal has been achieved while another goal was intended appears crucial to enable sample efficient learning. However, reinforcement learning agents have only recently been endowed with such a capacity for hindsight [1,2,3].

In this project, you will extend the existing hindsight policy gradients implementation to work on sparse-reward environments with continuous action spaces, and test whether it still leads to good sample efficiency.

[1] Karkus, Peter, et al. "Factored contextual policy search with bayesian optimization." arXiv preprint arXiv:1612.01746 (2016).

[2] Andrychowicz, Marcin, et al. "Hindsight experience replay." Advances in neural information processing systems. 2017.

[3] Rauber, Paulo, et al. "Hindsight policy gradients." International Conference on Learning Representations (201).

Training a Deep Q-Network to play a challenging ATARI game

Deep reinforcement learning has received significant attention since DeepMind researchers first showed that agents can learn to play many ATARI games directly from images [1, 2]. Since then, among other successes, deep reinforcement learning has been applied to teach agents to play Chess [3], Go [3], Dota 2 [4], and StarCraft II [5].

However, despite some recent successes [6], many of the original ATARI games considered by DeepMind [2] remain challenging for model-free deep reinforcement algorithms, because sparse-reward environments require agents that explore efficiently.

In this project, you will study the problems associated with reinforcement learning in sparse-reward environments, propose original heuristics to address these problems, and implement those heuristics to train a Deep Q-Network that successfully learns to play a sparse-reward ATARI game.

[1] Mnih, Volodymyr, et al. "Playing Atari with deep reinforcement learning." arXiv preprint arXiv:1312.5602 (2013).

[2] Mnih, Volodymyr, et al. "Human-level control through deep reinforcement learning." Nature 518.7540 (2015): 529-533.

[3] Silver, David, et al. "A general reinforcement learning algorithm that masters chess, shogi, and Go through self-play." Science 362.6419 (2018): 1140-1144.

[4] Berner, Christopher, et al. "Dota 2 with Large Scale Deep Reinforcement Learning." arXiv preprint arXiv:1912.06680 (2019).

[5] Vinyals, Oriol, et al. "Grandmaster level in StarCraft II using multi-agent reinforcement learning." Nature 575.7782 (2019): 350-354.

[6] Burda, Yuri, et al. "Exploration by random network distillation." arXiv preprint arXiv:1810.12894 (2018).

DR PENGWEI HAO

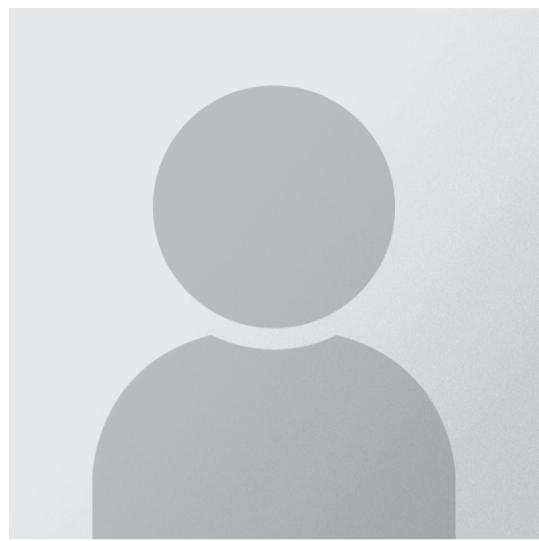
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Areas of Expertise and Interests:

- Computer Animation
- Computer Games
- Image/Video Processing

Also see link for further info:

<https://intranet.eecs.qmul.ac.uk/courses/studentprojects/projects/type/msc/supervisor/3019>



Project Ideas

Based on the areas mentioned above, please contact Pengwei if you would like to discuss project ideas.

DR QIANNI ZHANG

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Areas of Expertise and Interests:

- AI
- Image classification and segmentation
- Medical image analysis
- 3D human modelling



Also see link for further info:

<https://intranet.eecs.qmul.ac.uk/courses/studentprojects/projects/type/msc/supervisor/4368>

Project Ideas

- Estimate high-fidelity 3D human body models from a single image using deep learning
- Chest X-ray image classification based on deep learning networks
- Classification of retinal OCT Images based on deep learning
- Tumour tissue segmentation in histology images
- Cancerous cell detection in histology images
- Sign language recognition based on deep neural networks
- AI based waste classification
- AI based image colourisation
- Multi-class image scene classification
- Cloud detection and segmentation in satellite images

Based on the areas mentioned above, please contact Qianni if you would like to discuss project ideas.

DR RAUL MONDRAGON

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Areas of Expertise and Interests:

- Complex Networks
- Connectivity of The Internet
- Connectivity of Social Networks
- Growth Models of Networks Traffic Analysis



Also see link for further info:

<https://intranet.eecs.qmul.ac.uk/courses/studentprojects/projects/type/msc/supervisor/3159>

Project Ideas

Discovery of network connectivity via traffic analysis

Can we discover the connectivity of the network using only time stamps? The project consist of simulating a simple communication networks, measure the time arrivals and via statistical analysis reconstruct the connectivity of the network. The project requires some background in communication networks or complex networks, some knowledge of statistical methods and manipulation of data.

Image segmentation using community detection

Properties of an image can be represented as a network and hence use techniques developed in complex networks to study properties of the image, in this case image segmentation. Requirements basic knowledge of image representation, statistical techniques and data manipulation, some programming and use of the statistical package R.

Navigation information in a city

How easy is to navigate in a city if we don't have a map. The project explores concepts of information theory (navigational information) to classify how easy is to navigate without a map. Requirements, basic knowledge of information theory, basic mathematics, programming skills like C, C++, Java, Python, data analysis.

Discovering the connectivity of a network via different mechanisms

To compare and contrast different methods to measure the connectivity of a network, flooding, etc.

Requirements, some knowledge of communication networks, concepts of shortest-paths, routing. Programming skills and basics statistics.

Complex Network Structure of Musical Pieces

Representing the structure of a musical score as a complex network. Requirements some concepts of complex networks, statistical analysis and programming (use of package R, Matlab or equivalent).

DR ROBERT DONNAN

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Areas of Expertise and Interests:

- Electromagnetics
- Optics
- Microwave & Terahertz Engineering
- Antennas
- Optical Coherence Tomography

Also see link for further info:

<https://intranet.eecs.qmul.ac.uk/courses/studentprojects/projects/type/msc/supervisor/3132>



Project Ideas

Developing a lab-on-a-chip test for multiple sclerosis (MS)

Multiple sclerosis patients can receive an antibody treatment to manage the disease. However, some patients become resistant to the therapy. This project will develop a micro-fluidic lab-on-a-chip device with an optical sensor to detect the presence of resistant antibodies in human blood serum. This is a practical and inter-disciplinary project involving researchers from the Institute of Dentistry, Blizard Institute and Engineering. The objective of this project is to build a small desktop device for use at point of care or in a diagnostic lab.

Smartphone based optical RADAR imaging for personal healthcare

Optical RADAR imaging uses the ‘echoes’ of light reflected from tissue structures to form images that can be used to diagnose diseases from cancer to caries. Smartphones contain similar components that more costly laboratory systems use, i.e. light source, camera, display and computer. Based in the Institute of Dentistry, this project will build upon previous work to achieve optical RADAR imaging and assess its performance. This will require hands-on alignment of optical components, 3D printing and data analysis in MATLAB.

Developing a realistic computer model of light scattering in human tissue using CST

Diagnosis and monitoring of disease using light-based imaging technology is clinically attractive because it is non-ionising (safe), non-invasive and sensitive to subtle biological changes. However, biological tissue scatters visible and infrared light and ultimately limits the maximum imaging depth in tissue to about 1 mm. This project seeks to develop a comprehensive electromagnetic model of light scattering in human tissue using the modelling software CST. Doing this will unlock new ways of imaging beyond the 1 mm limit. This project is a collaboration between the Institute of Dentistry and EECS.

Overcoming multiple scattering in human tissue imaging using Monte Carlo simulation

Medical imaging technologies based on X-Rays enable accurate diagnosis and treatment of disease. However, these imaging devices are costly and expose patients to damaging ionising radiation. Infrared light can also provide detailed images of diseased tissue. However, it is strongly scattered, which limits imaging depths to 1-2 mm. This project will explore new imaging configurations that might overcome this limit. Achieving this will require working with the C programming language to modify well-known Monte Carlo light-transport software. Simulations will be run of different imaging configurations to explore the ability to image deeper.

Integrating Raman spectroscopy and optical RADAR imaging for intelligent disease detection

The lining of the mouth and throat cover a large surface area over which oral and oesophageal cancer can be hard to detect. This project brings together two optical techniques to improve disease detection. Optical RADAR imaging (also known as optical coherence tomography - OCT) can produce detailed 3D images of tissue structure, from which suspicious regions can be identified. Oftentimes, tissue that appears suspicious is healthy. Therefore, this project will add a Raman spectroscopy channels to an existing OCT microscope. Chemical composition of suspicious tissue can be assessed from the Raman spectra, improving early cancer detection accuracy.

Intra-Oral Imaging of White Spot Lesions Between Teeth

In dentistry, early forms of tooth decay manifest as white spots on the tooth. Frequently these occur at the interface between teeth and therefore go undetected under visual examination, leading to tooth pain and loss. When detected, these early lesions are reversible. Therefore, this project will use optical RADAR imaging to detect white spot lesions by reconstructing a 3D image volume from multiple indirect views of the tooth. The study will be laboratory based, conducted *in vitro* using equipment based in the Institute of Dentistry.

Optical Imaging of Traumatic Brain Injury

Traumatic brain injury can be the result of high speed impacts such as car and motorcycle accidents. Effective treatment of such injuries is currently limited by a lack of understanding of the brain and its response to trauma. Rodent models are frequently used to gain insight and test new therapies. This project focusses on developing a form of optical RADAR imaging to image changes to brain micro-blood vessels in the first few seconds and minutes post-injury. Working with existing image datasets, you will develop novel image processing methods in MATLAB to give researchers in the Blizzard Institute a greater insight into the development of traumatic brain injury.

Prototype of a micro-fluidic THz-sensor of dissolved proteins

This project will involve the student using LabVIEW to automate control of a four-channel micro-precision pump. Fluids from up to four channels may be mixed in a manifold in order to study protein behaviour as a function of pH, buffer concentrations and temperature. The LabVIEW programme will ideally be extended to allow on-the-fly post-processing of the raw acquired data to correlate dielectric with biological parameters of interest.

DR SERGIO IOOPPOLO

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Areas of Expertise and Interests:

- Laboratory Astrophysics & Astrochemistry
- Space Science
- Free-electron laser facilities
- Tandemtron Accelerator and electron cyclotron resonance (ECR) ion source facilities
- Storage ring and synchrotron radiation facilities



Project Ideas

Selective IR/THz Radiation Spectroscopy of Interstellar Ice Analogues

The role of the student in this project will involve the laboratory study of the physics and chemistry that drive the molecular complexity observed in space by analysing existing data and possibly performing state-of-the-art experiments at the FELIX Laboratory, Radboud University, Nijmegen, the Netherlands (www.ru.nl/felix). We will use the unique capabilities of FELIX-1 and FELIX-2 beamlines (tunability, high peak power and controllable repetition rate) to perform wavelength-dependent THz and mid-IR irradiation experiments of interstellar and Solar System relevant ices to study:

- The nature of the IR/THz modes in solids
- Energy relaxation processes in ices
- Molecular dynamics in ices
- Diffusion, segregation, reaction and desorption of molecules
- The physics and chemistry of the interstellar medium and Solar System

At FELIX Laboratory we will operate the Laboratory Ice Surface Astrophysics (LISA) ultra-high vacuum end-station dedicated to the study of interstellar and Solar System ices. Therefore candidates are required to have a good level of knowledge on ultra-high vacuum technology, Fourier Transform Reflection Absorption Infrared (FT-RAIR) Spectroscopy, Quadrupole Mass Spectrometry (QMS), Temperature Programmed Desorption (TPD) experiments and 1-5 keV electron gun processing of materials.

200 keV – 2 MeV ion irradiation of space ice analogues

The student will be involved in the laboratory study of the physics and chemistry that drive the molecular complexity observed in space by analysing existing data and possibly performing state-of-the-art experiments at the ATOMKI facility, Institute for Nuclear Research, Debrecen, Hungary (www.atomki.hu). We will use the wide energy range (200 keV – 2 MeV), different ion fluxes and a variety of projectiles available at the Tandetron accelerator beamline to perform systematic ion irradiation experiments of interstellar and Solar System relevant ices to study:

- Mid-IR spectroscopy of pure and mixed ices in support of the JWST space mission
- Physico-chemical changes in the ice materials in the mid-IR upon ion/electron irradiation
- Formation and destruction of new molecular species in ices
- Sputtering and desorption of molecular species from ice layers
- The physics and chemistry of the interstellar medium and Solar System

At ATOMKI we will operate the Ice Chemistry for Astrophysics (ICA) ultra-high vacuum end-station dedicated to the study of interstellar and Solar System ices. Therefore candidates are required to have a good level of knowledge on ultra-high vacuum technology, Fourier Transform Infrared (FTIR) Spectroscopy, Quadrupole Mass Spectrometry (QMS), Temperature Programmed Desorption (TPD) experiments and 1-5 keV electron gun processing of materials.

Photoabsorption Spectroscopy of Electron-Irradiated Ices

The student will be involved in the laboratory study of the physics and chemistry that drive the molecular complexity observed in space by analysing existing data and possibly performing state-of-the-art experiments at the ISA-ASTRID2 facility, Aarhus University, Aarhus, Denmark (www.isa.au.dk). We will use the two gratings of the AU-UV beamline to perform vacuum-ultraviolet (VUV) and ultraviolet-visible (UV-vis) photoabsorption spectroscopy experiments of electron irradiated interstellar and Solar System relevant ices in the spectral range 100-800 nm to study:

- VUV, UV-vis spectroscopy of pure and mixed ices in support of the JUICE space mission
- Physico-chemical changes in the ice materials in the VUV upon 1 keV electron irradiation
- Formation and destruction of new molecular species in ices
- Sputtering and desorption of molecular species from ice layers
- The physics and chemistry of the interstellar medium and Solar System

At ASTRID2 we will operate the Portable Astrochemistry Chamber (PAC) ultra-high vacuum end-station dedicated to the study of interstellar and Solar System ices. When the setup is not in use at ASTRID2, the same chamber is operated at the Molecular Astrophysics Laboratory of the Open University, Milton Keynes, UK, to collect mid-IR spectra of the same ices studied at ASTRID2 in the VUV spectral range. Candidates could potentially perform experiments at the OU and hence are required to have a good level of knowledge on ultra-high vacuum technology, Fourier Transform Infrared (FTIR) Spectroscopy, photoabsorption spectroscopy, Temperature Programmed Desorption (TPD) experiments and 1 keV electron gun processing of materials.

DR STEFAN POSLAD

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Areas of Expertise and Interests:

- Ubiquitous Computing
- Artificial Intelligence
- Internet of Things
- Security and Privacy



Project Ideas

Based on the areas mentioned above, please contact Stefan if you would like to discuss project ideas.

PROFESSOR STEVE UHLIG

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Areas of Expertise and Interests:

- Network Measurements
- Data Analysis
- Network Engineering and Management
- Network Protocols
- Blockchain

Also see link for further info:

<https://intranet.eecs.qmul.ac.uk/courses/studentprojects/projects/type/msc/supervisor/20955>



DR SUKHPAL SINGH GILL

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Areas of Expertise and Interests:

- Cloud Computing
- Energy Efficiency
- Quality of Service
- Resource Management
- IoT

Also see link for further info:

<https://intranet.eecs.qmul.ac.uk/courses/studentprojects/projects/type/msc/supervisor/67688>



Project Ideas

Systematic engineering of scalable solutions, which are targeted towards real problems and emerging computing paradigms such as Cloud Computing, Fog Computing and Service Computing.

1. Quality of Service in Cloud Computing: Development of novel real world systems capable of meeting the challenges/QoS requirements of emerging distributed applications, found in paradigms such as Cloud/Edge/Fog Computing, Serverless Computing and the Internet of Things.

2. Resource Management for Cloud/Fog/Edge Computing: To develop resource provisioning and scheduling techniques, frameworks and mechanisms, capable of manipulating these technologies to meet requirements of modern Internet applications.

3. IoT Applications: To design a resource management technique for management of IoT applications such as smart city, healthcare, agriculture, traffic management system etc.

4. Straggler Manifestation in Internet-based Distributed Systems: To Understand the straggler manifestation and conduct in-depth analysis and modelling of Internet-based distributed systems to quantify the precise relationship between straggler occurrence and system behaviour.

5. Holistic Resource Management for Sustainable and Reliable Cloud Computing: Minimizing the energy consumption of servers within cloud computing systems is of upmost importance to cloud providers toward reducing operational costs and enhancing service sustainability by consolidating services onto fewer active servers. Moreover, providers must also provision high levels of availability and reliability, hence cloud services are frequently replicated across servers that subsequently increases server energy consumption and resource overhead. These two objectives can present a potential conflict within cloud resource management decision making that must balance between service consolidation and replication to minimize energy consumption whilst maximizing server availability and reliability, respectively.

For more details about my research work, please visit <https://scholar.google.com.au/citations?user=NHkWom4AAAAJ&hl=en&oi=ao>

Based on the areas mentioned above, please contact Sukhpal if you would like to discuss project ideas.

DR THOMAS ROELLEKE

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Areas of Expertise and Interests:

- Large-scale Data Analytics (Data Science) and Business Intelligence
- Knowledge-based Search Technology (Intelligent/Semantic Web and Databases)
- Ranking-based Decision-Making and Recommender Algorithms

Also see link for further info:

<https://intranet.eecs.qmul.ac.uk/courses/studentprojects/projects/type/msc/supervisor/3053>



Project Ideas

Based on the areas mentioned above, please contact Thomas if you would like to discuss project ideas.

DR TIJANA TIMOTIJEVIC

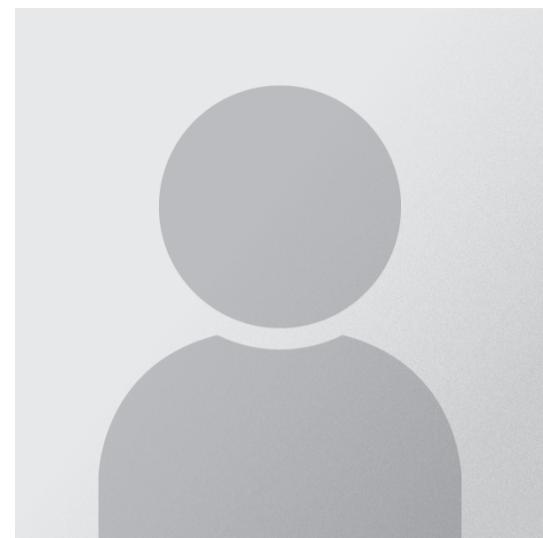
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Areas of Expertise and Interests:

- FPGA
- Motion Capture
- Sensors
- Microelectrode Array
- Design and Build
- Modelling
- COMSOL

Also see link for further info:

<https://intranet.eecs.qmul.ac.uk/courses/studentprojects/projects/type/msc/supervisor/3107>



Project Ideas

Based on the areas mentioned above, please contact Tijana if you would like to discuss project ideas.

DR USMAN NAEEM

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Areas of Expertise and Interests:

- Pervasive/Ubiquitous Computing
- Machine Learning
- Activity Recognition
- Mobile Sensing
- Gamification
- Assisted Living
- Computers and Education
- Social Technologies



Project Ideas

Unobtrusive Monitoring of User Depression using Mobile Sensing

The objective of this project is develop a mobile application to monitor the depression state of users based on location data and mobile questionnaires, which can be used to calculate/measure a mood score for each user.

The Impact of Social Network Applications on Student Academic Performance

Develop a mobile application (tool) that captures social network data in order analyse its impact on a student academic performance.

Mobile Activity Inference for Recognising Nursing Activity

The objective of this project is to develop a recognition framework based on machine learning techniques for inferring nursing activities. The student will be given access to real nursing dataset that they can use for applying a supervised machine learning approach.

DR WILLIAM MARSH

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Areas of Expertise and Interests:

- Decision support
- Data analysis
- Probabilistic reasoning
- Embedded systems

Also see link for further info:

<https://intranet.eecs.qmul.ac.uk/courses/studentprojects/projects/type/msc/supervisor/3016>



Project Ideas

Based on the areas mentioned above, please contact William if you would like to discuss project ideas.

PROFESSOR XIAODONG CHEN

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Areas of Expertise and Interests:

- MIMO
- 5G
- Antennas

Also see link for further info:

<https://intranet.eecs.qmul.ac.uk/courses/studentprojects/projects/type/msc/supervisor/3201>



Project Ideas

Based on the areas mentioned above, please contact Xiaodong if you would like to discuss project ideas.

PROFESSOR YANG HAO

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Areas of Expertise and Interests:

- Antennas and Radio Propagation for Body Centric Wireless Communications
- Active Antennas for Millimeter/Sub-Millimeter Applications
- Computational Electromagnetics
- Graphene and Nanomicrowave
- Microwave Metamaterials and Transformation Electromagnetics
- Thz And Photonic Integrated Antennas



Also see link for further info:

<https://intranet.eecs.qmul.ac.uk/courses/studentprojects/projects/type/ug/supervisor/3362/year/next>

Project Ideas

Based on the areas mentioned above, please contact Yang if you would like to discuss project ideas.