

Project proposals in Computer Vision, Artificial intelligence, Computational Quantum optics and Quantum Computing

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Project type : Software development projects MSc.

- 1) **Computer vision (machine vision)** has a broad application area in industry, traffic management, security (CCTV), health, communication, robotics and military. Particularly the development of a real-time computer vision software will help gain a productive skills and knowledge, which will give boosting effect in your career life.
- 2) **Artificial intelligence** is very generic technique (e.g. Bayesian networks) which can be exploited in different fields such as automated dynamic scene analysis and interpretation, biological behaviour analysis, security, etc. This area can easily fit to your specific personal application projects.
- 3) **Computational Psychology** is the quantisation method to measure psychological (mental or cognitive) parameters which contribute several fields like cyber security, mental disorder analysis, e-commerce related cognitive web site design, etc. The method includes console/computer games domain, user signal collection, and AI techniques to characterize cognitive behaviours or cognitive web design.
- 4) **Computational Quantum physics & Optics** : This field would require some lab experiments by using quantum instrumentation located in HLS Lab and hence requires attendance in the Lab at faculty of Health & life sciences (Hawthorn Building). More specifically the experiments would be on “characterisation of specific materials by use of computational quantum optics, microorganisms’ photonic communication analysis or working with Quantum Eraser set for material analysis “
- 5) **Quantum Computing by remote connection to IBMQ** : The task is involved with Quantum circuit designs and running them with quantum algorithms on remote Quantum Computing utility like IBMQ (Qiskit Terra) by remote connection. The project requires some Python programming knowledge.

Those who wish to undertake a project in one of above topics for MSc, can select one or more of specific project topics **as shown below**. The students are expected to have programming background and develop software codes in C/C++, visual basic, MATLAB, Python, etc. associating with hardware like CCD camera/s, game console, body signal collection devices, camera microscopy, etc.

Topic 1.

REAL-TIME MEDICAL TABLET INSPECTION SYSTEM :

Particularly industrial medical tablet analysis is commercially very popular fields which attracts broad range of tablet producers (i.e. Bayer, gsk, etc.) In this research you are expected to evaluate the inspection algorithms and software codes in VBasic or VC++ which may bring new optical solutions to traditional pharmaceutical production problems. The project has a potential of strong links with the tablet producers and may also lead to a future employment.

Topic 2.

Aerial surveillance by intelligent Drone :

This application includes AI techniques to interpret video/images collected by drone and their classification to meet requirements of some specific tasks like local urban inspections (e.g. railway defects inspection along its route, illegal building extensions inspection or traffic surveillance (unauthorised parking, lost vehicle detection, etc.) or environmental pollution observations.

In this application a commercial drone and its video recording capability would be used for professional aerial surveying and inspection by use of artificial intelligence techniques applicable onto video images for on-board automated instant image data processing. The similar method was already applied onto satellite imagery for man made v natural feature classification on the

earth surface.https://www.researchgate.net/publication/270558998_Automated_Identification_of_Man-Made_Textural_Features_on_Satellite_Imagery_by_Bayesian_Networks

(note: this project may require obtaining an official permission from local authorities for drone operation
Please make sure that you would not have such problems in further project stages)

Topic 3.

Intelligent Geographic Information System development

The system will be based on satellite images, maps, statistical data analysis by AI methods for urban development prediction, As its research outcome would later be applicable to flood estimation, which has an important economic aspect for the estate market in the UK or any critical region in the World. It is expected that any predictive system developed within this research can have a market potential for the Estate & Housing market. (e.g. for property value estimation)

Topic 4.

Medical Health Applications (medical imaging, Infrared imaging, tissue/skin texture analysis for diseases or abnormality detection.) Our novel method “intelligent Laser speckle Classification” is widely used for health abnormality detection from skin imagery. (e.g. diabetes, etc.) for more info please visit:

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

Topic 5.

Industrial Applications (vision systems for product inspection, robot vision, object tracking, texture analysis, 3D imaging in Aerospace/automotive industry, physical phenomenon modelling, etc.)

Topic 6.

Biologic cellular – chemical substance communication decoding

This topic of Bioinformatics is involved with decoding “communication language “ between the cells or bacterias or medications, at basic level and in further stages understanding their invisible strategies to develop counter strategies to combat diseases. For this kind of research some microscopic video recording utility and AI software are used.

Topic 7.

Computational Quantum physics & Optics

This project would require some lab experiments by using quantum instrumentation located in HLS Lab and hence requires attendance in the Lab at faculty of Health & life sciences (Hawthorn Building). More specifically the experiments would be on “characterisation of specific materials by use of computational quantum optics, “ microorganisms – substance” quantum communication analysis, etc. “

Topic 8.

Quantum Computing implementations

The project will be involved with Quantum circuit designs and running them with quantum algorithms on remote Quantum Computing utility like IBMQ (Qiskit Terra) by remote connection. In the research, related investigations would be done on some basic quantum phenomena like entangling, superposition, quantum measurements, etc. The project requires some Python programming knowledge.

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