

DURF 2022-2023 Posting

(Last update: 7 March, 2022)

Posting 1

Prof. Arindam BASU

Bio-inspired Camera for Surveillance in IoT

Project Description

The internet of things (IoT) dreams of having billions of sensors collecting data and transmitting it to the cloud. However, this wireless transmission is a huge burden, especially for camera sensors that handle a huge data volume.

This project will analyze data from a special bio-inspired camera that operates asynchronously like a human retina. Individual pixels only fire events when there is a moving object in the scene. Thus, it provides data compression at source. However, it needs new processing algorithms different from traditional frame based ones. In this project, we will explore denoising, tracking and classification of data from such camera.

Particulars:

- We seek 1-2 undergraduate researchers with motivation and strong aptitude for practical research.
- Skillset required: Programming in MATLAB/Python, Concepts of machine learning & neural networks
- Please indicate your interest to Prof. Basu (arinbasu@cityu.edu.hk) and email **on or before (Mar 21), 2022** to be considered for the position.

Posting 2

Dr. Lai-Man PO

Self-Supervised Learning with Generative Adversarial Networks

Project Description

In a conventional Generative Adversarial Network (GAN), the discriminator is trained in an unsupervised manner to classify images as real or fake (binary classification). In semi-supervised GANs, in addition to being unsupervised, the discriminator is trained on the class labels of real images in a supervised manner (multi-class classification). Unsupervised models learn features, supervised models learn classification. In regular GANs, we focus on training the generator and discard the discriminator. In semi-supervised GANs, the generator is discarded, and the supervised classifier (discriminator) is retained, since the goal is to train a classifier with limited labeled data. Experimental results have demonstrated that this approach can improve classifier accuracy using only a small fraction of labeled data and large portion of unlabeled data. In this project, students will first learn how to apply semi-supervised GANs to become familiar with the technique to improve multi-class classification using only a small amount of labeled data. However, dataset labeling is labor-intensive, and recently self-supervised learning has become very attractive in deep learning research trained on pretext tasks using only unlabeled data. The ultimate goal of this project is to develop self-supervised GANs to train discriminator as a classifier in a self-supervised manner using pretext tasks such that large unlabeled datasets can be used for classifier training. We believe this approach has the potential to significantly improve the accuracy performance of classifier training with GANs.

Particulars:

- We seek 1-2 undergraduate researchers with motivation and strong aptitude for practical AI and deep learning research.
- Please indicate your interest to Dr. Lai-Man Po and eelmpo@cityu.edu.hk **on or before 14 April, 2022** to be considered for the position. The post may still be available after this date, but strong preference will be given to candidates who reply in timely fashion.

Posting 3

Dr. Leanne L H CHAN

APP development on mental health monitoring

Project Description

Smartphone is a skyrocketing product which gains popularity among all age groups, especially the younger generation. This may lead to serious and much earlier eye diseases such as macular degeneration or retinopathy. Pupil size can reveal the fatigue of a person. This project aims to develop a low-cost pupil/iris segmentation system in mobile application for stress management.

Motivated and qualified summer students are welcomed to work within my research group, in the general direction of mental health monitoring and APP development. We are looking for students who have a strong interest in computer vision and mobile APP development. Strong problem-solving skills are essential for this project and communication skills are a strong asset. Please contact Leanne Chan at leanne.chan@cityu.edu.hk **by 31st March 2022** if you are interested to apply. Project specifics will be discussed with suitable applicants.

Posting 4

Dr. Ray C C CHEUNG

Motivated and qualified summer students are welcomed to work within my laboratory, CityU Architecture Lab for Arithmetic and Security (CALAS), in the general direction of System-on-Chip and High-Performance Computing. Some works involved include

- Research on ASIC/FPGA Design Methodology
- Research on CPU, RISC-V, ARM, Computer Architecture
- Research on Coupling AI and IoT System-level designs
- Developing solid skills in the state-of-the-art ARM/AMD/Intel Software & Hardware Platforms

We are looking for students who have a strong interest in FPGA programming and System-level Architecture. Strong problem-solving skills are essential for this project and communication skills is a strong asset. The preferred candidate should have taken performed satisfactorily in the course (EE2000, EE2004, EE3200).

Posting 5

Dr. Ehsan NEKOU EI

Project Description

Project1: Control of Patient Queuing Systems in Hospitals

Developing efficient healthcare systems has become more important in the last few decades for two major reasons: 1) the rapid increase in healthcare expenditures in more developed countries, and 2) the simultaneous growth of demand for healthcare services and patients' expectations of service quality. A major problem in patient appointment scheduling is appointment no-shows which lead to capacity underutilization and treatment delays. In this project, we will develop optimization algorithms for improving the efficiency of the patient scheduling and queuing systems. The performance of these algorithms will be verified using real-world data from hospitals.

Project 2: Glucose Control Systems

Description: DIABETES Mellitus is a metabolic disease characterized by insufficient production of insulin by the pancreas and elevated concentrations of blood glucose for prolonged periods of time. Chronic, untreated hyperglycemia can lead to serious complications that include cardiovascular diseases, blindness, kidney failure, and stroke. Furthermore, very low values of blood glucose (hypoglycemia) for even a few hours can result in loss of consciousness and coma. Thus, the maintenance of normal glucose concentrations (euglycemia) is of critical importance for both diabetic and nondiabetic individuals.

In this project, we will numerically investigate the efficiency of glucose control strategies, such as PID, in regulating the glucose level. You will learn about the application of feedback control in biological systems. You will also improve your programming skills.

Project 3: Building Control Systems

Description: In this project, we will study different techniques for controlling the heating, ventilation, and air-conditioning (HVAC) systems. HVAC systems are integral components of buildings and are responsible for a major portion of building energy consumption. You will learn to work with different building simulators as well as different control techniques for optimizing the energy consumption level of buildings, such as PID and reinforcement learning techniques.

Project 4: Bayesian Filtering Techniques for Real-time Signal Denoising

Description: This project will study different Bayesian filtering techniques for real-time denoising sensor measurements. Many problems in science require estimation of the state of a system that changes over time using a sequence of noisy measurements made on the system. In this project, you will learn about various filtering approaches, such as Kalman filter, particle filter, and Bayesian filters. We will investigate the application of Bayesian filtering in medical signal processing.

Posting 6

Dr. Cheng WANG

Motivated students are welcome to work with Dr. WANG Cheng in the area of integrated photonics field (check out more information at <http://www.ee.cityu.edu.hk/~cwang/>). Please contact Dr. Wang at cwang257@cityu.edu.hk directly if you are interested. Project specifics will be discussed with suitable applicants.

Posting 7

Dr. Alex M. H. WONG

I work in the general area of metasurfaces and applied electromagnetics. You can learn more about my work from my website (<https://www.ee.cityu.edu.hk/~amhwong/>) or from this video (<https://youtu.be/bnRofUoDaTg>). Please contact me by email if wish to work on a DURF project with me.

Last update: 7 Mar 2022