The Real-time Simulation & Computational Imaging Group of the Institute for Digital Communications (IDCOM) at the School of Engineering invites applications for PhD positions on randomised numerical algebra for real-time scientific computing.

“Real-time image restoration”

The aim of the post is to pursue research in the field of randomised numerical algebra to expedite algorithms for image restoration tasks like deblurring and inpainting. This capability is central to image-based diagnostics and decision making in automated manufacturing processes. The research should produce results in the form of new sampling algorithms and analysis to be published in scientific journals and presented at the flagship conferences of data and imaging sciences.

Background: Common tasks in automated high-volume manufacturing operations include model learning, fault detection, prevention and product quality assessment. The data available for this scope tend to vary with the specific application and setting, but imagery from optical, thermal, and microscopy are ubiquitous in manufacturing plants because of it is well-suited to operator-based interpretation as well as AI-based supervision. High-resolution imaging is used to verify the specifications of the manufactured parts at various stages of the process, e.g. by performing metrology or feature extraction, which is made challenging when the image quality gets poor due to blurring and distortion, caused by the ambient harsh operating conditions. In-process, seamless image restoration will provide necessary feedback to calibrate process parameters, reduce manual and visual inspection, suppress human bias and improve result consistency. Moreover, equipped with real-time image processing capabilities, autonomous monitoring systems can use key process input/output variables to track process health and enable product quality prediction and classification. Real-time ‘maintain or replace’ decision in semiconductor and pharma processes can then be triggered for key stages, as replacement can be a more cost-effective option compared to a lesser quality product. Data science advances can expedite the solution of the underlying image restoration inverse problems, by sampling and compressing the high-dimensional images and their underpinning blurring kernels allowing to restore the images and extract their features of interest at a fraction of the time it takes to process the whole image in classical deterministic methods.

Prerequisite: A scientifically oriented person with an above-average master's/diploma degree in mathematics, statistics or computer science with a focus on inverse problems, applied probability and linear algebra. Good programming skills are desirable but non-essential. The holder of the position should be willing to collaborate with the industrial partners (Seagate, GSK, Nvidia) and work collaboratively with other researchers in our group. Opportunities to be involved in teaching activities will also be explored if aligned to the career development of the student.

Technical queries should be directed to Dr Nick Polydorides (n.polydorides@ed.ac.uk). Start date in April-Sept 2021.

Keywords: data sketching, randomised numerical linear algebra, real-time simulation.

Funding: We anticipate competitive opportunities for funding to arise in the near future via PhD scholarship schemes.

Further info on the group’s interests and projects http://www.homepages.ed.ac.uk/npolydor/

Please apply by January 15th, 2021 using this LINK