Ph.D. Student Position on Compression of Holograms with Deep Learning

The Department of Electronics and Informatics (ETRO), an imec research group at the Vrije Universiteit Brussel (VUB), has an open research position for a talented and motivated researcher.

Motivation

Digital holography is a discipline of science that measures or reconstructs the wavefield of light by means of interference. The wavefield encodes three-dimensional information, which has many applications, such as interferometry, microscopy, non-destructive testing and data storage.

This property is especially useful for 3D display technology. Holograms can recreate the wavefield of a 3D object, thereby reproducing all depth cues for all viewpoints. They exhibit no accommodation-vergence conflict, continuous parallax and accurate shading, unlike alternative 3D display solutions, which tend to have one or more limitations. At high quality, the appearance of an object on a holographic display system becomes indistinguishable from a real one.

Digital holographic displays require pixels with sizes close to optical wavelength, which made fabricating large displays with their corresponding extreme resolutions reaching billions of pixels a hurdle which could not be overcome. Novel high-resolution spatial-light modulator technology currently developed at imec could break through this barrier and bring the advent of 3D display of objects and scenes with unprecedented detail and speed.

Project

However, these displays must be driven by high-resolution digital holograms that need to be delivered at high speeds, making this a critical computational and communication challenge. This would require the design and development of specialized compression algorithms for holograms. Our team has already investigated intensively advanced compression solutions for holographic content, and one of our solutions is currently being standardized by the JPEG committee as the JPEG Pleno Holography standard (ISO/IEC 21794-5).

However, in this project, we intend to dedicate the investigation to the exploitation of deep neural networks for the compression of holograms to speed up calculations and better modelling non-linear behaviour.

In this Ph.D., the candidate will design algorithms for the compression of holograms to be consumed by high-end holographic display systems, such as the one produced by imec-VUB's spin-off company Swave. This will include not only the compression of holograms using efficient GPU/ASIC architectures but also the investigation of the optical setups and the use of novel spatial light modulators designed at imec. The main goal is to engineer a 3D holographic communication and display software system with resolutions and realism beyond the current state-of-the-art.

Partners

The primary research location will be the ETRO department located in Brussels. The involved research team is also embedded in the nano-electronics research institute imec.

Profile and requirements:

- MSc degree focusing on electrical engineering, physics, mathematics, computer science or a related field.

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- Prior experience with image processing, image quality assessment, and computer vision is considered a strong asset;
- Proven programming experience (primarily Python and C/C++);
- Prior knowledge and hands-on experience with state-of-the-art machine learning frameworks (e.g., sci-kit-learn, Tensorflow, PyTorch) is considered as an advantage;
- Excellent oral and written communication skills in English;

What we offer:

- A competitive salary and benefits
- An international scientific environment driven by excellence in research
- Opportunities for learning new technical and non-technical skills
- Participation in national and international workshops and conferences

Application

Enquiries/applications may be addressed to Prof. David Blinder (david.blinder@vub.be).
A statement of professional interest, a CV and transcripts of your educational programme must accompany the application.