

PhD position on Using brain-inspired nanophotonic chips to speed up sorting of cancer cells

UGent/imec - Photonics Research Group
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A hot topic nowadays in cancer diagnosis is the detection of so-called circulating tumour cells (CTCs) in the blood. There exist techniques where a number of blood cells are sent at high speeds through a small capillary (so-called flow-cytometry systems), but in order to identify whether a cell is cancerous or not, people typically fluorescently label them. However, this tends to kill the cells so that they are no longer available for further study. A way around this problem is to use digital holography, where a light beam excites the cell, and the interference pattern of the incident light with the scattered light is recorded on a camera. Typically, the cell geometry is then calculated from this pattern by solving Maxwell's equation in reverse. However, this is an extremely time-consuming step, which does not lend itself to real-time high-speed detection of cancer cells.

We recently developed an alternative method to speed this up. Initial simulation results have been very promising, and now we plan to build upon this to construct a photonic hardware implementation of this network in silicon, in order to really achieve an important classification speedup in practice. Additionally, we still need to exploit many advantages that an all-optical implementation can give us (phase, wavelength, polarisation, ...) and this work is an important part of the PhD topic. Also, we need to investigate to what extent recent paradigms from machine learning (reservoir computing, deep learning, ...) can play a role in improving performance.

This PhD topic is inherently multidisciplinary, and sits at the interface between photonics and machine learning. Additionally, there is a strong collaboration with a team in imec which effectively fabricates chip-based flow cytometers and which can provide real data. A willingness to tackle challenges coming from these multidisciplinary collaborations is a must.

Application:

Apply by filling in the [application form](#).

More information:

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About Photonics Research Group

The Photonics Research Group (about 70 people) is associated with IMEC, and is part of the Department of Information Technology of Ghent University. The group is headed by Prof. R. Baets and has been active in photonics device research for many years. The other professors in the group are P. Bienstman, W. Bogaerts, N. Le Thomas, G. Morthier, G. Roelkens and D. Van Thourhout. The main applications under study are silicon nanophotonics, heterogeneous integration, optical interconnect, WDM optical communication, silicon photonics biosensors and photonic integrated circuits for biomedical applications in the near-infrared and mid-infrared wavelength range. More in particular, the silicon nanophotonics work focuses on the design and fabrication of SOI-based photonic devices using standard lithographic techniques compatible with CMOS-processing. The group is also strongly involved in the development of heterogeneous technologies, whereby the silicon photonics platform is combined with other materials such as III-V semiconductors for efficient sources, nanocrystals and polymers.

The photonics research group has been coordinating the network of excellence ePIXnet and is currently involved in a number of EU-projects, including the FP7 projects ActPhast, PLAT4M, Cando, Pocket and SMARTFIBER. Furthermore, the group is partner in the Center for Nano- and Biophotonics of Ghent University and the group has been awarded with three ERC Starting Independent Researcher Grants and one ERC Advanced Investigator Grant.