New developments in optical coherence tomography

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Abstract

Optical coherence tomography (OCT) is a non-invasive diagnostic technique which uses near infrared light to generate cross-sectional images of tissues with high resolution. Due to these features, it is particularly suitable in biomedical applications for in-vivo imaging of tissues, especially when the traditional microscopy in-vitro is inconvenient or even impossible to be performed. For that reason, this method has been widely used in ophthalmology, optometry, dermatology, otolaryngology, dentistry, gynaecology and many other medical fields. In OCT devices, the backscattered light is measured with an interferometric setup to reconstruct the depth profile of the sample at the selected location. Since the light used in OCT is partially coherent, a special type of noise occurs in the images, which takes the form of grainy structures and is therefore called speckle noise. Typically, this noise is reduced in OCT images to better visualise the imaged structures. However, another approach is to treat this noise as a source of information. Because light in OCT is scattered on the structures of the imaged tissue, speckle noise statistics can provide information about this structure as well as about the properties of the sample. This presentation will cover various methods of speckle analysis developed so far for OCT images of the cornea. Also, the possibilities of clinical use of statistical parameters of OCT speckle in ophthalmology will be discussed.

About the lecturer

Marcela Niemczyk received her PhD degree in biomedical engineering from Wrocław University of Science and Technology in 2022. She currently works in the Digital Signal Processing Group, led by Prof. Robert Iskander, at the Department of Biomedical Engineering, Faculty of Fundamental Problems of Technology. Her scientific interests focus on the analysis of images from optical coherence tomography (OCT), in particular the statistical modeling of speckle noise in OCT images of the cornea. She is currently working on projects aimed at the development of new methods for measuring intraocular pressure including detailed analysis of speckle noise together with the confounding factors influencing that noise, as well as biometric and biomechanical parameters of the eye.