Optical Coherence Tomography and Single Fiber Reflectance Spectroscopy

An internship position is available at the Biomedical Engineering and Physics department of the Academic Medical Center (AMC). In our group, new treatment and diagnostic procedures based on innovative physical techniques are developed. Research is performed by a multidisciplinary team that includes physicists, engineers, mathematicians, medical doctors, biologists, and chemists.

Background Optical Coherence Tomography (OCT) is a high resolution imaging technique analogous to ultrasound imaging, yielding detailed 3D visualization of tissue structure. OCT operates in the near-infrared wavelength range in order to achieve sufficient imaging depth. However, contrast due to absorption by chromophores such as hemoglobin is limited in that wavelength range. Single Fiber Reflectance spectroscopy (SFR) operates in the visible wavelength range, where such contrast is abundant. Although SFR is not an imaging technique, its measurement volume is on the same scale as that of OCT. Thus, combining both modalities can yield complementary information on tissue structure and composition.

Recent advances in fiber technology have made it feasible to combine both modalities into a single fiber optic probe. Using dual-clad fibers a co-axial measurement can be made, where the OCT signal travels through the fiber core, and the SFR signal through an inner fiber cladding (an outer cladding ensures proper guiding of the light). Only very recently, various components based on dual-clad fibers have come available such as couplers, circulators, etc, making construction of a dual OCT/SFR fiber based setup feasible.

Short summary of research The student will help develop the combined OCT/SFR setup in the optics laboratory and perform characterization measurements to establish the performance of both modalities. Trade-offs inherent to combining complementary techniques will be investigated and when possible addressed. Important parameters such as ranging depth and sensitivity to optical properties will be investigated using 'phantom' materials with known optical and physical properties.

Requirements: We are looking for a Bachelor/Master student with knowledge of physics and engineering and affinity for medical applications. The duration of the internship can be adjusted according to the curriculum.

Learning outcome: The student will gain knowledge in the field of biomedical optics and develop skills in building set-ups, understanding models to describe light-tissue interaction and apply these models to analyze the data. Being part of an interdisciplinary and international research group, the student will acquire competences including: (1) collaboration, (2) scientific writing, and (3) presentation.

Contact

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