Proposition de stage recherche

PFE Ingénieur et/ou Master M2

Université de Strasbourg - Laboratoire ICube

mars 2016 - août 2016

Implémentation d'algorithmes compacts et robustes pour OCT endoscopique et FF-OCT pour l'imagerie médicale

Implementation of compact and robust algorithms for endoscopic OCT and FF-OCT in medical imaging

ICube (Laboratoire des Sciences de l'**I**ngénieur, de l'**I**nformatique et de l'**I**magerie)
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Equipe d'accueil : Equipe IPP (Instrumentation et Procédés Photoniques) en collaboration avec l'équipe AVR (d'ICube.

Description du stage (300 mots)

Great challenges exist for being able to perform detailed imaging in the digestive tract and near surface skin tissue for the early detection and diagnostics of different pathologies. Fourier domain OCT (Optical Coherence Tomography) is being developed at ICube (IPP/AVR teams) [1, 2] for assisting a robotized endoscope for minimally invasive treatment of different cancers. OCT uses a fiber optic based point measurement system that is scanned to build up XZ image slices over a volume XYZ within tissue to a depth of a few mm. High resolution FF-OCT (Full-Field OCT, or Coherence Scanning Interferometry) has been developed over several years at IPP [3, 4] in the field of materials characterization. The technique is an optical microscopy based imaging system that also scans over volumes XYZ but over shorter depths of tens of µm. We are now looking to apply this high resolution microscopy technique to cellular and near surface tissue imaging such as the skin. Both techniques use the same principle of low coherence interferometry as an optical probe for imaging. One challenge is the processing of the fringe signal over the depth in order to extract structural and other useful information. To this end we have been working recently on the use of new algorithms to perform the signal processing (FFT, wavelets, visibility [4], energy operators [3]…).

This project consists of studying which of these new algorithms would be the most appropriate for high speed and/or high resolution imaging using OCT and FF-OCT in their respective applications in which there is often a trade-off between speed and precision. This internship will require competence in signal processing and programming in LabView and MATLAB to implement the developed algorithms for use on real fringe signals. The candidate chosen will have the possibility of working in a state of the art field of medical imaging.

Contacts :

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Gratification de stage :

Gratification de stage conformément aux règles en vigueur (de l'ordre de 554,40 €/mois).

Bibliographie :

[1] Gora M.J., Sauk J.S., Carruth R.W., Gallagher K.A., Suter M.J., Nishioka N.S., Kava L.E., Rosenberg M., Bouma B.E. & Tearneyet G.J., "Tethered capsule endomicroscopy enables less invasive imaging of gastrointestinal tract microstructure", Nature Medecine, 19, 238–240, 2013.
[2] Gora M., Karnowski K., Szkulmowski M., Kaluzny B., Huber R., Kowalczyk A. & Wojtkowski M., "Ultra high-speed swept source OCT imaging of the anterior segment of human eye at 200 kHz with adjustable imaging range", Optics Express 17, 14880-14894, 2009.
[3] Salzenstein F., Montgomery P.C. & Boudraa A.O. "Local frequency and envelope estimation by Teager-Kaiser energy operators in white-light scanning interferometry", Optics Express, 22 (15), pp.18325-18334, 2014.
[4] Montgomery P.C., Salzenstein F., Montaner D., Serio B. and Pfeiffer P., "Implementation of a fringe visibility based algorithm in coherence scanning interferometry for surface roughness measurement", Proc. SPIE (2013).