Extraction of endogenous fluorescence from diffuse optical images of fluorescence

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Team common language
English

Reference
Most likely the participants will use the wavelet package available on the following site.

http://www-stat.stanford.edu/∼wavelab/

Abstract

Recent years have seen diffuse optical imaging (DOI) in the near infrared emerge as a new biomedical imaging modality offering a good complement to Magnetic Resonance Imaging (MRI). A number of recent studies have demonstrated the usefulness of optical imaging for measuring neuronal activity or monitoring breast cancer. For example, the use of visual, somatosensorial stimuli allowed the identification of activated cognitive regions. Moreover, endogenous contrast resulting from the increased vascularization and metabolic activity of tumours can also be observed, demonstrating the importance of diffuse optical imaging in clinical applications.

The interest in diffuse optical imaging is not limited to neuronal activation. It has recently been applied to the field of molecular imaging, in which molecular beacons carrying optical contrast are used. The possibility to follow a given disease at the molecular and cellular levels by use of targeted probes or genetic reporters has opened the door to much more powerful applications. For example, the use of optical beacons in the detection of breast cancer enables one to target the disease in a specific and longitudinal way in time.

ART Advanced Research Technologies Inc. is currently developing an optical molecular imager that is used to image fluorescence in small animals (mice). These imagers generate images (2D) of fluorescence in the areas of animal bodies where the molecular beacons accumulate. In certain cases, fluorescence imaging has demonstrated the preferential accumulation of probes in tumours after injection of the product in vivo. The promises of this new imaging paradigm are significant: earlier detection of diseases, the follow-up in real time of the efficacy of a therapy, and the use of specific and targeted medications.

Molecular imaging, however, is subject to additional problems linked to the use of probes: the tissues also have fluorescence properties (endogenous

fluorescence), and thus the signals provided by the imager are contaminated by the latter and can hamper detection of the probes. This project aims to develop 2D filter techniques (Fourier, wavelets, etc.) that enable the identification of localized structures originating from targeted probes and isolate the signal from that originating from the tissues. As such, a set of 10 simulated images (for which the underlying sources are known) will be provided to develop the filtering algorithms. Separately, real images of fluorescence will be provided to evaluate the techniques. These images will be annotated for the students. Developments will be carried out with MATLAB.