

From bench to operation room: security aspects concerning vocal folds hyperspectral fluorescence imaging

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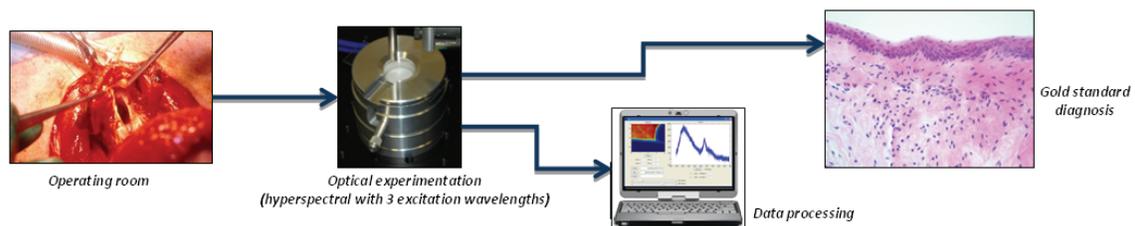
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One way to discriminate unhealthy tissues from healthy ones is to detect an abnormal concentration of particular proteins by means of fluorescence measurements. Two different methods can be used to detect proteins. The first one deals with exogen fluorescence which consists in applying a mixture of mono- or polyclonal antibodies functionalized with fluorophores. This method however requires the injection foreign substance into the body. The other way of detecting the target proteins is to use endogen fluorescence, also termed autofluorescence. It consists of studying the natural fluorescence of the target molecules.

In the frame of the European μ RALP project, we design an endoscope equipped with advanced fluorescence imaging techniques in order to help the surgeon to detect the cancerous nature of the tissues as well as the margins of the tumours. To this end, we plane to exploit possibilities offered by multiple excitation coupled with hyperspectral analysis of fluorescence images. Hyperspectral analysis consists in acquiring the whole fluorescence spectrum for each pixel of an image. In this way, a hyperspectral cube is obtained. Then, mathematical and statistical investigation of the hyperspectral cube should allow discriminating between malignant and non-malignant tissues.

However, directly testing this advanced imaging system directly on anesthetised patient will probably not be allowed without preliminarily specifying what illumination wavelength will be used and how the hyperspectral cube will be analysed. These data are required in order to fulfil the regulatory requirements of clinical investigation. Therefore, preliminary experiments are required in order to answer these questions.

In this conference, we will present what preliminary experiments are being currently conducted in collaboration between the Besançon University Hospital and the FEMTO-ST Institute. The work concerns the development of an advanced fluorescence probe that will be used on biopsies obtained from patient at the operating room. We will show what clinical constraints exist in this domain in terms of experiment duration and security for the tissue. In fact, the biopsies we are interested in are those that will be analysed in the anatomo-pathology unit of the hospital for official diagnosis. Therefore, we have to insert our experiments in the "journey" of the biopsies without any degradation of it as it is summarized in the figure below.



The journey of a vocal fold biopsy.