Hyperspectral Microscopy and Cluster Analysis for Oral Cancer Diagnosis

Anneliese Jarman, Arunthathi Manickavasagam, Neveen Hosny, Frederic Festy
(anneliese.jarman@kcl.ac.uk , arunthathi.manickavasagam@kcl.ac.uk , neveen.hosny@kcl.ac.uk , frederic.festy@kcl.ac.uk)

King's College London, Tissue Engineering and Biophotonics Department

Oral cancer incidences have been increasing in recent years and late detection means that the prognosis is often poor, particularly as metastasis is found at first inspection in 32.5% of cases [1]. The diagnosis gold standard, biopsy followed by histopathological examination, has been shown to have poor repeatability, particularly in marginal cases such as precancers[2, 3, 4]. A quantitative technique for a second "opinion" in difficult cases could lead to greater certainty and more personalised treatment, improving outcomes. Raman spectroscopy is a valuable diagnostic tool but it is not viable as a histopathological diagnostic aid due to its time consuming nature. *Notingher et al* have shown that a rapid pre-screening technique to find regions of interest for the targeted collection of Raman spectra is an effective solution to this problem [5]. To this end, our hyperspectral microsocopy system captures 450 focused, intensity-corrected and background-corrected images with wavelength ranging from 450-900 nm in around 40 minutes with spatial resolution of the order of microns and sub-micron spectral resolution. However, the hypercubes contain hundreds of thousands of spectra, including both spatial and spectral information, and the value of this information depends on the performance of the analysis technique used. Unstained human oral tissue is very complex, therefore we have collected data from simpler biological samples for this study including saliva droplets and mouse tissue and we have analysed them using in-house cluster analysis software.

References

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