New statistical method offers automatic mitotic cell detection for cancer diagnosis

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(Phys.org)—Scientists have developed a statistical image analysis method which can assist in the grading of breast cancer by automatically segmenting tumour regions and detecting dividing cells in tissue samples.

The system, developed at the University of Warwick, promises to bring objectivity and automation to the cancer grading process which is used to determine the aggressiveness of the treatment offered to the patient.

Number of mitotic cells, cells which are dividing to create new cells, is a key indicator used by histopathologists for diagnosing and grading cancer.

At present the dominant system in the UK and much of the world – the Nottingham Grading System - is based on expert analysis of tissue samples to determine the severity of the cancer.

As a subjective system dependent on visual analysis, it can produce substantial variability in diagnostic assessment, resulting in low agreement between pathologists.

A pilot study conducted by researchers at Warwick found there to be an agreement of 19 per cent between three pathologists in identifying the mitotic cells.

In response to the need for more objectivity, a team at the University of Warwick have developed a three-step method which takes an image of

tissue samples and applies statistical modelling to detect mitotic cells in that image.

Dr Nasir Rajpoot from the Department of Computer Science at the University of Warwick said: "It has long been recognised that there is a need to increase objectivity in the cancer grading process.

"This grading process determines the treatment offered to people who have been diagnosed with cancer, so it's vital to get it right in order to prevent patients undergoing unnecessarily aggressive treatments.

"We believe our method takes a significant step towards this by offering an objective, automatic technique to assist the pathologists in grading of breast cancer."

The method consists of three key steps. Firstly it segments the tumour margins, a step which is critical to the accuracy of mitotic cell detection.

Secondly it statistically models the intensity distribution of mitotic and non-mitotic cells in tumour areas, ignoring the non-tumorous areas. This step therefore identifies potential mitotic cells in tumour areas.

Finally the method looks at the surrounding architecture of these potential mitotic cell candidates in order to confirm them as mitotic cells, thereby reducing the number of possible false alarms.

Although there are algorithms in existence which provide automation in some parts of the mitotic cell detection process, the method developed at Warwick is the first to offer a comprehensive solution addressing the entire process.

The method is outlined in a study focusing on breast cancer histology images presented at a major conference on the subject.

Although the research to date has centred on breast cancer histology images, the scientists believe the method can be applied to other types of cancer.

In a pilot study, the method has been successfully tested against two expert pathologists' identification of the mitotic cells. Larger scale trials are currently under way and a patent application has been filed. The researchers are also keen to collaborate with industrial partners.

The study, entitled "A Gamma-Gaussian Mixture Model for detection of mitotic cells in breast cancer histopathology images," is authored by PhD student Mr Adnan Khan, his supervisor Dr Nasir Rajpoot, and University Hospitals Coventry and Warwickshire NHS Trustconsultant histopathologist Dr Hesham El-Daly, and is due to be presented at the International Conference on Pattern Recognition (ICPR 2012) to be held in Tsukuba, Japan between 11-16 November, 2012.

Provided by University of Warwick