Postgraduate student: **Spyridoula-Irida Xenaki**

Thesis Title:

Telepathology system for the automatic classification of brain tumours employing histopathology tissue samples.

Abstract:

In this thesis, a telepathology system has been developed which assists in improving diagnostic accuracy of brain cancer classification into grades of malignancy. The clinical material was histopathological tissue samples, which were collected from 35 patients from the University Hospital of Patra, who were diagnosed with astrocytic tumor. During data preparation the tissue samples were stained with H & E (Hematoxylin & Eosin), in order to expose the various components of the cells and nuclei. Then, a histopathologist examined the stained histopathological images of tissue samples and performed diagnosis based on histological criteria of malignancy in three grades (I, II, III or IV) according to the World Health Organization (WHO). At the same time, the histopathologist noted on the samples the most representative region (Region of Interest - ROI) for the examination. Thus, each sample image was digitized, taken from the predefined ROI and applied nuclei segmentation. The most important element of such a picture, from which conclusions can be drawn for the diagnosis, is the nucleus. Therefore, algorithms were created, which removed all remaining areas of the image and segmented nuclei for further analysis of these. From the results of image segmentation revealed that overall average 588 segmented nuclei were isolated and studied for each patient sample, while it has been shown that even 200 correctly segmented nuclei are sufficient to feature extraction. Then morphological characteristics, texture and architecture of their segmented nuclei were exported to describe the degree of malignancy of each sample-patient relationship. These characteristics were entering a pattern recognition system designed to provide the dangerousness of each tumor. This system was constructed by supervised, semi-supervised and unsupervised algorithms. The SVM Supervised Classifier (Polynomial or Quadratic kernel) has been proved a solution in the automated classification of astrocytomas as it had an accuracy rate of 94.29% in classifying data. The unsupervised clustering k-Means and Fuzzy gave an accuracy rate of 74.29% and Semi-Supervised with Co-Training classifier gave maximum accuracy rate of 88.57%. Finally, the characteristics Mean (first class texture feature), mean Correlation, range Correlation, mean Gray Level Non-Uniformity and mean Run Length Non-Uniformity (second class textural) highlighted as those features with the highest percentage likelihood to appear in feature vector that gives the maximum (best) accuracy rate of a classifier.

SUBJECT AREA: Image Processing, Pattern Recognition
KEYWORDS: microscope, astrocytoma, supervised / unsupervised / semi-supervised algorithms.

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