

# Abstract

The histopathological examination of a biopsy is considered as the gold standard in the diagnosis of diseases for almost all kinds of cancer. Traditionally, the histopathological slides are examined under a microscope by pathologists. Nowadays, with the help of high speed, high resolution image scanning technique, a glass slide can be digitized at high magnification to create a digital whole slide image (WSI). Manual examination of the glass slides and the WSIs are time-consuming and difficult. Also, the traditional diagnosis is subjective and often leads to intra-observer and inter-observer variability. In this dissertation, I develop several key techniques of the computer-aided diagnosis (CAD) system for digital histopathological image analysis of skin specimen of melanocytic disease. This CAD system operates on reliable quantitative measures and provides objective and reproducible information that can be used by pathologist for diagnosis.

The proposed CAD system has six modules. In the first module, the whole slide skin image is automated segmented into biologically meaningful parts: epidermis and dermis. The high resolution image tiles of interest are then generated for further analysis. In the second module, the nuclei in the epidermis area are segmented using the proposed hybrid gray-scale morphological reconstructions and local region

adaptive threshold selection methods. In the third module, two efficient techniques based on local double ellipses descriptor analysis and radial line scanning analysis are proposed to detect the melanocytes. In the fourth module, an efficient technique is proposed to detect the mitotic cells in the multi-spectral histopathological images. Based on the pre-segmented regions of interest (ROI), the morphological features and the spatial relationship are analyzed in the fifth module. These features reveal the cytological and architectural characteristics of the tissue sample that are correlated to the disease diagnosis. In the last module, classification is performed using the pre-extracted features in order to grade the skin tissue.

The experimental results based on a set of skin WSIs show that the proposed CAD system is able to provide objective and reproducible measures that can assist to the final diagnosis by pathologist.