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# Automatic Differential Diagnosis of Melanocytic Skin Tumours Using Ultrasound and Spectrophotometric Data

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**Abstract :** Cutaneous melanoma is a melanocytic skin tumour, which has a very poor prognosis while is highly resistant to treatment and tends to metastasize. Thickness of melanoma is one of the most important biomarker for stage of disease, prognosis and surgery planning. In this study, we hypothesized that the automatic analysis of spectrophotometric images and high-frequency ultrasonic 2D data can improve differential diagnosis of cutaneous melanoma and provide additional information about tumour penetration depth. This paper presents the novel complex automatic system for non-invasive melanocytic skin tumour differential diagnosis and penetration depth evaluation. The system is composed of region of interest segmentation in spectrophotometric images and high-frequency ultrasound data, quantitative parameter evaluation, informative feature extraction and classification with linear regression classifier. The segmentation of melanocytic skin tumour region in ultrasound image is based on parametric integrated backscattering coefficient calculation. The segmentation of optical image is based on Otsu thresholding. In total 29 quantitative tissue characterization parameters were evaluated by using ultrasound data (11 acoustical, 4 shape and 15 textural parameters) and 55 quantitative features of dermatoscopic and spectrophotometric images (using total melanin, dermal melanin, blood and collagen SIAgraphs acquired using spectrophotometric imaging device SIAscope). In total 102 melanocytic skin lesions (including 43 cutaneous melanomas) were examined by using SIAscope and ultrasound system with 22 MHz center frequency single element transducer. The diagnosis and Breslow thickness (pT) of each MST were evaluated during routine histological examination after excision and used as a reference. The results of this study have shown that automatic analysis of spectrophotometric and high frequency ultrasound data can improve non-invasive classification accuracy of early-stage cutaneous melanoma and provide supplementary information about tumour penetration depth.

**Keywords :** cutaneous melanoma, differential diagnosis, high-frequency ultrasound, melanocytic skin tumours, spectrophotometric imaging
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