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Computer-Aided Diagnosis of Eyelid Skin Tumors Using Machine Learning

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Abstract : Purpose: The aim is to develop an automated framework based on machine learning to diagnose malignant eyelid skin tumors. Methods: This study utilized eyelid lesion images from Sheba Medical Center, a large tertiary center in Israel. Before model training, we pre-trained our models on the ISIC 2019 dataset consisting of 25,332 images. The proprietary eyelid dataset was then used for fine-tuning. The dataset contained multiple images per patient, aiming to classify malignant lesions in comparison to benign counterparts. Results: The analyzed dataset consisted of images representing both benign and malignant eyelid lesions. For the benign category, a total of 373 images were sourced. In comparison, the malignant category has 186 images. Based on the accuracy values, the model with 3 epochs and a learning rate of 0.0001 exhibited the best performance, achieving an accuracy of 0.748 with a standard deviation of 0.034. At a sensitivity of 69%, the model has a corresponding specificity of 82%. To further understand the decision-making process of our model, we employed heatmap visualization techniques, specifically Gradient-weighted Class Activation Mapping. Discussion: This study introduces a dependable model-aided diagnostic technology for assessing eyelid skin lesions. The model demonstrated accuracy comparable to human evaluation, effectively determining whether a lesion raises a high suspicion of malignancy or is benign. Such a model has the potential to alleviate the burden on the healthcare system, particularly benefiting rural areas and enhancing the efficiency of clinicians and overall healthcare.

Keywords : machine learning;, eyelid skin tumors;, decision-making process;, heatmap visualization techniques
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