A Novel Implementation of Image Processing and Machine Learning for the Early Diagnosis of Melanoma

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Melanoma is one of the deadliest cancers but can be cured if detected early. The purpose of this project was to create an accurate system that allows for early diagnosis. Image processing techniques, based on the ABCD guidelines used by dermatologists, were used to analyze the skin lesions. The following sections were included in this project: image capture, pre-processing, edge detection, image segmentation, feature extraction, statistical analysis, and machine learning. Pre-processing consisted of a morphological closing operation to remove noise such as hair from the image. A feature extraction program was implemented to define a border around the lesion. "Outside-in" radial search was used to locate the boundary edge. Certain features were extracted from the boundary (area, perimeter, etc.) and used to calculate the border and asymmetry irregularity indexes. These index values were analyzed statistically using a normal distribution curve to understand the impact for each independent factor. Finally, Artificial Neural Networks (ANNs) were created, used and tested with the extracted values. Predicted benign lesions were further examined with supplementary neural networks and statistical analysis to eliminate false negatives. This multi-step system had a promising overall accuracy of 86%, and the detection of false negatives was reduced to 0%. Future steps include expanding the database using cloud technology and extracting accurate color features.

Awards Won:
Third Award of $1,000