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Potential Use of a New Energy Vision (NEV) Camera for Diagnostic Support of Carpal Tunnel Syndrome

Carpal Tunnel Syndrome (CTS) is a prevalent neuropathy requiring accurate, non-invasive diagnostics to minimize patient burden. This study evaluates the New Energy Vision (NEV) camera, an RGB-based multispectral imaging tool, to detect CTS through skin texture and color analysis, developing a machine learning algorithm to distinguish CTS-affected hands from controls.

Methods

A two-part observational study included 103 participants (50 controls, 53 CTS patients) in Part 1, using NEV camera images to train a Support Vector Machine (SVM) classifier. Part 2 compared median nerve-damaged (MED) and ulnar nerve-normal (ULN) palm areas in 32 CTS patients. Validations included nerve conduction tests (NCT), Semmes–Weinstein monofilament testing (SWMT), and Boston Carpal Tunnel Questionnaire (BCTQ).

Results

The SVM classifier achieved 93.33% accuracy (confusion matrix: [[14, 1], [1, 14]]), with 81.79% cross-validation accuracy. Part 2 identified significant differences ($p < 0.05$) in color proportions (e.g., red_proportion) and Haralick texture features between MED and ULN areas, corroborated by BCTQ and SWMT.

Conclusions

The NEV camera, leveraging multispectral imaging, offers a promising non-invasive CTS diagnostic tool using detection of nerve-related skin changes. Further validation is needed for clinical adoption.

Keywords

Carpal Tunnel Syndrome, multispectral imaging, NEV camera, machine learning, non-invasive diagnosis, Haralick features

Biography

Dr. Hamza Murad is an orthopedic surgery resident and doctoral researcher at the University of Haifa, specializing in artificial intelligence and machine learning. His clinical focus is on upper limb, hand, and elbow surgery, while his research explores the application of AI and computer vision in musculoskeletal diagnostics and surgical planning. By bridging clinical practice with computational innovation, Dr. Murad aims to develop intelligent imaging and decision-support tools that enhance precision and patient outcomes in orthopedic care.

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