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A HYBRID DEEP LEARNING AND QUALITY METRIC FOR IMPROVING FINGERPRINT IDENTIFICATION ACCURACY

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Abstract:
Biometric systems play a vital role in enhancing security across various fields. Fingerprint recognition has gained significant attention due to the uniqueness and permanence of fingerprint patterns. However, despite this uniqueness, challenges remain in the accurate extraction and matching of fingerprint features. This paper proposes a hybrid system that leverages the strengths of the pretrained Visual Geometry Group model with sixteen convolutional layers (VGG16) and the Universal Quality Index (UQI) metric to improve fingerprint identification accuracy. As VGG16 may not effectively capture ridge structures and minutiae in fingerprints, the proposed VGG-UQI Score (VUS) metric is designed to combine the deep feature representations of VGG16 with the statistical properties of UQI. This fusion aims to enhance discriminatory power and reduce error rates. Extensive experiments conducted on large-scale benchmark databases demonstrate notable improvements, confirming the efficacy of the VUS metric over traditional methods in terms of accuracy and reliability. By bridging the gap between deep learning and statistical approaches, this study contributes to the advancement of next-generation biometric systems.

Keywords: biometrics; fingerprint; visual geometry group; universal quality index; image matching.

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