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Abstract: The escalating demand for accessible, effective, and precise healthcare solutions has driven extensive research into integrating artificial intelligence into the medical field. Recognizing intricate patterns within biomedical images remains a formidable challenge for human practitioners. In response to this, our study introduces a pioneering image enhancement paradigm, the stationary wavelet channel fusion filtered (SWCFF) algorithm. Additionally, we employ the invariant scattering network (ISN), a novel feature learning methodology to analyze leukocyte images. The novelty of our approach lies in the inventive combination of SWCFF and ISN for enhanced feature extraction and discrimination of leukocytes. Our investigation aims to assess the efficacy of automatically extracted features from this algorithm in differentiating leukocytes, leveraging a support vector machine (SVM) classifier for the diagnosis and detection of leukemia and other blood-related conditions. The proposed model is rigorously evaluated on four benchmark datasets: ALLIDB, C_NMC, BCCD, and LISC. Notably, the ALLIDB binary class achieves a peak accuracy of 96.15% (95% CI: 0.9 to 1), while the class accuracy for neutrophils reaches an impressive 97.96% (95% CI: 0.89 to 1), accompanied by a precision of 100% and a false positive rate of 0%. Our innovative approach holds promise for the deployment of a cost-effective computer-aided diagnosis (CAD) tool in rural settings, aiding physicians in early disease prediction and the timely monitoring of treatment.
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