**Multilevel and Multiscale CNN for Accurate Localization and Classification of Breast Lesions**

Abstract : This research focuses on enhancing the efficiency and accuracy of breast cancer diagnosis (BCD) using computer vision and artificial intelligence. We critically examine various vision-based frameworks for BCD, emphasizing the need for precise lesion localization and categorization. We identify that the baseline frameworks, though computationally efficient, are significantly limited in their capacity to extract valuable features for final detection due to their reliance on feed-forward Convolutional Neural Network (CNN) architectures. These baseline models neglect crucial multilevel and multiscale features, which are indispensable in mitigating gradient vanishing / exploding issues and boosting early-stage diagnostic capabilities. To address these limitations, we propose a single-stage BCD framework, built on a unique CNN architecture, capable of localizing and classifying breast lesions from mammograms simultaneously. The performance of our proposed model is evaluated using two well-known benchmarks: INbreast and Curated Breast Imaging Subset of the Digital Database for Screening Mammography (CBIS-DDSM). Preliminary results show a significant improvement over the baseline frameworks. Specifically, the proposed hybrid CNN model exhibits an increase of 3.046% in accuracy and 4.767% in F1-Score for breast cancer classification on the INbreast dataset. For breast cancer detection, our model delivers a mean average precision (mAP) of 81.09%, outperforming the baseline detector by 10.75%. These results suggest a promising direction for future work in vision-based BCD, with potential implications for improved patient outcomes and clinical workflows.

Keywords : Breast Cancer Diagnosis, Mammogram Analysis, Convolutional Neural Network (CNN), Artificial Intelligence in Healthcare, Multilevel Features, Multiscale Features