Abstract

Kidneys are excretory organs that function to eliminate waste products and toxins from the body. A loss of function in the kidney leads to lethal diseases with high mortality rates, such as chronic kidney disease (CKD). Thus, there is a need to detect abnormalities in kidney function during the early stages to prevent an unfavorable prognosis. In the hope of early diagnosis, the medical field has shifted its focus to research on effective computer-aided diagnosis, leveraging the implementation of artificial intelligence (AI). Nonetheless, one of the major challenges faced by AI-based diagnosis that can highly influence model performance is imbalanced data. Due to this challenge, this study aims to evaluate methods for overcoming it by using imbalanced electrocardiogram (ECG) data to classify the kidney function of patient samples from the MUSIC dataset, retrieved from PhysioNet, using several AI classification models from YOLOv11. The basis for utilizing ECG data is that non-invasive, highly accessible ECGs can detect anomalies in kidney function, according to prior research. The results show that downsampling the imbalanced data for balance gave better performance, and the small model had the best results with 73% sensitivity and 77% specificity among YOLOv11 classification models. This indicates that downsampling could be a solution to imbalanced medical data to improve medical diagnosis. Moreover, this study also shows that ECG has potential in kidney function monitoring, but further studies are still required.

Keywords: artificial intelligence, kidney function, electrocardiogram, You Only Look Once (YOLOv11)