Abstract Type : Poster exhibition
Abstract Submission No.: A-0162
Abstract Topic : Non-dialysis CKD

Development and Evaluation of a Deep Learning Model for Classifying Kidney Conditions Using Image Data

Muhammad Umair Ahmad Khan, MUHAMMAD ARSLAN, EISHA TAHIR, MUHAMMAD FAHAD TOUQIR
Department of Biomedical Engineering, University of Engineering and Technology Narowal Campus, Pakistan

Objectives : This study aimed to create and test a deep learning model based on EfficientNet-B0 to classify kidney conditions into four categories: Normal, Cyst, Tumor, and Stone. The goal was to improve diagnostic accuracy for kidney diseases using advanced image analysis techniques.
Methods : We collected 12,446 images of kidneys, each labeled into one of four categories. Before training, data preprocessing involved augmentation and normalization. The dataset was partitioned into training (70%), validation (15%), and testing (15%). The model, EfficientNet-B0, pretrained on ImageNet, was adapted by adding a dropout layer (to prevent overfitting) and a fully connected layer with softmax activation for classification. The training process used stochastic gradient descent (SGD) with a learning rate of 0.01, momentum of 0.9, cross-entropy loss, batch size of 32, and ran for 10 epochs.
Results : The EfficientNet-B0 model achieved an overall test accuracy of 84.7%, compared to a training accuracy of 89.1%. Individual class accuracies varied, with the highest accuracy observed for Normal (89.7%), followed by Cyst (87.6%), Tumor (84.2%), and Stone (81.5%). Training accuracy steadily improved, reaching 93.4% by the final epoch. The validation accuracy peaked at 86.2% at epoch 8, indicating some degree of variance but minimal overfitting. Test loss was moderate, highlighting reasonable generalization capability to unseen data.
Conclusions : The EfficientNet-B0 model demonstrated good performance in classifying kidney diseases, suggesting potential utility as a diagnostic aid. The model shows promise as a supportive tool for clinical diagnosis.