An Automated Procedure for Estimating the Glomerular Filtration Rate and Determining the Normality or Abnormality of the Kidney Stages Using an Artificial Neural Network

Authors : Hossain A., Chowdhury S. I.

Abstract : Introduction: The use of a gamma camera is a standard procedure in nuclear medicine facilities or hospitals to diagnose chronic kidney disease (CKD), but the gamma camera does not precisely stage the disease. The authors sought to determine whether they could use an artificial neural network to determine whether CKD was in normal or abnormal stages based on GFR values (ANN). Method: The 250 kidney patients (Training 188, Testing 62) who underwent an ultrasonography test to diagnose a renal test in our nuclear medical center were scanned using a gamma camera. Before the scanning procedure, the patients received an injection of ^{99m}Tc-DTPA. The gamma camera computes the pre- and post-syringe radioactive counts after the injection has been pushed into the patient's vein. The artificial neural network uses the softmax function with cross-entropy loss to determine whether CKD is normal or abnormal based on the GFR value in the output layer. Results: The proposed ANN model had a 99.20 % accuracy according to K-fold cross-validation. The sensitivity and specificity were 99.10 and 99.20 %, respectively. AUC was 0.994. Conclusion: The proposed model can distinguish between normal and abnormal stages of CKD by using an artificial neural network. The gamma camera could be upgraded to diagnose normal or abnormal stages of CKD with an appropriate GFR value following the clinical application of the proposed model.