



CLASSIFICATION OF DIABETIC TONGUE IMAGES USING DEEP LEARNING

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Abstract:

This study evaluates deep learning methods, focusing on convolutional neural networks (CNNs), for non-invasive diabetes classification using two tongue image datasets. Various CNN models were trained and assessed, with ensemble techniques (including majority voting, soft voting and stacking) applied to improve classification performance. The results demonstrated that the majority voting technique achieved one-hundred percent classification accuracy. Individual CNN models also demonstrated strong performance, with accuracy values reaching 93.53 percent for Residual Network 50, 91.54 percent for Residual Network 101, 95.52 percent for Visual Geometry Group Network 16, 98.51 percent for Visual Geometry Group Network 19, 98.01 percent for Google Network, 97.01 percent for Densely Connected Convolutional Network 121, 96.52 percent for Densely Connected Convolutional Network 169 and 98.51 percent for Mobile Network. The soft voting ensemble achieved an accuracy of 98.01 percent and the stacked generalisation achieved an accuracy of 97.51 percent. Normalisation and weighting methods were applied to identify the optimal model, highlighting deep learning-based tongue image analysis as a promising non-invasive complement to traditional diabetes diagnostics.

Keywords: diabetes classification; deep learning; neural network; tongue image; ensemble learning.

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