

An Explainable AI Framework for Multiclass Skin Lesion Classification with CNN and Generative AI

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Abstract

Skin diseases are one of the most common worldwide health problems, and the early diagnosis of malignant tumors, such as melanoma or basal cell carcinoma, is critically important. However, clinical evaluation still relies heavily on the skin specialist's perceptual judgment of the lesion, which is different for every clinician and, in addition, there is a worldwide scarcity of professionals in this field. To solve this, the paper suggests a skin-lesion prediction system built from three interacting components: a convolutional neural network (CNN) for predicting skin-lesion classification, Gradient-weighted Class Activation Mapping (Grad-CAM) for interpreting images and a predefined reporting layer that outputs an easy-to-read clinical summary in which the lesion-class output is processed. The nine lesion types in the TensorFlow and Keras CNN model that have been used are: Nevus, Basal cell carcinoma, Squamous cell carcinoma, Pigmented benign keratosis, Dermatofibroma, Melanoma, Vascular lesion, Seborrheic keratosis, Actinic keratosis. In the classification phase, the CNN has shown a good performance with an accuracy of 96.67%, precision of 98.11%, recall of 89.7 and 92.43% F1 score on the defined test set. Grad-CAM highlights the image region that most influenced each prediction, and the predefined reporting layer produces a message report for the predicted class. A complete pipeline is implemented as a Django web application with an SQLite login database; through this system, users can register themselves, upload an image for comparison, and obtain a classification result along with a visual and textual explanation. The approach achieves results close to those published in the study reported here, and is important for its ability to deliver a plain explanation for every prediction – a vital factor in building confidence between clinicians and patients. This document proves the latest innovations in the field of deep learning technologies and display how the future of deep learning appears. This paper will provide you with an idea about the future of deep learning and demonstrate what is going on in this sphere.

Keywords

Convolutional neural network, deep learning, Django, explainable AI, Grad-CAM, generative AI, skin lesion classification, TensorFlow.