Aplicación de redes neuronales convolucionales en la detección y clasificación de cáncer de piel: Una revisión.

Application of Convolutional neural network for skin cancer detection and classification: A review.

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Abstract

The application of convolutional neural networks (CNN) has currently become a transversal tool for different areas. In the medical field several of the developed diagnosis aid systems are based on artificial intelligence. Particularly, there has been demonstrated its potential for detection and classification of different medical anomalies, such as skin cancer. Moreover, these intelligent systems have shown to be capable to recognize characteristics of skin cancer from images. This is a complex process due to the variability in the characteristics of the images and to the fact that there are different types of cancer. In this paper it is presented a review of different developed methods and systems, based on CNNs, for classification and detection of skin cancer, which were trained by using open access datasets.

Palabras clave: skin cancer, convolutional neural networks, classification, dataset

Introduction

The American Cancer Society classifies skin cancer into three categories: melanoma and basal cell and cellular skin cancer. These types include cancers that are less common, such as Merkel cell carcinoma, Kaposi's sarcoma, cutaneous lymphoma, sarcomas, which show up as skin abnormalities, as well as c, warts, hemangiomas, and moles; the last two are rare cases and become benign cancer. Images of all these types of cancer and many others can be observed in different datasets such as the HAM10000 (Afza et al., 2022; Gajera et al., 2023; Jain et al., 2021; Tschandl et al., 2018), Diverse Dermatology Images DDI (Daneshjou et al., 2021), derm7pt (Kawahara et al., 2019) and ISIC2018 (Afza et al., 2022; Harangi et al., 2020).

Traditional methods of skin cancer detection can be divided according to the analysis technique, which can be by a biopsy or by visual verification (Munir et al., 2019). In visual verification it is quite important the experience of the dermatologist or oncologist, since the diagnosis is based on the recognition of borders, colour, asymmetries, pigmentation of lesions, irregularities, among other characteristics. These are complex methods and require be performed by high qualified and trained specialists.

In order to aid in the diagnosis process researchers have proposed different methods. Some of these methods are based on image analysis, in which by different techniques different features can be identified and weighted to determine if corresponds to a certain type of cancer.

Architectures Convolutional Neural Networks

Typically, CNNs are used as classifiers that requires, as input, segmented images containing feature information of skin lesions. Regarding CNN classifiers in literature several predefined architectures have been proposed. Some of them have used CNNs models such as DenseNet201 (Al-masni et al., 2020; Huang et al., 2016), ResNet50V2 (He et al., 2015; Kadampur & Al Riyaee, 2020), VGG16 (Menegola et al., 2017; Ren et al., 2015) and GoogleNet (Harangi, 2018) for detecting melanoma. For example, (Steppan & Hanke, 2021) presented the results obtained by analyzing the ISIC2019 dataset with these architectures. it is worth

highlighting the knowledge transfer implemented by the authors with the related architectures, favoring the execution of the CNN.

The knowledge transfer is performed with the architecture, which overcome the limitation of adding direct access connections, a problem that in some other neural networks is implemented by adding layers generating a greater depth in the construction but generating a greater number of errors in training and validation, (Ashfaq et al., 2019) focuses his research on the classification of 4 characteristics such as asymmetry, irregular edges, color and diameter, this allows him to achieve 93.7% accuracy with the Derm IS and DermQuest dataset of 206 images. On the other hand, (Bi et al., 2017) performs the comparison of the segmentation between the Resnet-seg model and the VGGNet architecture finding a better area under the curve in the ResNet (Ensembled) equivalent to 91.50%. Likewise, (Romero Lopez & Giro-I-Nieto, 2017) implements the learning transfer with the network to detect melanomas and non-melanomas and reaches 78.66% in the sensitivity of the architecture.

***Table 1**. Architectures.*

Author	Architecture	Dataset	Accuracy (%)	Classification
(Jain et al., 2021)	Xception Net	HAM10000	90.48	Melanoma/non-melanoma
(Hekler, Utikal, Enk, Hauschild, et al., 2019)	CNN	HAM10000, ISIC	89.2	Melanoma/non-melanoma
(Kadampur & Al Riyaee, 2020)	Squeeznet	HAM10000	99.77	Melanoma/non-melanoma
(Afza et al., 2022)	ELM-based clasification	HAM10000 y ISIC2018	93.40 y 94.36	Akiec, bcc, bkl, df, mel, nv, vasc
(Alom et al., 2019)	NABLA-N	ISIC2018	87	Akiec, bcc, bkl, df, mel, nv, vasc
(Florez Fuentes et al., 2022)	CNN	HAM10000	89.73	BKL, MEL, NV

Source: author's own elaboration.

Similarly, as described above, different researchers have made implementations with public domain datasets, which contain manually labeled images, in these implementations the authors perform detections according to the specific classification, in Table 1. Five architectures that classify melanomas and non-melanomas or classify various types of skin cancer are visualized with the implementation of public datasets.

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