A COMPREHENSIVE ASSESSMENT OF CLINICAL, DERMOSCOPIC, AND IMAGING STUDIES ON ARTIFICIAL INTELLIGENCE AND MELANOMA

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ABSTRACT

Melanoma diagnosis, prediction, and therapy are complicated and challenging aspects of cutaneous oncology that have a significant effect on health outcomes and healthcare costs. In these jobs, artificial intelligence (AI) use is quickly evolving. In the characterization of pigmented lesions, neural networks of increasing complexity are used in the cancer clinical presentation, analysis of the dermoscopic image, and also in the categorization of the histopathologic sample obtained from the patient. These initiatives hold the prospect of faster and more precise melanoma detection, as well as precise prognosis and therapy response prognosis. Through this manuscript we attempt to present a brief overview of AI, highlighting current research uses of artificial intelligence in melanoma, and the obstacles associated with artificial intelligence .

INTRODUCTION

Skin cancer has becomea serious health concern throughout the world. In historical aspects, skin cancer was thought to be a prominently found condition in European countries. But recent trends shows that it is spreading in almost all countries of the world. The high population of geriatric community, exposure to the UV radiation with increased outdoor activities, higher UV radiation in the sunlight, better access to healthcare and increased rate of diagnosis, and higher patient awareness about skin cancer are regarded to be contributing factors to the spike in incidence rate (1). A skin sample and histopathologic examination are performed to diagnose skin cancer. But, the discomfort at the site of lesion as well as the scar formation makes the process of ascertainingall pigmented lesions by biopsya difficult task to be accomplished. As a result, an observation done by a skilled specialist is assessed to identify whether or not a biopsy is needed. Moreover, dermatologists require a tool that

can identify changes in the surface lesions over time while keeping the lesions in detail in order to avoid wrong-site surgery (2, 3). Methods and techniques for capturing and evaluating what physicians observe have advanced quickly with the advancement of imaging techniques. The dermoscopic imagingtechnique is used for irradiatingthe light onto the dermal layer of the skinwhich is present in the higher leveland thus it isenabled for being seen and capturing the highly precisecolour changes in the skin.In recent years, there is a phenomenal growth in the highly innovative ,non-invasive instruments for the purpose of diagnosis.Examples include multiphoton microscopy ,confocal microscopyetc.These advancements in technology iscapable of detecting the cancer in cellular levels. The knowledge about the cutaneous lesions without biopsy has also been expanded over years. As a result, assessing skin scans utilizing the technology of artificial intelligence have been proven to be more efficient in average compared to the clinical diagnostic outcomes done by the clinicians. These advancements aided by the artificial intelligence are predicted to possess a substantial rolein the detection of skin cancer. Also it is helpful for the precise tracking of alterations on theproblematic lesions, and the efficient follow-up which is essential after the skin cancer surgery. Programs which could be accessed in the ordinary smartphones have become more accessible for customer convenience; nevertheless, these are not properly supported by scientific data. (4)

MACHINE LEARNING

This is a form of artificial intelligence in which computers draw conclusions from existing data without the explicit programming being done. The approach towards the study can be done in a supervisedmanner, semi-supervised manner or even in aunsupervised way. With the approach of supervised learning, the computer is feeded with the data initially. Thenevery sample is added with the answer or the class associated with it. Further, it is learned by the trial and error methodology.

DEEP LEARNING

Deep learning comes under the spectrum of machine learning .Ituses the ordered layers of artificial neural networks (ANNs) for constructingvarious layers that is capable of recognizing certain aspects of a dataset given. There is no requirement for the manual extraction of data features from the image. Deep learning is more faster and more effective way of machine learning than the traditional approach towards the machine learning .

CLINICAL DIAGNOSIS OF PIGMENTED LESIONS WITH AI

An ANN subtype that is especially helpful for picture categorization and identification are convolutional neural networks (CNNs). These models, which are used in the robots, have been demonstrated to recognize traffic signals, things, and faces smarter than people. CNNs are the predominant method used in dermatology due to their greater capacity to identify and categorize pictures.The first studies based on clinical pictures that used computer-aided photomicrography (CNNs) for pigmented lesion classification were released in 2016. Nasr-Esfahani et al. employed a research based on 170 non-dermoscopic clinical photos which consists of 70 melanoma cases and 100 nevuscases.Then various simple techniques like cropping, scaling and rotating was done to the original images

.Then it is enlarged to produce 6120 images. For the detection of melanoma, the algorithm was 81 percent sensitive to the true diagnosis, 80 percent were found to be specific, and 81 percent were found to be accurate in results.(5)Certain other investigations have reported similar results and have obtained even better results. The sensitivity of diagnosis wasup to 90% and the accuracy of the diagnosis were found to be in the range of 82%–94%. When this technology was used to assess whether biopsy, treating the lesion, or giving reassurance to the patient is to be done, an artificial intelligence aided computer surpassed the clinical decision taken by the dermatologists (Esteva et al., 2017).(6)In discriminating suspected pigmented lesions from the nonsuspicious lesions, this program has even attained a sensitivity of 90% and specificity in diagnosis of 90%. The power of a CNN to create original images. The CNN was in charge of feature extraction.(6)

ARTIFICIAL INTELLIGENCE IN PIGMENTED LESION DERMOSCOPY

For more than two decades, artificial intelligence has been applied to the analysis of the dermoscopic images (Binder et al., 2000). CNNs are used in modern artificial intelligence to distinguish between melanoma and non-melanoma. Eleven studies found a conclusion that CNN is more benficialin a comprehensive review,which compared the accuracy of a CNN to the clinical specialists in the classification of pigmented lesions. The physiciansimproved their sensitivity in diagnosis to 88.9 percent and specificity in diagnosis to 75.7 percent whenmore clinical information and photos were provided, but they still fell short to the efficiency of CNN.(7) Artificial intelligence is vulnerable to the image factors which may be negligible or insignificant while a practitioner is doing the visual examination.

AI IN PIGMENTED LESION PATHOLOGY

Hekler et al. in the year of 2019used a convolutional neural networksin melanocytic lesions for classifying it as benign nevi or melanoma. The particular employed system was trained on 595 photos which were randomly cropped. Then the system was employed for testing the accuracy on 100 images. Using dermatopathologist-curated representative photos, the system obtained a accuracy of 92 percent in the classification .Thesensitivity was found to be 85 percent and the specificity of the system was found to be 99 percent. (8) An ensemble of three CNNs was trained to classify benign and malignant melanoma WSIs(Whole slide and was then compared to a panel of 18 dermatopathologists (Brinker et al., 2021). In a study for identifying the slides with a tumor region which is annotated as a region of interest, 92 percent of accuracy has been obtained by a CNN .Also, 88 percent accuracy was obtained for unannotated slides which has used 108 WSIsas training set.(9)

For two validation sets with 51 melanoma patients who were having at least 24 months of follow-up, the model's output was further assessed for accuracy in predicting distant metastatic recurrence (DMR).(9)

CHALLENGES OF AI

When compared to radiography or funduscopic images, photographs of human skin are not uniform. This means that a human must select images (patches) from WSIs or photos to classify and feed to neural

networks. The majority of existing datasets are made up of photographs from fair-skinned populations in Asia, Europe, and the United States. Melanoma detection in skin of color is significantly less reliable

than in skin of any other race or ethnicity. (10) When clinical information, such as skin cancer history and demographics, is fed into an artificial intelligence (CNN) system, clinicians' accuracy improves. The adoption of AI in clinical practice has the possibility to cause cognitive bias. There is a need for research into the impact of human factors on the use of AI.(11)

CONCLUSION

Dermatologists and dermatopathologists should collaborate with technical professionals to embrace artificial intelligence (AI), which has the potential to improve medical decision-making and expand access to care. These advantages are especially important in the diagnosis and therapy of melanocytic neoplasms, which, despite decades of research, remain a puzzling mystery.

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