AI-based localization and classification of skin disease with Erythema

DOMAIN NAME: ARTIFICIAL INTELLIGENCE

GROUP NAME: AI based localization and classification of skin disease with erythema

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Paper 1: The Classification of Six Common Skin Diseases Based on Xiangya-Derm: Development of a Chinese Database for Artificial Intelligence

Published year : 2021

Author :Shuang Zhao

Journal Name : Journal of medical Internet Research

Summary : In this study, we established a new database, Xiangya-Derm, which consists of over 150,000 clinical images of 571 different skin diseases in the Chinese population. Xiang-Derm is the first integrated, normative database based on skin conditions in the Chinese population. Based on this database, we selected six common skin diseases and proposed an AI network, Xy-SkinNet. The top 1 and top 3 diagnostic accuracies of Xy-SkinNet were higher than those of dermatologists from the Department of Dermatology. This study was an attempt at exploring AI products and services and has successfully set the stage for future development. An increasing number of studies are incorporating clinical images.There are already some open databases, such as AtlasDerm, Derm101, and Dermnet. Considering differences in skin color, Xiangya-Derm can provide data for realizing AI diagnosis of skin diseases among the Chinese population. Many existing databases lack medical history information, especially information about pathological diagnosis, and, potentially, contain some misdiagnosed photos. Notably, one of the greatest advantages of Xiangya-Derm is that most images contain corresponding skin pathology results, providing the category annotation of a gold standard, which can be most effectively

applied to various research studies and in the development of AI.

This feature ensures that the diagnostic information about pictures used for deep learning is accurate and reduces the diagnostic errors caused by misdiagnosis. Of course, there are also a small number of unmatched pictures in our database, which is correlated with the lack of corresponding dermoscopic images.In addition, XiangyaDerm provides image data with the location for all skin lesions, thus enabling researchers to apply object detection algorithms in computer vision for the automatic diagnosis of skin diseases. Moreover, each image has a full set of clinical information about the patient, including demographic information, complaints, current medical history, past medical history, and family history. Given the complete set of big data, conducting further research on AI diagnosis using multimodal data, which is more coincident with the real-world diagnosis process and more intuitive for both doctors and patients, is achievable.

Methodology Used : Artificial intelligence

Paper 2 : Skin disease detection using artificial intelligence

Published Year: 2022

Author Name: S. Kuzhaloli,L. M. Varalakshmi,Kamal Gulati,Makarand Upadhyaya,Narinder Kumar Bhasin,Vijayakumar Peroumal

Journal Name: AIP Conference Proceedings

Summary: Artificial intelligence (AI) algorithms for automated classification of skin diseases are available to the consumer market. Studies of their diagnostic accuracy is rare. We assessed the diagnostic accuracy of an open-access AI application for recognition of skin diseases. The AI algorithm classified the images giving 5 differential diagnoses, which were then compared to the diagnoses made clinically by the dermatologists and/or histological. The level of diagnostic accuracy varied considerably for diagnostic groups. The online application demonstrated low diagnostic accuracy compared to a dermatologist evaluation and needs further development. Input signs have been developed to classify the disorder. With the aid of

experts in the area, we received symptoms of 10 skin diseases. The symptom data were trained by various classifiers. We observed that high quality AI-based support for clinical decision making enhances the accurate diagnosis of either AI or doctors alone and that less skilled physicians are better served by AI.

Methodology Used: Artificial Intelligence

Paper 3: AI-Skin: Skin disease recognition based on self-learning and wide data collection through a closed-loop framework

Published Year: 2019

Author Name: Min chen,Ping Zhou

Journal Name: Science Direct Journal and Book

Summary: There are a lot of hidden dangers in the change of human skin conditions, such as the sunburn caused by long-time exposure to ultraviolet radiation, which not only has aesthetic impact causing psychological depression and lack of self-confidence, but also may even be life-threatening due to skin canceration. Current skin disease researches adopt the auto-classification system for improving the accuracy rate of skin disease classification. However, the excessive dependence on the image sample database is unable to provide individualized diagnosis service for different population groups. To overcome this problem, a medical AI framework based on data width evolution and self-learning is put forward in this paper to provide skin disease medical service meeting the requirement of real time, extendibility and individualization. First, the wide collection of data in the close-loop information flow of user and remote medical data center is discussed. Next, a data set filter algorithm based on information entropy is given, to lighten the load of edge node and meanwhile improve the learning ability of remote cloud analysis model.
In addition, the framework provides an external algorithm load module, which can be compatible with the application requirements according to the model selected. Three kinds of deep learning model, i.e., LeNet-5, AlexNet and VGG16, are loaded and compared, which have verified the universality of the algorithm load module. The

experiment platform for the proposed real-time, individualized and extensible skin disease recognition system is built. And the system's computation and communication delay under the interaction scenario between tester and remote data center are analyzed. It is demonstrated that the system we put forward is reliable and effective.

Methodology Used: Deep learning

Paper 4: Skin Diseases Classification Using Hybrid AI Based

Localization Approach

Published Year: 2022

Author Name: Vijay Kumar

Journal Name: Hindawi Computational Intelligence and Neuroscience Volume 2022, Article ID 6138490

Summary: One of the most prevalent diseases that can be initially identified by visual inspection and further identified with the use of dermoscopic examination and other testing is skin cancer. Since eye observation provides the earliest opportunity for artificial intelligence to intercept various skin images, some skin lesion classification algorithms based on deep learning and annotated skin photos display improved outcomes. The researcher used a variety of strategies and methods to identify and stop diseases earlier. All of them yield positive results for identifying and categorizing diseases, but proper disease categorization is still lacking. Computer-aided diagnosis is one of the most crucial methods for more accurate disease detection, although it is rarely used in dermatology. For Feature Extraction, we introduced Spectral Centroid Magnitude (SCM). The given dataset is classified using an enhanced convolutional neural network; the first stage of preprocessing uses a median filter, and the final stage compares the accuracy results to the current method.

Methodology Used: Artificial Intelligence

Paper 5: Automatic histologically-closer classification of skin lesions

Published Year: 2018

Author Name: Pedro Pedrosa Rebouças Filhoa , Solon AlvesPeixotoa ,Raul VictorMedeiros da Nóbregaa

Journal Name: Science Direct Jouranl and Book

Summary: According to the American Cancer Society, melanoma is one of the most common types of cancer in the world. In 2017, approximately 87,110 new cases of skin cancer were diagnosed in the United States alone. A dermatoscope is a tool that captures lesion images with high resolution and is one of the main clinical tools to diagnose, evaluate and monitor this disease. This paper presents a new approach to classify melanoma automatically using structural co-occurrence matrix (SCM) of main frequencies extracted from dermoscopy images.

The main advantage of this approach consists in transform the SCM in an adaptive feature extractor improving his power of discrimination using only the image as parameter. The images were collected from the International Skin Imaging Collaboration (ISIC) 2016, 2017 and Pedro Hispano Hospital (PH2) datasets. Specificity (Spe), sensitivity (Sen), positive predictive value, F Score, Harmonic Mean, accuracy (Acc) and area under the curve (AUC) were used to verify the efficiency of the SCM. The results show that the SCM in the frequency domain work automatically, where it obtained better results in comparison with local binary patterns, gray-level co-occurrence matrix and invariant moments of Hu as well as compared with recent works with the same datasets. The results of the proposed approach were: Spe 95.23%, 92.15% and 99.4%, Sen 94.57%, 89.9% and 99.2%, Acc 94.5%, 89.93% and 99%, and AUC 92%, 90% and 99% in ISIC 2016, 2017 and PH2 datasets, respectively.

Methodology Used: Machine learning

Paper 6: Developing a Recognition System for Diagnosing Melanoma Skin Lesions Using Artificial Intelligence Algorithms

Published Year: 2021

Author Name: Fawaz Waselallah Alsaade,Theyazn H. H. Aldhyani, Mosleh Hmoud Al-Adhaileh

Journal Name: Hindawi Journal

Summary: In recent years, computerized biomedical imaging and analysis have become extremely promising, more interesting, and highly beneficial. They provide remarkable information in the diagnoses of skin lesions. There have been developments in modern diagnostic systems that can help detect melanoma in its early stages to save the lives of many people. There is also a significant growth in the design of computer-aided diagnosis (CAD) systems using advanced artificial intelligence. The purpose of the present research is to develop a system to diagnose skin cancer, one that will lead to a high level of detection of the skin cancer. The proposed system was developed using deep learning and traditional artificial intelligence machine learning algorithms. The dermoscopy images were collected from the PH2 and ISIC 2018 in order to examine the diagnose system. The developed system is divided into feature-based and deep leaning. The feature-based system was developed based on feature-extracting methods. In order to segment the lesion from dermoscopy images, the active contour method was proposed. These skin lesions were processed using hybrid feature extractions, namely, the Local Binary Pattern (LBP) and Gray Level Co-occurrence Matrix (GLCM) methods to extract the texture features. The obtained features were then processed using the artificial neural network (ANNs) algorithm. In the second system, the convolutional neural network (CNNs) algorithm was applied for the efficient classification of skin diseases; the CNNs were pretrained using large AlexNet and ResNet50 transfer learning models. The experimental results show that the proposed method outperformed the state-of-art methods for HP2 and ISIC 2018 datasets. Standard evaluation metrics like accuracy, specificity, sensitivity, precision, recall, and -score were employed to evaluate the results of the two proposed systems. The ANN model achieved the highest accuracy for PH2 (97.50%) and ISIC 2018 (98.35%) compared with the CNN model. The

evaluation and comparison, proposed systems for classification and detection of melanoma is presented.

Methodology Used: Artificial intelligence

Paper 7: Automatic skin disease diagnosis using deep learning from clinical image and patient information

Published year: 2021

Author: K. A. Muhaba,K. Dese,T. M. Aga,F. T. Zewdu,G. L. Simegn

Summary: The most prevalent diagnosis approach for illnesses is visual assessment in conjunction with clinical information. Manual skin disease diagnosis takes time, requires skill and great visual acuity, and is prone to error. A deep learning pre-trained mobilenet-v2 model is provided for the automated diagnosis of five common skin diseases using data from clinical photos and patient information. Using the suggested technique, a multiclass classification accuracy of 97.5%, sensitivity of 97.7%, and precision of 97.7% has been attained for the common five skin diseases.

Methodology Used: Mobilenet-V2

Paper 8: A Method Of Skin Disease Detection Using Image Processing And Machine Learning

Published year: 2019

Author: Nawal Soliman ALKolifi ALEnezi

Summary: The advancement of lasers and Photonics based medical technology has made it possible to diagnose the skin diseases much more quickly and accurately. But the cost of such diagnosis is still limited and very expensive. Proposed an image processing-based approach to diagnose the skin diseases. This method takes the digital image of disease effect skin area then use image analysis to identify the type of disease. Initially, the input images are pre-processed, then features are extracted using pretrained CNN. Finally, classification is performed using SVM classifier. The system was tested on six types of skin diseases with accuracy of 95%.

Methodology Used: AlexNet(CNN)

Paper 9: Segmentation and Classification of Skin Lesions for Disease Diagnosis

Published year: 2015

Author: R.Sumithra MahamadSuhil D.S.Guru

Summary: Visual evaluation in concert with clinical data is the most common method of sickness diagnosis. Manual skin disease diagnosis is labourintensive, error-prone, and demands considerable skill and visual acuity. A novel approach for automatic segmentation and classification of skin lesions using SVM and k-NN classifiers is proposed. A dataset of 726 samples from 141 photos representing 5 different types of diseases is used to assess the system's performance. The results are highly encouraging, with F measures of 46.71% and 34% for SVM and k-NN classifiers, respectively, and 61% for SVM and kNN classifier fusion.

Methodology Used: SVM and KNN Classifiers

Paper 10: Multiclass skin cancer classification using EfficientNets – a first step towards preventing skin cancer

Published year: 2021

Author: KararAliac, Zaffar Ahmed Shaikha, Abdullah AyubKhan, Asif Ali Laghari

Summary: The dermatologist's experience limits the visual examination of dermatoscopic pictures. Due to the subjectivity of human decisionmaking, alongside high inter-class similarity in skin lesions and other complicating factors, this method is prone to mistakes. To better mimic and maybe exceed medical experts, an automated computer system must engage in vast amounts of visual exploration utilising historical data. To examine the EfficientNets B0-B7's classification abilities using the HAM10000 dataset of dermatoscopic pictures. 10015 photos from seven different skin cancer classes—akiec, bcc, bkl, df, mel, nv, and vasc—make up the dataset. By performing transfer-learning on the pre-trained weights of ImageNet and adjusting the Convolutional Neural Networks, they trained the EfficientNets B0-B7 on the HAM10000 dataset. They assessed the performance of all EfficientNet variations on this unbalanced multiclass classification issue using metrics such as Precision, Recall, Accuracy, F1 Score, and Confusion Matrices in order to examine the effects of transfer learning and fine-tuning. For each of the eight models, the study displays the per-class

classification scores as Confusion Matrices. Our most reliable model, EfficientNet B4, in particular, achieved an 87 percent F1 Score and an 87.91 percent Top-1 Accuracy..

Methodology Used: EfficientNets B0-B7

Paper 11: Assisted deep learning framework for multi-class skin lesion classification considering a binary classification support

Published year: 2020

Author: Balazs Harangi Agnes Baran, AndrasHajdu

Summary: Skin cancer is a frequent and locally damaging type of malignant development. It comes from the cells that are arranged in a row along the membrane that divides the outermost layer of skin from the deeper layers. Because pigmented lesions are found on the skin's surface, a clinical professional can visually check one to identify malignant behaviour (such as melanoma) early. However, the majority of the time it goes unnoticed, which has serious health consequences. In this paper they proposed a CNN architecture, which is simultaneously trained to solve a binary and a multi-class classification problem, where the two classes of the binary task represent the benign/malignant classes of the original 7-class skin lesion classification problem. They have simultaneously trained the identical CNN architecture (GoogleNet Inception-v3) for a binary and multi-class challenge by merging their softmax outputs on a support training layer and multiplying the multi-class confidences with the corresponding binary ones. By doing this, They have significantly improved a 7-class classification issue with regard to skin lesions. When the classes cannot be combined directly into fewer classes, Their method has a natural constraint. However, by using a non-supervised technique like k-means clustering, this problem can be solved.

Methodology Used: GoogLeNet Inception-v3

Paper 12: Artificial Intelligence Based Cooperative Spectrum Sensing Algorithm Intelligence Based Cooperative Spectrum

Published Year: 2018

Author: M. Mourad Mabrooka, Hussein A.Khalilb , Aziza I.Husseinc

Summary: Cognitive Radio (CR) technology is regarded as a key network technology used to manage the limitation of the available spectrum in wireless communication networks. Spectrum Sensing (SS) is the core process in CR engine based on detecting the free channels and sharing it among other users. In wideband spectrum, many algorithms are proposed to sense the available free channels. Cooperative sensing is mainly considered as an effective solution of signal fading and shadowing problems in CR networks. Wideband spectrum sensing techniques achieved great importance in cognitive radio networks. Therefore, adaptive blind multi-Coset sampling based wide spectrum sensing technique is used in this paper. In order to overcome the effect of noise and fading problems, centralized cooperative sensing scheme is developed. The error was theoretically calculated about 10% but practical wise was 1 % after 300 epoch of training.

Methodology Used: Cognitive Radio technology in cooperative spectrum

Paper 13: AI-based localization and classification of skin disease with erythema using CNN

Published year: 2021

Author: Ha Min Son1, Wooho Jeon1, Jinhyun Kim2, Chan Yeong Heo3, Hye Jin Yoon1

Summary: Although computer-aided diagnosis (CAD) is used to improve the quality of diagnosis in various medical fields such as mammography and colonography, it is not used in dermatology, where noninvasive screening tests are performed only with the naked eye, and avoidable inaccuracies may exist. This study shows that CAD may also be a viable option in dermatology by presenting a novel method to sequentially combine accurate segmentation and classification models. Given an image of the skin, we decompose the image to normalize and extract high-level features. Using a neural network-based segmentation model to create a segmented map of the image, we then cluster sections of abnormal skin and pass this information to a classification model. We classify each cluster into different common skin diseases using another neural network model. Our segmentation model achieves better performance compared to previous studies, and also achieves a near-perfect sensitivity score in unfavorable conditions. Our classification model is more accurate than a baseline

model trained without segmentation, while also being able to classify multiple diseases within a single image. This improved performance may be sufficient to use CAD in the field of dermatology.

Methodology used: CNN

Paper 14: Skin lesion classification system using a K-nearest neighbor algorithm

Published year: 2019

Author: Mustafa Qays Hatem

Summary: One of the most critical steps in medical health is the proper diagnosis of tthe disease. Dermatology is one of the most volatile and challenging fields in terms of diagnosis. Dermatologists often require further testing, review of the patient's history, and other data to ensure a proper diagnosis. Therefore, finding a method that can guarantee a proper trusted diagnosis quickly is essential. Several approaches have been developed over the years to facilitate the diagnosis based on machine learning. However, the developed systems lack certain properties, such as high accuracy. This study proposes a system developed in MATLAB that can identify skin lesions and classify them as normal or benign. The classification process is effectuated by implementing the K-nearest neighbor (KNN) approach to differentiate between normal skin and malignant skin lesions that imply pathology. KNN is used because it is time efficient and promises highly accurate results. The accuracy of the system reached 98% in classifying skin lesions. As it is based on the KNN algorithm, and as a result, new data can be added seamlessly without affecting the accuracy.

Methodology Used: KNN

Paper 15: Machine Learning and Deep Learning Integration for Skin Diseases Prediction

Published year: 2016

Author: Samir Kumar Bandyopadhyay , Payal Bose, Amiya Bhaumik, Sandeep Poddar

Summary: Living creature skin disease is a fairly prevalent ailment. In the medical world, monitoring dermatological disorders and classifying them is a complex process. Due to the sheer intricacy of

individual skin tone and the visible proximity effect of infections, recognizing the precise type can be challenging at times. As a result, it is critical to diagnose and recognize skin disease as soon as possible. Artificial intelligence (AI) is quickly expanding in therapeutic areas in a modern context. For diagnostic purposes, much deep learning (DL) and machine learning (ML) methods are applied. These strategies drastically enhance the diagnosing process while also speeding it up. In this study, to improve disease detection, a model combining deep learning (DL) and machine learning (ML) has been developed. For classification, three sets of machine learning models were utilized, and for feature selection, four sets of pre-trained deep learning models were being used. Forclassification models, deep neural networks Alexnet, Googlenet, Resnet50, and VGG16 were used, while Support Vector Machine, Decision tree, and Ensemble boosting Adaboost classifier were applied for classification. To identify the best prediction model, a comparative study was carried out. The hybrid method Resnet50 with SVM produced the best results, with 99.11% accuracy.

Methodology Used: Deep Learning and Machine Learning