LITERATURE SURVEY

AI-BASED LOCALIZATION AND CLASSIFICATION OF SKIN DISEASE WITH ERYTHEMA

Domain: Artificial Intelligence

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Paper 1: AI-based localization and classification of skin disease with erythema

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Journal name: www.nature.com/scientificreports

Summary:

The classification of a disease is difficult due to the strong similarities between common skin disease symptoms. Therefore, it would be beneficial to exploit the strengths of CAD using artificial intelligence techniques, in order to improve the accuracy of dermatology diagnosis. This paper shows that CAD may be a viable option in the field of dermatology using state-of-the-art deep learning models. The segmentation and classification of skin diseases has been gaining attention in the field of artificial intelligence because of its promising results. Two of the more prominent approaches for skin disease segmentation and classification are clustering algorithms and support vector machines (SVMs). Clustering algorithms generally have the advantage of being fexible, easy to implement, with the ability to generalize

features that have a similar statistical variance. Trabelsi et al.3 experimented with various clustering algorithms, such as fuzzy c-means, improved fuzzy c-means, and K-means, achieving approximately 83% true positive rates in segmenting a skin disease. Rajab et al.4 implemented an ISODATA clustering algorithm to find the optimal threshold for the segmentation of skin lesions. An inherent disadvantage of clustering a skin disease is its lack of robustness against noise. Clustering algorithms rely on the identification of a centroid that can generalize a cluster of data.

In this paper, we present a method to sequentially combine two separate models to solve a larger problem. In the past, skin disease models have been applied to either segmentation or classification. In this study, we sequentially combine both models by using the output of a segmentation model as input to a classification model. In addition, although past studies of non-CNN segmentation models used innovative preprocessing methods, recent CNN developments have focused more on the architecture of the model than on the preprocessing of data.

Conclusion:

We have shown that even without a large dataset and high-quality images, it is possible to achieve sufficient accuracy rates. In addition, we have shown that current state-of-the-art CNN models can outperform models created by previous research, through proper data preprocessing, self-supervised learning, transfer learning, and special CNN architecture techniques. Furthermore, with accurate segmentation, we gain knowledge of the location of the disease, which is useful in the preprocessing of data used in classification, as it allows the CNN model to focus on the area of interest. Lastly, unlike previous studies, our method provides a solution to classify multiple diseases within a single image. With higher quality and a larger quantity of data, it will be viable to use state-of-the-art models to enable the use of CAD in the field of dermatology.

Paper 2: Necrolytic migratory erythema is an important visual cutaneous clue of glucagonoma

Publication year: August 2022

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Journal name: www.nature.com/scientificreports

Summary:

Erythema is an extremely rare and slow-growing functional pancreatic neuroendocrine tumor arising from islet alpha cells in the tail of the pancreas. It usually presents with glucagonoma syndrome associated with characteristic clinical symptoms, including necrolytic migratory erythema (NME), diabetes mellitus (DM), stomatitis, anemia, deep vein thrombosis (DVT), weight loss, diarrhea and other symptoms. With the exception of NME, other clinical manifestations are nonspecific, which accounts for the delay in diagnosis in most cases and also for the fact that at least 50% of cases already have metastatic disease at the time of diagnosis. NME is observed in approximately 70–90% of patients diagnosed with glucagonoma. This rash is usually widespread, and the major sites of involvement are the perioral region, trunk, extremities and perineum. The distinguishing feature of NME is annular erythematous plaques with central bullous, ulcerative lesions surrounded by brown pigment, which are usually pruritic and painful. The histological features of this skin lesion include parakeratosis, hyperkeratosis, spongiosis of the epidermis with necrolysis, loss of the granular layer, vacuolization of keratinocytes, and perivascular and interstitial inflammation. This paper summarizes the clinical characteristics of seven typical patients with glucagonoma followed at our hospital during the past 10 years. Our cumulative experiences (including diagnosis and treatment) may help clinicians to better recognize, diagnose and treat glucagonoma.

This study was approved by the Ethics Committee of the First Affiliated Hospital of Xi'an Jiao tong University and the study was conducted in accordance with the approved guidelines. Informed consent was obtained from all subjects and/or their legal guardian(s). We reviewed the database and collected seven cases of glucagonoma in the past 10 years. Patients with clinical presentations of skin manifestation (the skin rash is characterized by an intense erythematous lesion, which shows superficial epidermal necrosis and spreads in a centrifugal pattern), glucagonoma syndrome, elevated plasma glucagon, and a pathological diagnosis of pancreatic islet cell tumor were included in this cohort. The medical records of the included patients were reviewed. Tumor diameters were obtained from CT scan measurements. Follow-up data, including patients' follow-up status, symptoms (skin rash), recovery and administration of other therapies, were acquired from hospital medical records or by phone interviews with the patients, relatives practitioners.

Conclusion:

Surgical removal is considered to be the only definitive and curative treatment for pancreatic glucagonoma and NME7 . Optional operations included simple enucleation (< 2 cm) with peripancreatic lymph dissection, pancreaticoduodenectomy with peripancreatic lymph dissection, distal pancreatectomy with peripancreatic lymph dissection and splenectomy. However, more than half of all glucagonomas present with metastatic disease, most commonly liver metastasis. It has been reported that synchronous resection of pancreatic neuroendocrine tumors and liver metastasis (more than 30% of the liver tissue retained) provides a more favorable outcome. Liver transplantation may be considered as a potential therapeutic approach for unresectable hepatic metastases arising from pancreatic glucagonoma20. TACE might also be a safe therapeutic approach for liver metastasis arising from NETs because of the highly vascular and blood supply that primarily derives from the hepatic artery21. In addition, RFA is usually performed in combination with surgery, which has certain advantages in removing isolated metastases22. Medical therapy for glucagonoma, including chemotherapeutics, somatostatin analogous, PRRT and molecular targeted drugs, are also effective in controlling clinical symptoms and tumour growth7,16.

In conclusion, erythema is a rare type of functional NET. Since NME might be the only clue for the early detection of this tumour, it is very important to correctly diagnose NME in a timely manner Currently, surgical intervention is the only definitive treatment for this disease. Medical therapy is effective for symptom control and metastatic disease management.

Paper 3: Hyperspectral Imaging and Classification for Grading Skin Erythema

Publication year: 28 August 2018

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Journal name: www.frontiersin.org

Summary:

Skin Erythema, also called cutaneous inflammation, is a symptom associated with diverse cutaneous diseases [1] such as psoriasis [2, 3] and acne lesions [4], as well as with skin injuries such as pressure sores and burns [5, 6]. In more extreme cases of thrombocytopenia, cutaneous inflammation is claimed to be a trigger for a life-threatening hemorrhaging condition [7]. Although considered an adverse response, erythema is commonly used as a feature to monitor the manifestation of skin diseases and the severity of treatment induced side effects. In radiation therapy, erythema reactions resulting from skin exposure to ionizing radiation also known as radiation dermatitis is a common limiting factor. Unchecked, severe radiation dermatitis can lead to intense pain, skin ulcers and tissue necrosis resulting in treatment interruptions and reduced quality of life [8–11]. Early assessment of radiation induced erythema can facilitate more timely interventions; it may help reduce patient discomfort, increase compliance with treatment and improve treatment outcomes[10].

In the current study, the constructed skin contours display the temporal phases along with the spatial changes of the skin reaction intensity. The displayed contours, of different reactions, are attained via a sequence of steps. The first step is grading the induced skin reaction by VA. This step is repeated for all consecutive imaging cycles for each volunteer. Following grading, the second step is computing the ratio of each erythematous reaction region with respect to the entire ROI. The final step is plotting the graded contours of skin at the corresponding imaging cycle, which represents the temporal evolution as shown. The induced skin erythema intensity fades away gradually over time.

Conclusion:

In this study, we aimed to investigate the feasibility to use an AOTF-HSI system to quantitatively measure skin erythema. This pilot study on healthy volunteers with artificially induced erythema is a checkpoint prior to apply the AOTF-HIS method in a clinical study on radiation treatment induced skin erythema. The current study results demonstrated that HIS can sufficiently classify skin erythema. Compared to diffuse reflectance spectroscopy or color photography, HSI acquires a complete set of wide-field images with full spectral information, which is shown to be important to skin erythema classification. Even though both spectral and color imaging techniques approved the green region as the most discriminating region inerythema assessment; color imaging is sufficient for interpreting the green reflectance change with

erythema alteration. In addition to skin reflectance analysis, supervised classification, LDA processing, contributed in clustering distinct level of induced skin erythema. This clustering technique yields a map for distributed changes of skin erythema. Training the developed LDA classifier with the ground truth created an objective quantitative method of erythema assessment.

Paper 4: Skin Diseases Classification Using Hybrid AI Based Localization Approach

Publication year:29 August 2022

Author name: Keshetti Sreekala, A. Yeshitla

Journal name: https://www.hindawi.com/

Summary:

The image processing techniques are involved in the given input data sets go through the preprocessing techniques. These techniques are handled by using the median filter in this proposed approach. The preprocessing techniques are helping to remove the noise in the images, the median filter removes the salt and the pepper noise in the given input images. After the completion of the preprocessing technique, the segmentation process has been handled by reducing the dimensionality space in the entire image.The feature extraction in the entire image processing is considered as the dimensional reduction process, thus the entire dataset individual images are broken up into more manageable groups; in this paper, it is implemented that the given collections for skin diseases are extracted by using the Structural Co-Occurrence matrixes. This feature extraction plays a vital role in image processing since the better quality the dimensional quality reduction in the entire network system provides enhanced accuracy results in the image classifications. This proposed approach provides an enhanced Convolutional Neural Network for the classification of the whole scale images. The combination of the feature extraction in SCM and the classification in ECNN shows better accuracy when compared to the existing techniques.

Conclusion:

This paper implements that the structural Co-Occurrence Matrixes for feature

extraction in the skin diseases classification and the preprocessing techniques are handled by using the Median Filter, this filter remove the salt and pepper noise in the Image processing; thus, it enhances the quality of the images, and normally, the skin diseases are considered as the risk factors in all over the world. Many researchers are involved to detect and prevent the diseases earlier, thus we found this new approach from many existing approaches are involved in the classification of the accuracy results in the entire network, and the comparison of our approach provides less amount of accuracy. This proposed approach provides 97% of the classification of the accuracy results while other existing model such as FFT+SCM gives 80%, SVM+SCM gives 83%, KNN+SCM gives 85%, and SCM+CNN gives 82%.

Paper 5: A Novel Hybrid Deep Learning Approach for Skin Lesion

Segmentation and Classification

Publication year: 18 April 2022

Author name: Puneet Thapar, Manik Rakhra , Gerardo Cazzato, and Md Shamim Hossain

Journal name: https://www.hindawi.com/

Summary:

On the basis of discussed data sets, an automatic skin lesion segment and intelligent classification models were designed and the overall process of the proposed method is shown suggested model's whole operational procedure depicts the working architecture of the module that aids in the segmentation and classification of skin cancer from dermoscopic images of skin lesions. Preprocessing, K-means with GOA-based segmentation, SURF-based feature extraction, and SURF-based feature extraction are the five steps of the described model's operation and feature selection using GOA and CNN-based training as well as classification. Initially, preprocessing step is carried out using the hair removal technique with image quality enhancement that is named as the HR-IQ algorithm.The K-means algorithm with GOA is used to segment the exact skin lesion region from the preprocessed dermoscopic images known as the region of lesion (ROL). When ROI segmentation is done, the next, SURF-based feature extraction with feature selection process occurs using GOA as a feature optimization technique. Finally, CNN is used to train and classify skin cancer from the dermoscopic image for automatic skin

lesion and intelligent classification models into different classes. Based on the given process of automatic skin lesion segment and intelligent classification model, each step is described in detail in the following sections of the research article.

Conclusion:

Results of the projected automatic skin lesion segment and intelligent classification model are examined in this part using three different data sets. e number of images used by the projected model during segmentation and classification of skin lesion dermoscopic images is presented. ISIC-2018, PH-2, and ISIC-2017 are the three data sets used in the proposed research for training and testing. 1000 photos are gathered for training and testing in the ISIC-2017 and ISIC-2018 data sets, with 60% of images (600 images) used for training and 40% used for testing. In PH-2 data set, 600 images are collected where 60% of images (400 image) are used for testing and 40% images are used for testing. In the proposed work, two classes of cancer are used that are melanoma and nonmelanoma. In this work, two subclasses of nonmelanoma are used that are common nevus and atypical nevus. Dermoscopy images are available that help in the diagnosisof skin lesions by the computer-aided diagnosis systems based on CNN, a deep learning approach that can automatically extract features inside patterns that help in efficient classification. In this study, utilizing the ISIC-2017, ISIC- 2018, and PH-2 data sets, images of skin lesions were classified. e model obtained a classification accuracy of 98.42%. To achieve this, various existing SI techniques are evaluated, and GOA is found to exhibit the best performance for skin lesion segmentation work. Further, SURF is taken for the feature extraction of the segmented regions and the CNN for classification of the skin lesion images into melanoma and nonmelanoma classes. e proposed work exhibits the best performance with 98.42% classification accuracy, 97.73% precision, MCC of 0.9704, and also outperformed the existing work by 6.12% accuracy. It was observed that the proposed approach improves the existing work with 9.21%, 5.78%, and 8.34% higher specificity, precision, and F-measure, respectively. e MCC of the existing work is 0.795 which is nearly 18% less than the proposed work. is shows that the approach has a broader scope for melanoma diagnosis, and in future work, higher success can be obtained by enhancing the model and upgrading the data set and also further evaluated for more classes to address the practical challenges in healthcare and diagnosis.