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Facial Recognition based Diagnosis Using Transfer Learning

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Abstract

The association between the face and sickness has been debated for thousands of years, leading to the emergence of facial diagnosis. Deep learning algorithms will be used to investigate the possibility of diagnosing diseases from uncontrolled 2D facial photos. We propose leveraging deep transfer learning from face recognition to provide computer-aided facial diagnosis on several diseases in this research. In the trials, we use a small dataset to perform computer-aided face diagnosis on single and multiple disorders (beta-thalassemia, hyperthyroidism, Down syndrome, and leprosy). Deep transfer learning from face recognition can achieve top-1 accuracy of more than 90%, outperforming both classic machine learning approaches and doctors in the studies. In practice, gathering disease-specific face photos is difficult, expensive, and time intensive, and it involves ethical constraints due to the treatment of personal data. As a result, datasets for face diagnostic research are often private and tiny in comparison to those for other machine learning application fields. Deep transfer learning algorithms that succeed in facial diagnosis with a short dataset could provide a low-cost and non-invasive method for illness screening and detection.

1. INTRODUCTION

1.1 Introduction

Thousands of years ago, the basic doctrinal source for Chinese medicine, Huangdi Beijing, wrote, "Qi and blood in the twelve Channels and three hundred and sixty-five Collaterals all flow to the face and infuse into the Hongqiao (the seven orifices on the face)." It signifies that degenerative alterations in the internal organs can be seen in the affected locations. In China, a single experienced doctor can observe the patient's facial features to determine the patient's overall and local lesions, a process known as "facial diagnosis." Similar theories could be found in ancient India and Greece. Nowadays, face diagnosis refers to practitioners diagnosing diseases by analyzing facial traits. The limitation of facial diagnosis is that great accuracy is required for facial diagnosis. Doctors must have extensive practical experience. Many diseases, according to modern medical study, have corresponding traits on human faces. Because of inadequate medical resources, it is still difficult for residents in many rural and undeveloped areas to undergo medical examinations, resulting in treatment delays in many cases. Even in major cities, limits such as high costs, long wait times in hospitals, and the doctor-patient contradiction, which leads to medical disputes, exist. Computer-aided facial diagnosis enables us to do non-invasive disease screening and detection fast and easily. As a result, if facial diagnosis can be demonstrated to be effective while maintaining an acceptable mistake rate, it has enormous promise. We could use artificial intelligence to investigate the association between face and sickness in a quantitative manner. Deep learning technology has advanced the state of the art in several domains, particularly computer vision, in recent years. Deep learning, which is inspired by the structure of human brains, employs a multi-layer structure to perform nonlinear information processing and feature learning. It performed best in the ImageNet Large Scale Visual Recognition Challenge (ILSVRC) in 2012. As the competition progressed, various famous deep neural network models such as AlexNet, VGGNet, ResNet, Inception-ResNet, and SENet emerged. The findings of ILSVRCs have fully demonstrated that deep learning methods can convey the intrinsic information of the data more effectively. More successfully than the synthetic features. Deep learning is now one of the newest research trends in artificial intelligence. Face recognition is a term for the technology used to confirm or identify a subject's identity based on their appearance in photos or videos. In the realm of computer vision, it is a hot topic. Comparing a candidate's face to another and determining whether it matches is known as face verification. A one-to-one mapping is used. Matching a given face image to a face in a database of faces is the task of face identification. It is a mapping from one to many. Both can be done using different algorithmic frameworks, or metric learning can combine them into a single framework.

2. Literature Survey

• **[1] Y. Gurovich, Y. Hanani, O. Bar, G. Nadav, N. Fleischer, D. Gelbman, L. Basel-Salmon, P. M. Krawitz, S. B. Kamphausen, M. Zenker et al., "Identifying facial phenotypes of genetic disorders using deep learning,"**., 8% of the general population is affected by syndromic genetic disorders1. Numerous disorders have distinguishable face characteristics2, which are very useful to clinical geneticists. According to recent studies, facial analysis systems can identify syndromes just as well as skilled clinicians. These technologies only recognized a small number of disease phenotypes, which limited their application in clinical situations where hundreds of diagnoses must be taken into account. Here, we introduce the DeepGestalt framework for face picture analysis, which uses deep learning and computer vision algorithms to measure similarities to hundreds of syndromes. In three first studies, two with the aim of identifying people with a specific syndrome from other syndromes and one with the goal of separating several genetic subtypes in Noonan syndrome, Deep Gestalt outperformed physicians. Deep Gestalt identified the right diagnosis on 502 different photos with top-10 accuracy in the final testing, which reflected a real clinical setting problem. A community-driven phenotyping platform collected a dataset of more than 17,000 photos spanning more than 200 syndromes, which was used to train the model. Phenotypic evaluations in clinical genetics, genetic testing, research, and precision medicine may benefit greatly from the use of Deep Gestalt.

[2] Z. Shi, H. Hao, M. Zhao, Y. Feng, L. He, Y. Wang, and K. Suzuki, "A deep cnn based transfer learning method for false positive reduction," Multimedia Tools and Applications: When using a Computer Aided Detection (CAD) system to identify pulmonary nodules in thoracic Computed Tomography (CT), a low false positive (FP) rate is crucial. However, obtaining a low FP rate is still a very difficult challenge due to the heterogeneity of nodules in appearance and size. In this research, we present a deep transfer learning method based on Convolutional Neural Networks (CNN) for FP reduction in pulmonary nodule detection on CT slices. We employed a support vector machine (SVM) for nodule classification and one of the most recent CNN models, VGG-16, as a feature extractor to collect nodule features. First, we added all the layers from a VGG-16 model that had been previously trained in ImageNet to our target networks. The CNN model was then tweaked to adapt to the categorization of pulmonary nodules job using the final fully linked layers. Using the training data, such as the pulmonary nodule patch images and associated labels, the original CNN filter weights were then improved by back-propagation such that they more accurately represented the modalities in the pulmonary nodule image dataset. A SVM classifier was trained using the features that were learned in the refined CNN. The SVM's output was used to make the final classification. According to experimental findings, the proposed approach's overall sensitivity was 87.2% with 0.39 FPs per scan, which is greater than the 85.4% with 4 FPs per scan produced by another state-of-the-art technology.

3. OVERVIEW OF THESYSTEM

3.1 Existing System

In the current system, outdated techniques like physician-assisted screening in laboratories using expensive equipment that takes a long time to get results are ineffective. Such a method also necessitates that we are aware of our objectives from the outset. Additionally, a lot of the newer systems use machine learning to identify patient conditions. But their poor precision hurts them.

3.1.1 Disadvantages of Existing System

- Less feature compatibility
- Low accuracy.

3.2 Proposed System

Deep learning and neural networks are used in the proposed method to record human faces and identify any potential diseases that may be present. Deep learning is very scalable and increases the accuracy of disease identification.

To address the data imbalance in the system, we applied data augmentation techniques. Additionally, it enables us to reduce overfitting and produce more accurate results than ever before.

3.3 Methodology

In this project work, I used five modules and each module has own functions, such as:

1. System Module
2. User Module

3.3.1 Dataset Collection:

The dataset containing images of the desired objects to be recognize is split into training and testing dataset with the test size of 20-30%.

3.3.2 Preprocessing

Resizing and reshaping the images into appropriate format to train our model. .

3.3.3 *Training:*

Use the pre-processed training dataset is used to train our model using CNN Deep learning algorithm along with some of the transfer learning methods.

3.3.4 Classification

Use the pre-processed training dataset is used to train our model using CNN algorithm.

3.3.5 User Module

Register

The user needs to register and the data stored in MySQL database.

Login

A registered user can login using the valid credentials to the website to use a application.

About Project:

In this application, we have successfully created an application which takes to classify the images.

Upload Image

The user has to upload an image which needs to be classify the images.

Prediction

The results of our model is displayed as either Down syndrome, Hyperthyroidism, Beta-thalassemia, Leprosy.

Logout

Once the prediction is over, the user can logout of the application.

4 Architecture

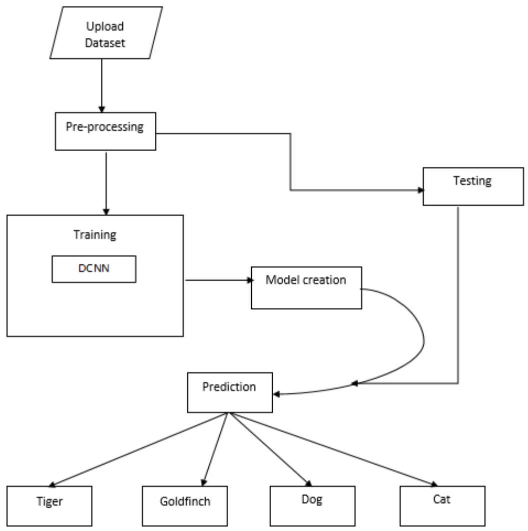

Fig 1: Frame work of proposed method

Above architecture diagram shows three stages of data flow form one module to another module. Data collection, preprocessing, and algorithm training.

5 RESULTS SCREEN SHOTS

Home Page:

Upload image:

Choose options:

Predict Result:

7. CONCLUSION

✓ Computer-aided facial diagnosis is a promising method for disease screening and detection, according to an increasing number of research. In this research, we propose deep transfer learning using methods of face recognition to achieve computer-aided facial diagnosis effectively and validate them on single disease and different diseases with the healthy control. In the case of the short dataset for facial diagnosis, the experimental results of above 90% accuracy have demonstrated that CNN as a feature extractor is the best suitable deep transfer learning approach. It can partially address the general issue of incomplete data in the field of facial diagnostics. With the aid of data augmentation techniques, deep learning models will be developed further in the future to do face diagnosis efficiently. We anticipate that facial photos can effectively detect an increasing number of disorders.

Future Enhancement

✓ Future updates to this program might incorporate different facial disorders as well as new models like MobileNet, AlexNet, Xception, and Inception for comparing model performance.

8. References

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Screen Shots :

Fig 1:**Home page:**

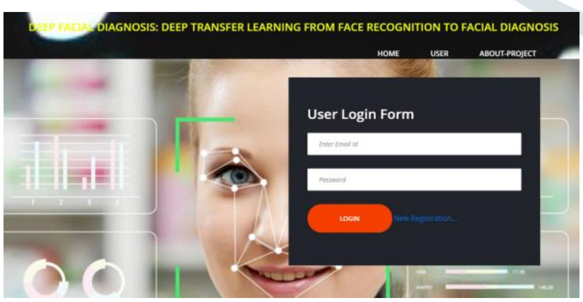

Fig 2:User login page:

Fig 3:User home page:

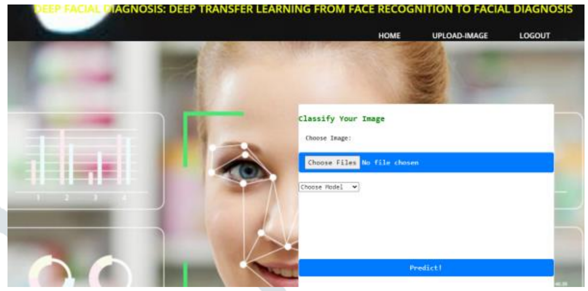

Fig 4:Upload an image:

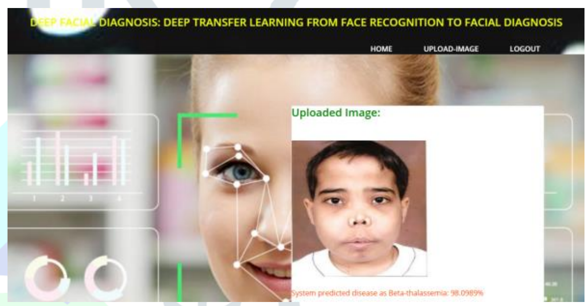

Fig 5:System predict the image as Beta-thalassemia:

Fig 6:System predict the image as Down syndrome:

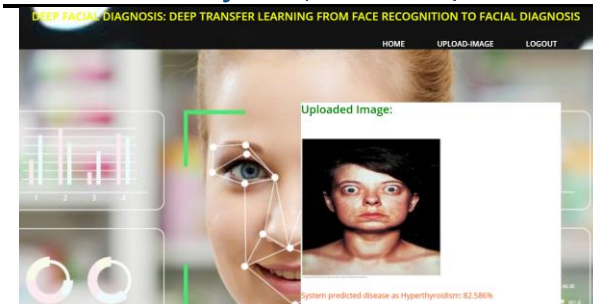

Fig 7:System predict the image as Hyperthyroidism:

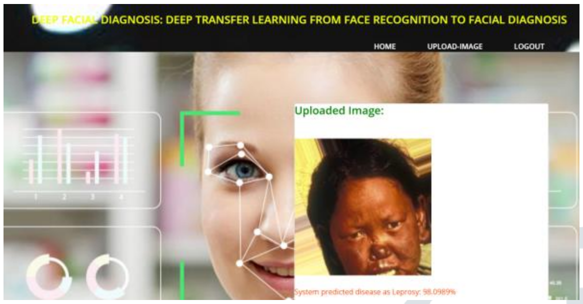

Fig 8:System predict the image as Laprosy: