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LITERATURE REVIEWS: Deep Learning Fundus Image Analysis for Early Detection of Diabetic Retinopathy.

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ABSTRACT

Early detection of Diabetic Retinopathy is crucial in order to sustain the patient's vision effectively. The main issue involved with DR detection is that the manual diagnosis process is very time, money, and effort consuming and involves an ophthalmologist's examination of eye retinal fundus images. The latter also proves to be more difficult, particularly in the early stages of the disease when disease features are less prominent in the images. Machine learning-based medical image analysis has proven competency in assessing retinal fundus images, and the utilization of deep learning algorithms has aided the early diagnosis of Diabetic Retinopathy (DR).

LITERATURE SURVEY

Survey 1 :

AUTHORS: Mohammad Z. Atwany , Abdulwahab H. Sahyoun , And Mohammad Yaqub (March 22).

TITLE: 'Deep Learning Techniques for Diabetic Retinopathy Classification: A Survey.'

METHODS: This paper reviews and analyzes state-of- the-art deep learning methods in supervised, self-supervised, and Vision Transformer setups, proposing retinal fundus image classification and detection. For instance, referable, non-referable, and proliferative classifications of Diabetic Retinopathy are reviewed and summarized. Moreover, the paper discusses the available retinal fundus datasets for Diabetic Retinopathy that are used for tasks such as detection, classification, and segmentation.

Survey 2 :

AUTHORS: Mohamad Hazim Johari , Hasliza Abu Hassan , Ahmad Ihsan Mohd Yassin (July 2018).

TITLE: 'Early Detection of Diabetic Retinopathy by Using Deep Learning Neural Network.'

METHODS: This project presents a method to detect diabetic retinopathy on the fundus images by using deep learning neural network. Convolution Neural Network (CNN) has been used in the project to ease the process of neural learning. The data set used were retrieved from MESSIDOR database and it contains 1200 pieces of fundus images. The images were filtered based on the project needed. There were 580 pieces of images types has been used after filtered and those pictures were divided into 2, which is Exudates images and Normal images. On the training and testing session, the 580 mixed of exudates and normal fundus images were divided into 2 sets which is training set and testing set. The result of the training and testing set were merged into a confusion matrix. The result for this project shows that the accuracy of the CNN for training and testing set was 99.3% and 88.3% respectively.

Survey 3 :

AUTHOR: Recep Emre Hacisoftaoglu (Dec 2019).

TITLE: 'Deep Learning Frameworks For Diabetic Retinopathy Detection Using Smartphone-Based Retinal Imaging Systems.'

METHODS: In this thesis, we first investigate the smartphone-based portable ophthalmoscope systems available on the market and compare their Field of View and image quality to determine if they are suitable for Diabetic Retinopathy detection during a general health screening. Then, we propose automatic Diabetic Retinopathy detection algorithms for smartphone-based retinal images using deep learning frameworks, AlexNet and GoogLeNet. To test our proposed methods, we generate smartphone-based synthetic retina images by simulating the different Field of View with masking the original image around the optic disk and cropping it.

Survey 4 :

AUTHORS: Lei Lu , Ying Jiang , Ravindran Jaganathan , and Yanli Hao. (Jan 2019).

TITLE: 'Current Advances in Pharmacotherapy and Technology for Diabetic Retinopathy: A Systematic Review.'

METHODS: Direct injections or intra virtual anti-inflammatory and anti angiogenesis agents are widely used pharmacotherapy to effectively treat DR and diabetic macular edema (DME). However, their effectiveness is short term, and the delivery system is often associated with adverse effects, such as cataract and increased intraocular pressure. Further, systemic agents and plants-based drugs have also provided promising treatment in the progression of DR. Recently, advancements in pluripotent stem cells technology enable restoration of retinal functionalities after transplantation of these cells into animals with retinal degeneration. This review paper summarizes the developments in the current and potential pharmacotherapy and therapeutic technology of DR. Literature search was done on online databases, PubMed, Google Scholar, clinitrials.gov, and browsing through individual ophthalmology journals and leading pharmaceutical company websites.

Survey 5 :

AUTHORS: Obaida M. Al-Hazaimeh , Bassam Al-Naami , Khalid M.O. Nahar (2018).

TITLE: 'An effective image processing method for detection of diabetic retinopathy diseases from retinal fundus images.'

METHODS: The current state-of-the-art techniques are not satisfied with sensitivity and specificity. In fact, there are still other issues to be resolved in state-of-the-art techniques such as performances, accuracy, and easily identify the DR disease effectively. Therefore, this paper proposes an effective image processing method for detection of diabetic retinopathy diseases from retinal fundus images that will satisfy the performance metrics (i.e.,sensitivity, specificity, accuracy). The proposed automatic screening system for diabetic retinopathy was conducted in several steps: Pre-processing, optic disc detection and removal, blood vessel segmentation and removal, elimination of fovea, feature extraction (i.e., Micro-aneurysm, retinal hemorrhage, and exudates), feature selection and classification. Finally, a software-based simulation using MATLAB was performed using DIARETDB1 dataset and the obtained results are validated by comparing with expert ophthalmologists. The results of the conducted experiments showed an efficient and effective in sensitivity, specificity and accuracy.

REFERENCES

1) Mohammad Z. Atwany , Abdulwahab H. Sahyoun , And Mohammad Yaqub, 2022, 'Deep Learning Techniques for Diabetic Retinopathy Classification: A Survey.'

2) Mohamad Hazim Johari , Hasliza Abu Hassan , Ahmad Ihsan Mohd Yassin, 2018, 'Early Detection of Diabetic Retinopathy by Using Deep Learning Neural Network.'

3) Recep Emre Hacisoftaoglu, 2019, 'Deep Learning Frameworks For Diabetic Retinopathy Detection Using Smartphone-Based Retinal Imaging Systems.'

4) Lei Lu , Ying Jiang , Ravindran Jaganathan , and Yanli Hao, 2019, 'Current Advances in Pharmacotherapy and Technology for Diabetic Retinopathy: A Systematic Review.'

5) Obaida M. Al-Hazaimeh , Bassam Al-Naami , Khalid M.O. Nahar, 2018 , 'An effective image processing method for detection of diabetic retinopathy diseases from retinal fundus images.'