International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 09 Issue: 06 | Jun 2022 www.irjet.net p-ISSN: 2395-0072

Diabetic Retinopathy Detection

Kandula Sundar[1], Grandhi Rama Janardhana[2], Yaswanth Sai Bojja[3]

[1,2,3] Student of Dept. Of CSE, Vignan's Foundation for Science , Technology & Research,Vadlamudi.

---***---

Abstract - *Diabetic retinopathy is the prime cause of blindness in the world's working population. In agreement with epidemiology research, diabetic retinopathy troubles one out of every three people with the disease. Disease diagnosis is crucial in medical imaging nowadays. Machine learning in medical imaging permits for a better aspect of the condition to be perceived. The intention of this research is to use machine learning to diagnose diabetic retinopathy. The use of machine learning in medical imaging might diagnose diabetic retinopathy considerably more quickly and correctly. Different Deep learning technologies, algorithms, and models will be examined in this work in order to identify diabetic retinopathy as quickly as possible in order to aid the health-care system. Support vector machine (SVM) is applied on MobileNet v2 for training the model.*

Key Words: *Diabetic retinopathy, model, machine learning, diagnosis , Support Vector Machine (SVM),F-1 index,CNN,precision)*

1. INTRODUCTION

Diabetes damages blood vessels all over the body, exceptionally in the eyes. Diabetic retinopathy is a disruption in which the blood vessels in the eyes become puffed up. DR is a bitter health issue and one of the chief causes of blindness. DR is an affliction that leads to diabetes and causes visual impairment, ultimately blindness. If diabetes isn't served for a long time, it is more foreseeable to develop. It is more cost-effective and time-saving to spot Diabetic Retinopathy utilizing automated approaches. For diabetic retinopathy recognition, we may tie up a variety of automated methods that take shorter time than the manual approaches. The current study included ten articles that used deep neural networks and convolutional neural networks to categorize various types of DR images. To run DR classification, we used MobileNetV2 architecture, which is a small-scale architecture. On the APTOS 2019 dataset, we were able to train the Entire architecture with proportionately minimum computational cost by using a small-scale architecture and a mini-input size. In lieu of the pre trained weights obtained from training in bigger DR Datasets, we used the general MobileNetV2 pre-trained weights from ImageNet as initialization. During the process of training, we used image augmentation and resampling to make the class imbalance perfect. Given that the DR label is ordinal. We got a quadratic weighted kappa score of 0.937 and 87 percent accuracy.

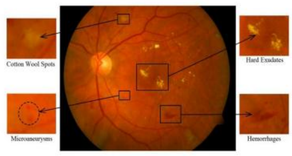
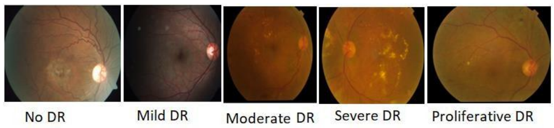


Fig. 1 Various stages of lesions established in retinopathy retina afflicted patients are depicted in a retina colour funds picture.



Literature Review:-

Zubair khan et al [2] have suggested the VGG-NiN model, which can analyse a DR picture at any size thanks to the SPP layer's virtues, and also concentrates on identifying the DR's multiple phases using the fewest learnable parameters feasible to speed up training and model convergence. The model outperforms the others in terms of accuracy and computing resource usage, according to the results.

T.Walter et al [3] provides a new method for exudate detection; exudate detection is an essential diagnostic activity in which computer aid may be useful. The high grey level variation identifies exudates, and the outlines of these exudates are shown using morphological reconstruction techniques. The algorithm has been put to the test and has shown to improve accuracy.

Ramon pires et al [4] Meta classification is a new algorithm that was introduced. The output of many lesion detectors is sent into the meta classifier, which provides a strong high-level feature representation for retinal pictures. They investigated an alternative bag-of-visual-words (BoVW)-based lesion detector that is based on coding and pooling low-level local descriptors.

Darshit Doshi et al [5] demonstrated the design and implementation of GPU-accelerated deep convolutional neural networks for diagnosing and classifying high-resolution retinal pictures into five disease phases depending on severity. The accuracy of the quadratic weighted kappa measure improves as a result of this.

Lifeng Qiao et al [6] The fundus image was classified as normal or diseased using a semantic segmentation method. To detect the characteristic of micro aneurysm, semantic segmentation splits the picture pixels based on their shared connotation. A Prognosis of Microaneurysm and Early Diagnosis System for NPDR has been suggested, which is capable of efficiently training a deep convolution neural network for semantic segmentation of fundus pictures while also improving the efficiency and accuracy of NPDR prediction.

Enrique V.Carrera et al [7] At any retinal picture, the grade of non-proliferative diabetic retinopathy was automatically identified. An early stage of image processing separates blood vessels, micro aneurysms, and hard exudates to extract characteristics that an SVM uses to determine the retinopathy grade of each retinal picture. The robustness of the system as well as other factors have been assessed.

Z.A.Omar et al [8] With the goal of enhancing the accuracy of existing systems, an algorithm based on the DR detection approach was devised. Image pre-processing, vessel and haemorrhage detection, optic disc removal, and exudate detection are all phases of the procedures used to identify DR characteristics such as exudates, haemorrhages, and blood vessels.

Carla Agurto et al [9] For distinguishing between normal and abnormal retinal pictures, multiscale amplitude-modulation-frequency-modulation (AM-FM) approaches were developed. Standard photos from the early treatment diabetic retinopathy research are used to test the approach. To quantify interstructure similarity, they employed distance metrics between the extracted feature vectors. Based on AM-FM traits, the researchers were able to statistically distinguish between normal retinal structures and diseased lesions.

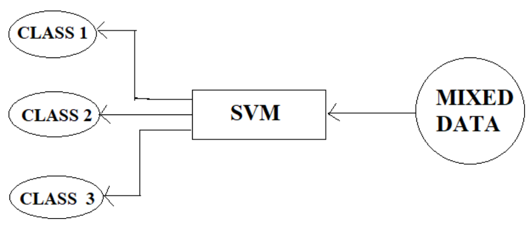
Xianglong Zeng et al [10] By dividing colour retinal fundus pictures into two classes, researchers suggested a computer-aided diagnosis technique based on deep learning to automatically detect referable diabetic retinopathy. They used a transfer learning approach to construct a new convolutional neural network model with a Siamese-like topology. They offer a model that takes binocular fundus pictures as inputs and learns their correlation to aid prediction.

Mohamed Chetoui et al [11] proposed the use of many texture characteristics for DR, including the Local Ternary Pattern (LTP) and the Local Energy-based Shape Histogram (LESH). They used LBP to extract characteristics. For the categorization of the extracted histogram, Support Vector Machines (SVM) are utilized.

Proposed Methodology:

SVM:

SVM is a supervised machine learning technique that may be used for both classification and regression. Though we might also argue regression difficulties, categorization is the best fit. The goal of the SVM method is to discover a hyperplane in an N-dimensional space that categorizes data points clearly. The hyperplane's size is determined by the number of features. If there are just two input characteristics, the hyperplane is merely a line. When there are three input characteristics, the hyperplane becomes a two-dimensional plane. When the number of characteristics exceeds three, it becomes impossible to imagine.



Metrics:

To measure the performance we have used some metrics for our model they were explained below

Accuracy:-

Based on the input, or training, data, accuracy is used to assess which model is better at recognizing correlations and patterns between variables in a dataset.

Accuracy = (True Positives + True Negatives) / Total Outputs

Precision:-

It measure the proportion of real positives among expected positives and value can be found by using formula given below

Precision = True Positives / (True Positives + False Positives)

Recall: -

It measure the proportion of true positives to all true positive forecasted values and value can be found by using formula given below

Recall = True Positives / (True Positives + False Negatives)

F1 score:-

It is used to combine precision, recall metrics into one single metric.

F1-score = 2 * [(Precision*Recall) / (Precision + Recall)]

Summary about dataset:-

Thousands of images are required to train the CNN effectively thus the size of the training dataset will be crucial because one of the characteristics of deep learning is its ability to perform well when trained with large data sets. The workers images were collected through browsing. The image files collected were in JPG or PNG image format. A dataset providing a selected group of high quality medical pictures that are indicative of diabetic retinopathy and have been verified by specialists is an essential tool for trustworthy assessment and comparison of medical image processing algorithms. First, the **APTOS2019** dataset is utilized to conduct the experiment for detection of normal and abnormal retinal pictures.

Class	Severity Level	Samples
0	Normal	1805
1	Mild Stage	370
2	Moderate Stage	999
3	Severe Stage	193
4	Proliferative Stage	295
Total		**3662**

Fig -1: Dataset Description

Results:

The results obtained after applying SVM classification.

	Precision	Recall	F1-Score	Overall Accuracy
0-No DR	99	97	98	85
1-Mild DR	65	59	62	
2-Moderate DR	82	82	82	
3-Severe DR	50	74	60	
4-Proliferative DR	64	62	63	

Conclusion:

The major goal of this study is to use an SVM classifier to decrease ophthalmologists labour in screening DR based on microaneurysms .Grayscale conversion, pre-processing and feature extraction are all performed on the retinal pictures based on the retrieved characteristics as input the SVM classifier classifies the pictures as Normal, Mild or Severe. The accuracy of the model is 85% .as a result of this SVM technology, and effective DR screening tool has been developed which aids in the early detection of illness.

REFERENCES

[1] M. Chetoui, M. A. Akhloufi and M. Kardouchi, "Diabetic Retinopathy Detection Using Machine Learning and Texture Features," 2018 IEEE Canadian Conference on Electrical & Computer Engineering (CCECE), 2018, pp. 1-4, doi: 10.1109/CCECE.2018.8447809.

[2] Z. Khan et al., "Diabetic Retinopathy Detection Using VGG-NIN a Deep Learning Architecture," in IEEE Access, vol. 9, pp. 61408-61416, 2021, doi: 10.1109/ACCESS.2021.3074422.

[3] T. Walter, J. . -C. Klein, P. Massin and A. Erginay, "A contribution of image processing to the diagnosis of diabetic retinopathy-detection of exudates in color fundus images of the human retina," in IEEE Transactions on Medical Imaging, vol. 21, no. 10, pp. 1236-1243, Oct. 2002, doi: 10.1109/TMI.2002.806290.

[4] R. Pires, H. F. Jelinek, J. Wainer, S. Goldenstein, E. Valle and A. Rocha, "Assessing the Need for Referral in Automatic Diabetic Retinopathy Detection," in IEEE Transactions on Biomedical Engineering, vol. 60, no. 12, pp. 3391-3398, Dec. 2013, doi: 10.1109/TBME.2013.2278845.

[5] D. Doshi, A. Shenoy, D. Sidhpura and P. Gharpure, "Diabetic retinopathy detection using deep convolutional neural networks," 2016 International Conference on Computing, Analytics and Security Trends (CAST), 2016, pp. 261-266, doi: 10.1109/CAST.2016.7914977.

[6] L. Qiao, Y. Zhu and H. Zhou, "Diabetic Retinopathy Detection Using Prognosis of Microaneurysm and Early Diagnosis System for Non-Proliferative Diabetic Retinopathy Based on Deep Learning Algorithms," in IEEE Access, vol. 8, pp. 104292-104302, 2020, doi: 10.1109/ACCESS.2020.2993937.

[7] E. V. Carrera, A. González and R. Carrera, "Automated detection of diabetic retinopathy using SVM," 2017 IEEE XXIV International Conference on Electronics, Electrical Engineering and Computing (INTERCON), 2017, pp. 1-4, doi: 10.1109/INTERCON.2017.8079692.

BIOGRAPHIES

Kandula Sundar of CSE Dept. at Vignan's Foundation for Science , Technology & Research.

Grandhi Rama Janardhana of CSE Dept. at Vignan's Foundation for Science, Technology & Research.

Yaswanth Sai Bojja of CSE Dept. at Vignan's Foundation for Science, Technology & Research