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DISTANCE LOG MAR VISUAL ACUITY COMPARISON WITH SEVERITY OF DIABETIC RETINOPATHY

Sheri Deepika Dept. of Computer Science, Himalayan University, Itanagar, AP, India.

Email: nagulapalli.lingareddy@gmail.com

Dr. Kailash Jagannath Karande Research Supervisor, Dept. of Computer Science, Himalayan University, Itanagar, AP, India.

Email: kailashkarande@yahoo.co.in

ABSTRACT:

Introduction: A significant number of these recent technical advancements may be attributed, at least in part, to the software that has recently been accessible as a result of resources associated to information and technology.

Aim of the study: the main aim of the study is to Distance Log Mar Visual Acuity Comparison With Severity Of Diabetic Retinopathy

Material and method: Studies are being conducted to better understand how to automatically identify and segment lesions associated with diabetic and hypertensive retinopathy.

Conclusion: Using an analysis of variance test to determine whether the distance visual acuity of Log MAR BCVA differed in subgroups of diabetic retinopathy.

1. INTRODUCTION

1.1 ARTIFICIAL INTELLIGENCE IN DIABETIC RETINOPATHY

However, artificial intelligence is comprised of a great deal more than just a massive database. After going through the first stages of education, the system or machine is then instructed to "improve," or develop further based on its previous education so that it may become more precise and effective. In order for the system to comprehend the nonlinear interactions that exist between various variables by means of a flow of information known as "neural networks," it must first master difficult mathematical equations.

This learning is further complicated by the utilisation of these equations. In practise, this sort of "higher training" enables AI to appraise and balance the likelihood of a variety of outcomes, much unlike a hypothetically perfect physician would! A significant number of these recent technical advancements may be attributed, at least in part, to the software that has recently been accessible as a result of resources associated to information and technology.

2. LITERATURE REVIEW

Lakshminarayanan, Vasudevan & Kheradfallah (2021) Diabetic retinopathy, often known as DR, has emerged as the primary cause of visual loss throughout the globe in recent years. Over the course of the last several years, techniques based on artificial intelligence (AI) have been used to identify and assess DR. Early identification makes it possible to get the necessary therapy, which in turn helps to avoid vision loss. Deep learning and machine learning are two approaches that may be used to analyse photos in order to extract characteristics from them and determine whether or not DR is present. Classification, segmentation, and hybrid approaches are used in the process of implementing a variety of tactics in order to identify and grade the existence of DR. This study looks at the research that has been published in open-access journals over the last five years that deals with AI-based disaster recovery strategies (2016-2021). In addition, a thorough list of all of the DR datasets that are currently accessible is included in the study. In all, 114 published publications met the criteria for our evaluation, and we provide a summary of those articles below. In addition to that, a list of the 43 most important datasets is provided below.

Ryu, Gahyung & Lee, Kyungmin & Park (2021) As the prevalence of diabetes has grown, so has the number of people who need diabetic retinopathy tests (DR). Because of this, fewer human hours are needed to handle the same volume of data that formerly took days or weeks. By contrasting the algorithm's results with those of a traditional machine learning model, we confirmed the algorithm's viability. Using ultra-widefield fluorescein angiography, ground truths for classifications were found to enhance the accuracy of the data annotation process. The recommended CNN classifier achieves 91%-98% precision, 86%-97% recall, 94%-98% specificity, and 0.919-0.976 area under the curve. On average, the results of the external validation were quite close to those of the internal validation. The results were consistent across a range of OCTA picture sizes and depths, indicating that DR could be properly diagnosed using only a tiny subset of the macula and a single image slab of the retina. That the findings were consistent provided proof of this. It is anticipated that the CNN-based classification performed using OCTA would provide a unique diagnostic procedure for the diagnosis and referral of DR.

Boned-Murillo, Ana & Albertos (2021) This article provides an up-to-date summary of the different OCTA applications now in use and how they impact the evaluation of DR. As a result of eliminating duplicates, only 107 of the 1456 studies that were initially located underwent the screening procedure. Articles that didn't make the cut weren't included. In the end, after searching for any missing information, we decided to include 135 papers in our evaluation. Findings concerning the diagnostic utility of OCTA in patients with diabetes mellitus (DM) are presented, including both common and novel findings gleaned from our literature search and analysis of the publications obtained as a consequence of that search. Patients with diabetes who lack lesions detectable by conventional means can still be diagnosed and followed thanks to the OCTA.

Ran, Anran & Cheung, Carol (2021) "Deep learning," or "DL" for short, is a branch of AI that relies on extremely complex neural networks to solve problems. Using OCT and OCTA pictures as evaluation data, research has shown that DL algorithms produce high performance in terms of illness identification, prognosis prediction, and image quality management.

Ursin, Frank & Timmermann (2021) Since 2018, diabetic retinopathy (DR) may be diagnosed using an approach that is based on artificial intelligence (AI), and this approach has been made accessible on the commercial market. When it comes to acquiring patients' informed permission, this creates additional ethical issues that must be overcome. This effort will build a checklist of factors that should be reported when diagnosing DR using AI systems in a primary care context.

3. METHODOLOGY

Studies are being conducted to better understand how to automatically identify and segment lesions associated with diabetic and hypertensive retinopathy. In order to acquire an accurate result, different pre-processing processes are required for lesion detection, such as noise removal from pictures. The severity of the illness is then determined by its signs and symptoms, such as microaneurysms, exudates, and haemorrhages. Extracting characteristics such as blood vessels, optic disc, optic cup, and papilledema is necessary for symptom detection. Then, several machine learning models may be used to determine the disease's classification and severity. The likelihood of successful treatment for visual loss improves when its cause and extent can be identified. Patients may benefit from this research since it provides methods for detecting and predicting Diabetic and Hypertensive Retinopathy (DHR) in retinal pictures.

4. RESULTS

4.1 DISTANCE LOG MAR VISUAL ACUITY COMPARISON WITH SEVERITY OF DIABETIC RETINOPATHY

Table 4.1 Displaying a comparison between distance log mar visual acuity and the degree of diabetic retinopathy (N =300, p < 0.001) by using one-way ANOVA using PostHoc test

GROUPS	NO OF EYES	MEAN	STD DEVIATION	P-VALUE
Mild NPDR.	60	0.21	0.252	< 0.001
Moderate NPDR.	60	0.31	0.398	
Severe NPDR.	60	0.45	0.335	
PDR.	60	0.61	0.519	
CSME.	60	0.85	0.589	
Total.	300	0.48	0.488	

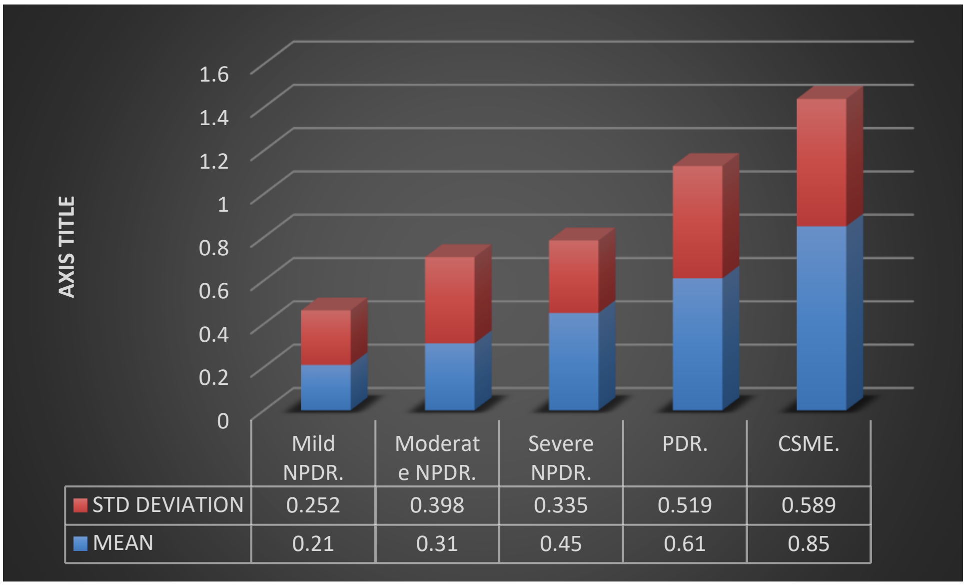

Figure 4.1 Displaying a comparison between distance log mar visual acuity and the degree of diabetic retinopathy (N =300, p < 0.001) by using one-way ANOVA using Post-Hoc test.

In our research, employing the One-Way ANOVA Test with a 95% confidence interval revealed that visual acuity dropped as diabetic retinopathy severity rose.

4.1.1 Log mar visual acuity comparison with the severity of diabetic retinopathy by using one-way ANOVA

Table 4.2 demonstrates a connection between the severity of diabetic retinopathy and near log mar visual acuity (N =300, p < 0.001) by using one-way ANOVA using PostHoc test.

GROUP	NO OF EYES	MEAN	STD. DEVIATION	P-VALUE
Mild NPDR.	60	0.09	0.18	< 0.001.
Moderate NPDR.	60	0.19	0.28	
Severe NPDR.	60	0.24	0.25	
PDR.	60	0.33	0.30	
CSME.	60	0.41	0.28	
Total.	300	0.49	0.489	

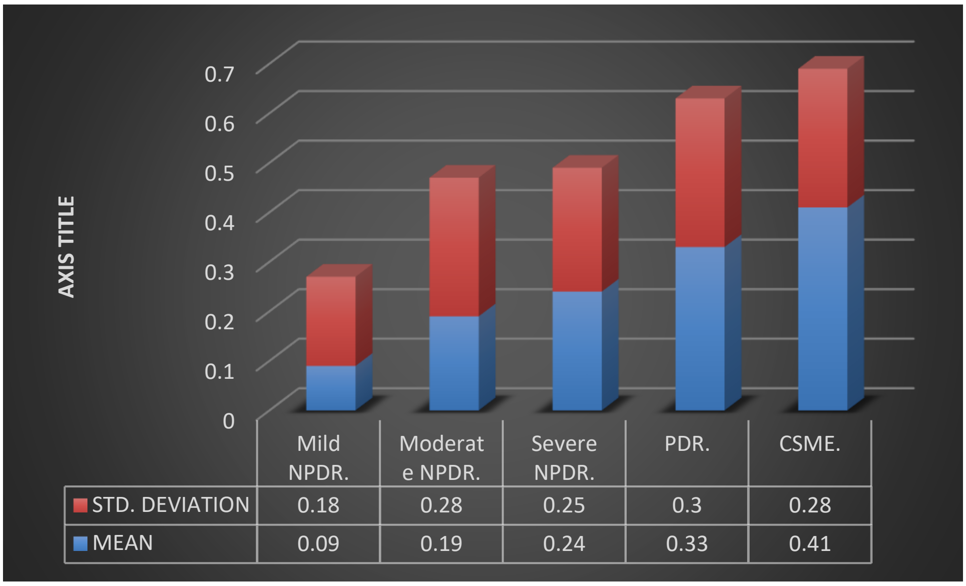

Figure 4.2-line diagram displaying around Log Mar Comparison of near visual acuity with diabetic retinopathy severity (N =300, p < 0.001).

According to the findings of our research, the Near Log Mar visual acuity dropped as the severity of diabetic retinopathy grew, as measured by a one-way ANOVA test with a 95% confidence interval.

4.1.2 Log Mar Distance BCVA And Central Macular Thickness Have A Linear Relationship

It was constructed a scatter plot with central macular thickness on the X-axis and LogMAR distance BCVA on the Y-axis. It demonstrated a linear relationship (r2 = 0.232) between the two parameters, indicating that changes in central macular thickness correlated with changes in LogMAR distant visual acuity. The link between the LogMAR distant visual acuity and central macular thickness was quite substantial, as shown by the Pearson correlation coefficient value of 0.481 with a P-value of 0.001.

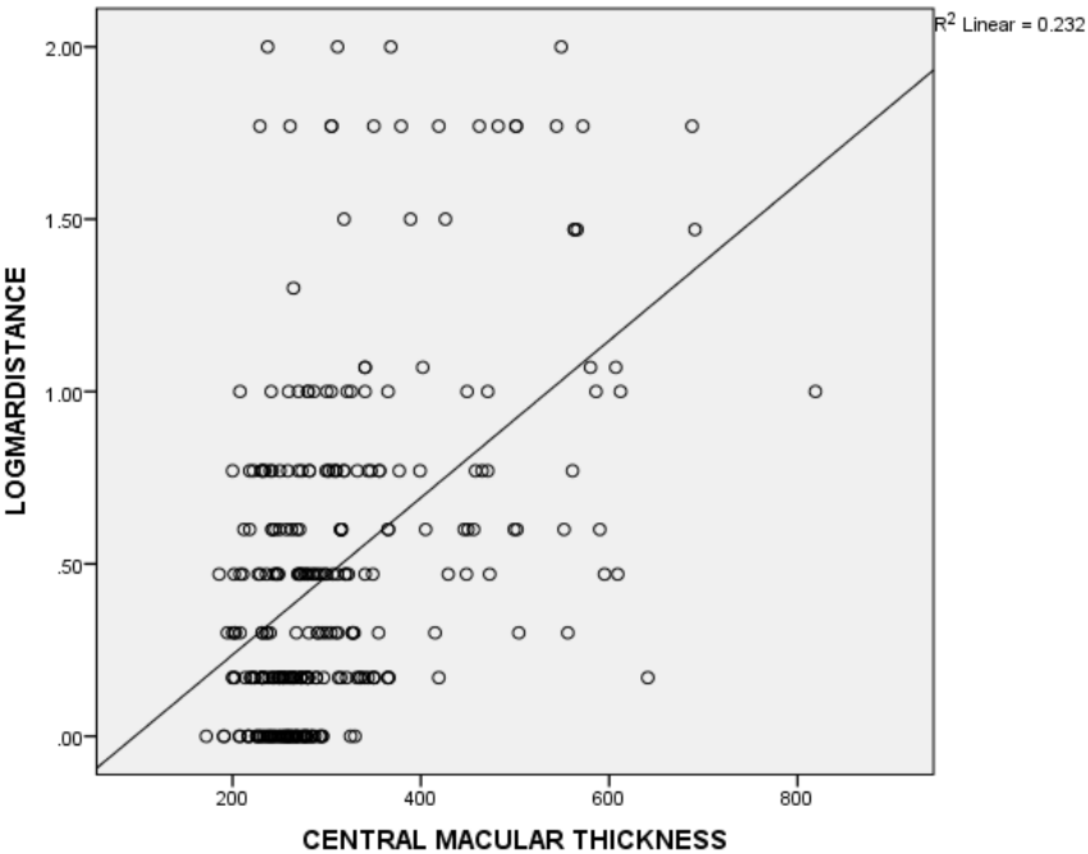

Figure 4.3 Linear association between Log Mar Distance BCVA and central macular thickness

4.1.3 Linear association between Log Mar Near BCVA and central macular thickness

It was decided to generate another scatter plot, this time using LogMAR Near BCVA on the y-axis and central macular thickness on the x-axis. LogMAR near visual acuity assessment altered proportionately to a change in central macular thickness, as shown by the finding of a linear link (r2 = 0.185) between the two parameters. This indicates that the relationship between the two is causal. There is a very significant association between the LogMAR near visual acuity and the mean central macular thickness, as shown by the extremely high value of the Pearson correlation coefficient, which was 0.430, with a P-value that was less than 0.001.

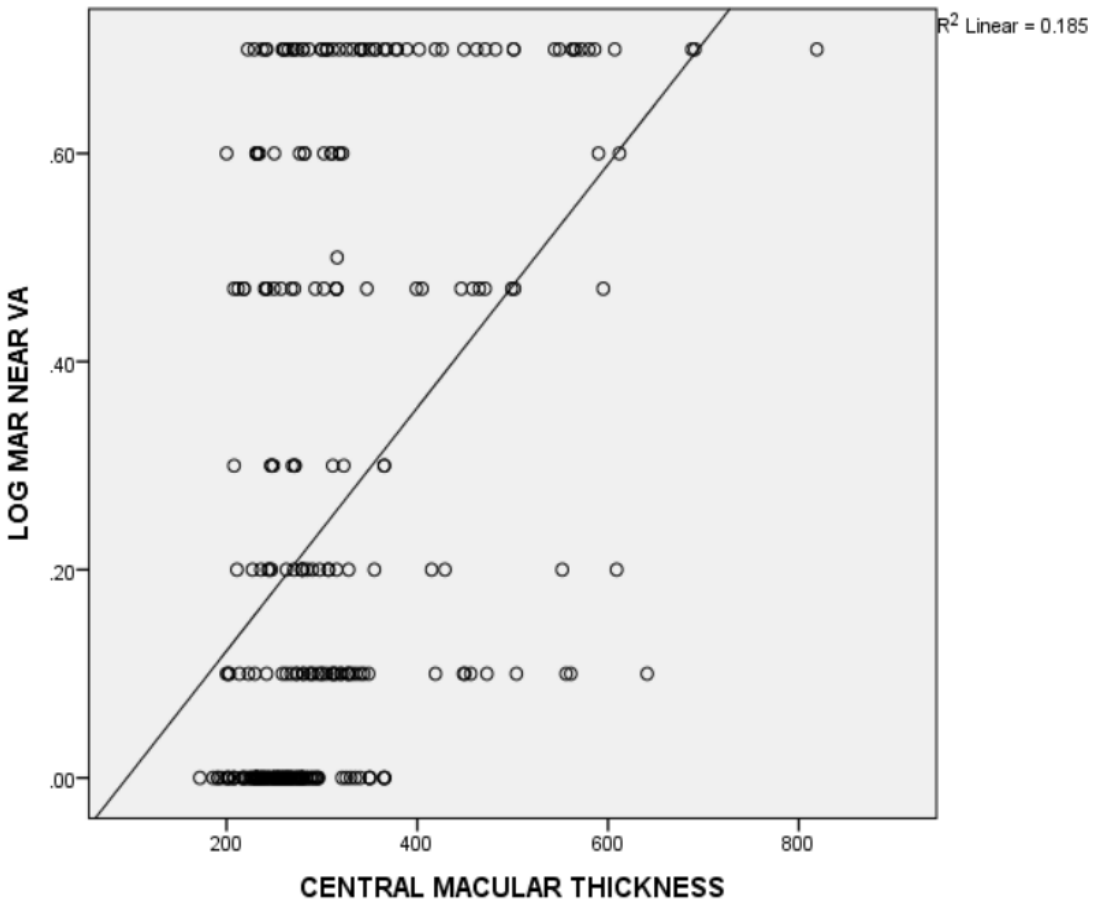

Figure 4.4 Showing Linear association between Log Mar Near BCVA and central macular thickness

4.1.4 One-way comparison between intraocular pressure and the severity of diabetic retinopathy ANOVA

Table 4.3 Showing Intraocular Pressure comparison with severity of diabetic retinopathy (N =300, p =0.34) by using one-way ANOVA using Post-Hoc test.

GROUPS	NO OF EYES	MEAN	STD. DEVIATION	P-VALUE
Mild NPDR	60	15.82	3.105	0.34
Moderate NPDR	60	15.73	3.574	
Severe NPDR	60	14.90	3.101	
PDR	60	15.57	5.554	
CSME	60	14.68	2.933	
Total	300	15.34	3.784	

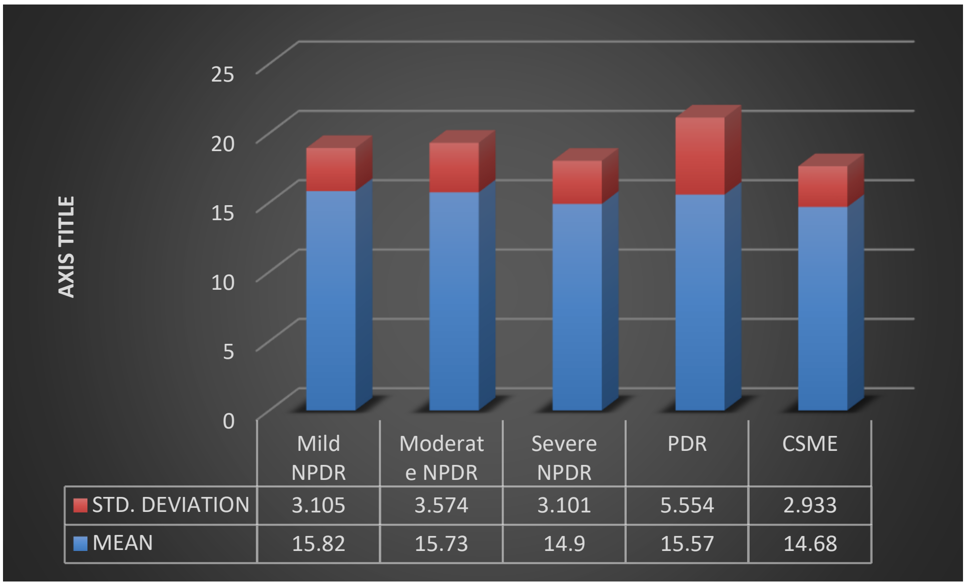

Figure 4.5 showing Intraocular Pressure comparison with severity of diabetic retinopathy (N =300, p =0.34) by using one-way ANOVA using Post-Hoc test.

According to the findings of our research, there was not a significant difference between intraocular pressure in diabetic patients and the severity of diabetic retinopathy when compared with one-way analysis of variance with a confidence interval of 95 percent.

4.1.5 Random Blood glucose level comparison with severity of Diabetic Retinopathy

Table 4.4 Comparison of Diabetic Retinopathy Severity with Random Blood Glucose Levels

GROUPS	NO OF EYES	MEAN	STD. DEVIATION	P- VALUE
Mild NPDR	60	211.93	112.01	0.01.
Moderate NPDR	60	223.92	84.74	
Severe NPDR	60	231.35	79.95	
PDR	60	252.53	75.55	
CSME	60	261.88	77.17	
Total	300	236.32	88.28	

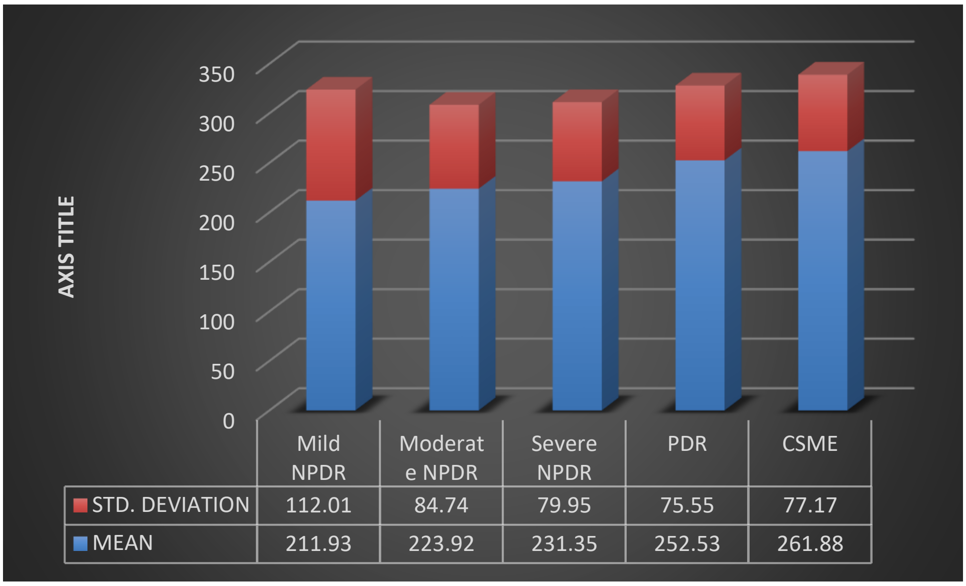

Figure 4.6 demonstrating the Correlation between Blood Glucose and Diabetic Retinopathy Severity in Random Samples (N =300, p =0.01) by using one-way ANOVA using Post-Hoc test

According to the findings of our research, there was a statistically significant increase in thickness. This was determined by analysing the correlation between the level of random blood glucose and the severity of diabetic retinopathy using one-way ANOVA and the Post-Hoc test at a confidence interval of 95 percent.

5. CONCLUSION

Using an analysis of variance test to determine whether the distance visual acuity of Log MAR BCVA differed in subgroups of diabetic retinopathy, the test was found to be relevant with a p-value that was less than 0.05. This was done in order to examine whether the subgroups of diabetic retinopathy differed. Using tests that were similar to those used to analyse the link between the best corrected visual acuity of near and distant both and the central macular thickness determined by OCT, it was discovered that the association was significant with a P value that was less than 0.05.

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