

Digital Vision Test using AI for Early Detection of Vision Problems in Patient with Diabetes Mellitus

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Abstract: Diabetic retinopathy is a diabetic condition that affects the eyes by destroying the retinal blood vessels. It may be asymptomatic at first or produce fluctuating visual difficulties. As it progresses, it affects both eyes and finally results in partial or total vision loss. This usually happens when the blood sugar level is out of control. As a result, a person with diabetes mellitus is constantly at risk of contracting this condition. Early detection can reduce the possibility of total and permanent blindness. As a result, an effective screening method is required. The current study looks at a machine learning approach that uses the Tensorflow library to detect diabetic retinopathy early. It categorizes fundus pictures as having No DR, Mild DR, Moderate DR, Severe DR, or Proliferative DR. The dataset was collected from Kaggle.com, an online site to store datasets. The suggested technique follows the machine learning development cycle. The proposed model was 90% accurate. The primary goal of this effort is to create a reliable method for automatically detecting DR.

Keywords: Artificial Intelligence, Diabetic Retinopathy, Vision test, Eye, Fundus

Introduction

Diabetes is a chronic health condition that affects how the body turns food into energy. The majority of the food eaten is converted to glucose and absorbed into the bloodstream. When blood sugar levels rise, the pancreas is prompted to release insulin. Insulin is a key that allows blood sugar to enter the body's cells and be used as energy. If an individual is diabetic, the body either does not produce enough insulin or does not use it as effectively as it should. Too much blood sugar persists in the bloodstream when there isn't enough insulin or when cells stop responding to insulin. This could result in clogging inside the bloodstream, which could produce health issues if not treated [1]. There exists multiple eye disease that occur due to diabetes mellitus such as diabetic retinopathy, diabetic macular edema, neuropathy, ischemic optic neuropathy, glaucoma, corneal edema, corneal nerve alterations and cataract [2].

It is necessary for a vision test to be conducted to detect the symptoms of vision problems among diabetic patients. According to the National Eye Institute of America, the common test is the dilated eye exam where the doctor applies some eye drops to the eye to dilate the pupil and check the eyes for any sign of eye problems [4]. This type of vision test requires a lot of effort on the doctor's part to diagnose any symptoms. According to Clinical Governance: An International Journal Vol. 15, there exists vision tests to replace the dilated eye exam such as colour vision testing and retinal photography [3].

Diabetes affects more than 180 million people globally, according to the World Health Organization. By 2030, this number is expected to have more than doubled. Diabetic retinopathy is expected to cause vision impairment in at least 10% of people [5]. Thus, a new vision test is needed urgently to detect early signs of vision

problems in diabetic patients to prescribe early precautions to prevent further deterioration of their vision.

One of the problems that this project aims to solve is the missed or delayed diagnoses are a common problem in the medical field [27]. With the process of current vision tests being slow to produce results and quite often misdiagnosed by ophthalmologists, a new vision test is needed to produce a quick result in the highest degree of accuracy to avoid the errors in diagnosis. Another problem is there are many different types of machine learning models, each with their own unique set of features and capabilities. Some models are better suited for certain tasks than others, and this can have a big impact on the accuracy of the diagnoses they produce. However, it is important to note that different machine learning models can produce different diagnoses with different levels of accuracy [28].

In order to overcome the problems, the project aims to develop a system to assist ophthalmologists in diagnosing Diabetic Retinopathy. The proposed system will utilize artificial intelligence to perform diagnosis for Diabetic Retinopathy. Another objective of the project is to identify the most suitable machine learning algorithm to detect Diabetic Retinopathy. Furthermore, the project is to be developed with a machine learning algorithm with a high degree of accuracy for the diagnosis. The advent of technology in this modern age assists the current civilization to solve problems in an easier manner. The rapid pace of development in the field of computer science can further improve the accuracy of medical diagnosis. As a result, the use of artificial intelligence can lessen the burden of work held by doctors in their detecting early signs of vision problems in patients with diabetes mellitus.

This project consists of two scopes which are user scope and system scope. There are two users: the ophthalmologist and the diabetic patient. The results from the project to be created can assist ophthalmologists in