**Vivekanand Education Society's Institute of Technology**

**Department Of Computer Engineering**

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**Group No. :-** 45 **Date :-** 10.08.2023

**BE Project Synopsis (2023-24) - Sem VII**

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**Abstract**

Diabetes Mellitus, a chronic metabolic disorder, is a global health concern affecting millions of individuals worldwide. In India, diabetes has reached alarming proportions, affecting an estimated 77 million people, as reported by the International Diabetes Federation. Both the number of cases and the prevalence of diabetes have been steadily increasing over the past few decades.

To address this critical issue, Our aim is to focus on early detection, prediction and post-diagnosis care and management of diabetes. To build the **predictive** model, we will be leveraging a comprehensive dataset, The *PIMA Indian Diabetes Dataset*, provided by the National Institute of Diabetes and Digestive and Kidney Diseases that aims to accurately identify individuals at risk of developing diabetes. Early **detection** will be done using *Retinopathy*, a medical condition that affects the retina, the light-sensitive tissue located at the back of the eye, resulting in change in retina’s structure and function because of damage to blood vessels caused by high blood sugar levels. This damage disrupts the normal supply of blood and nutrients to the retina, leading to the formation of abnormal blood vessels, leakage, and other changes that affect vision. It is a common complication of diabetes, thus making retinopathy a way to detect it in its early stages, thus allowing for timely intervention that can slow the progression of the condition and preserve vision by early diagnosis and management of this vision-threatening complication.

**Introduction**

Diabetes, a multifaceted metabolic disorder, arises from a combination of genetic predisposition, lifestyle choices, and environmental factors. This chronic condition disrupts the body's ability to regulate blood sugar levels effectively. Insufficient insulin production or decreased insulin sensitivity leads to elevated blood sugar levels, a condition known as hyperglycemia. Prolonged hyperglycemia can result in a range of complications, including cardiovascular disease, kidney damage, nerve dysfunction, and vision problems.

Diabetic retinopathy, a diabetes-related complication affecting the eyes, often starts with minimal or no symptoms, possibly causing slight vision issues. However, if left untreated, it can progress to blindness. Therefore, early detection is vital for preventing such outcomes.

**Problem Statement**

The aim of this project is to address the challenges associated with diabetes risk prediction and management. Using traditional physical assessments Long queues, limited appointment availability, high costs, and potential geographic barriers hinder timely access to healthcare professionals. This project aims to overcome these challenges by developing an AI-powered application that offers virtual diabetes risk assessment and personalized insights, providing a convenient, cost-effective, and accessible solution for individuals seeking to understand and manage their diabetes risk.

This project endeavors to create ML models that can detect ( using retinopathy) and predict diabetes by analyzing a retinal image dataset and the PIMA dataset involving patient attributes, medical history, and lifestyle choices respectively.

This can be divided into basic steps:

1. Data analysis
2. Exploratory data analysis
3. Model building
4. Saving model

Nearly all [patients with diabetes](https://diabetesjournals.org/care/article/27/suppl_1/s84/24669/Retinopathy-in-Diabetes#:~:text=Diabetic%20retinopathy%20is%20the%20most,type%202%20diabetes%20have%20retinopathy.) will eventually develop some form of diabetic retinopathy within 15-20 years. The disease has four main stages and if it’s detected in the earlier stages, it is more easily treatable.

* Stage 1: Mild nonproliferative diabetic retinopathy.
* Stage 2: Moderate nonproliferative diabetic retinopathy.
* Stage 3: Severe nonproliferative diabetic retinopathy.
* Stage 4: Proliferative diabetic retinopathy.

It will be a multi-step process that includes image preprocessing, feature extraction, and classification using machine learning algorithms. Retinal images will be collected from diverse sources and standardized to ensure consistency. Preprocessing techniques will be employed to enhance the quality of images and remove any artifacts that could hinder accurate analysis.

Feature extraction will involve identifying relevant features from retinal images that can be indicative of diabetic retinopathy. These features might include changes in blood vessel patterns, microaneurysms, hemorrhages, and exudates. Advanced image processing techniques and computer vision algorithms will be employed to extract these features.

For classification, machine learning algorithms such as convolutional neural networks (CNNs) will be trained on a large dataset of labeled retinal images. The system will learn to distinguish between normal retinal images and those showing signs of diabetic retinopathy. By fine-tuning the model, the system will strive for high accuracy and sensitivity in detecting early-stage retinopathy.

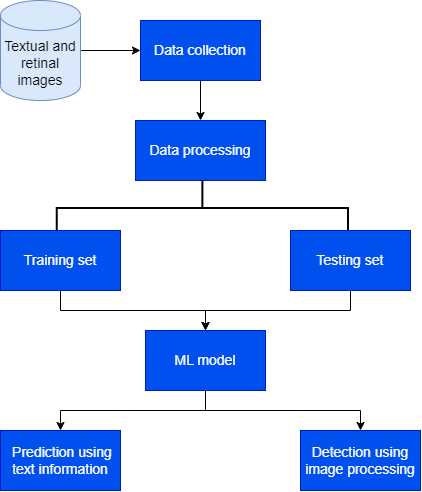
**Proposed Solution**

The core functionality of the application involves users providing input such as patient attributes (age, gender, family history), medical history (glucose levels, blood pressure), and lifestyle factors (diet, physical activity). This input data will be processed by the ML model, which has been trained on extensive datasets to recognize patterns and correlations indicative of diabetes risk. The model's output will provide a prediction regarding the likelihood of the user developing diabetes in the future.

Our application will also be able to detect whether an individual is diabetic with the help of retinal images. This is called Retinopathy. Diabetes,in severe cases,can be determined from the retina.Thus, it aims to determine the same from the retinal images by using the technique of image processing.

Users input their data, enabling the machine learning model to predict their risk of diabetes and offer personalized insights. The application offers tailored health recommendations, lifestyle modifications, and potential referrals to healthcare professionals based on the user's risk level. By integrating continuous progress tracking and updates, the application empowers users to take informed actions towards better health, bridging the gap between risk assessment and medical intervention.

**Methodology / Block Diagram**



**Hardware , Software and tools Requirements**

* **Languages**: Python for the ML model
* **IDE**: Jupyter Notebook/ Google Colab, Visual Studio Code
* **Python Stack**:

1. Scikit Learn

2. Numpy

3. Matplotlib

4. Pandas

5. Keras

6. Kivy

7. LIME

8. SHAP

9. TensorFlow

* **To build the Application**: Android Java/ Kivy

**Proposed Evaluation Measures**

Since the primary goal of this project is to predict accurately whether the user may or may not have diabetes or is at risk, the evaluation measures for the model will be **Accuracy**, **Precision**, **Confusion Matrix**, etc. for the model. For the final product, the performance measures will depend on a few factors. Some of them being:

**User Engagement** that includes frequency of usage, and duration of interaction of users with the application alongwith their satisfaction

**Health Behavior** Changes: Assess whether users have made positive lifestyle changes based on the application's recommendations and insights.

**Impact on Public Health**: Evaluate the project's potential to reduce diabetes risk, promote healthier lifestyles, and potentially prevent diabetes-related complications on a larger scale.

**Conclusion**

To summarize, this project aims to revolutionize diabetes risk assessment and management through the development of an AI-powered application. By leveraging machine learning algorithms, the application offers a user-friendly platform for individuals to input their data and receive personalized insights regarding their diabetes and associated risks.

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