**SYNOPSIS**

Team No: 5

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Title of the Project: Methods for segmentation and measurement of diabetic neuropathy lesions

Brief Description of the Project:

Diabetes is a widespread disease in the world and can lead to diabetic retinopathy, macular edema, and other obvious microvascular complications in the retina of the human eye. Diabetic retinopathy is characteristic of a local distribution that involves early-stage risk factors and can forecast the evolution of the illness or morphological lesions related to the abnormality of retinal blood flows.

Regional variations in retinal blood flow and modulation of retinal capillary width in the macular area and the retinal environment are also linked to the course of diabetic retinopathy. This study attempts to detect diabetic retinopathy (DR), which has been the main reason behind the blindness of people in the last decade.

An ophthalmologist generally determines the seriousness of the retinopathy of the eye by directly examining color photos and evaluating them by visually inspecting the fundus.

In this project, we propose a method of segmenting and measuring the diabetic retinopathy lesions.

In the first step, we pre-process the image, which involves resizing the image to a common size and converting it to a grayscale image format. Generallyy, the grayscale image is estimated from the R, G, and B values and since our main goal is to extract the blood vessels and clots, we give higher weightage to the red values as compared to the other two colors.

In the second step, the preprocessed images are given to the Histogram of Gradient (HoG) which extracts the features of the images that are present over the grid of overlapping

rectangular blocks in the search window and Speeded Up Robust Features (SURF) is a point detector and descriptor which is computationally fast, while not sacrificing performance, feature detection and the description is performed by utilizing some predetermined integral images.

The third step is to pass the image through SVM classification models and classify the images into normal an abnormal categories and further classifying the abnormal images into four categories using CNN:

* Mild DR
* Moderate DR
* Severe DR
* Proliferative DR

Objectives:

1. Develop automated lesion segmentation algorithms for diabetic neuropathyimages: The primary objective of segmentation and measurement of diabetic retinopathy lesions is to enable early detection of the disease. By accurately identifying and locating lesions at an early stage, healthcare professionals can intervene promptly and initiate appropriate treatment to prevent further progression and potential vision loss.
2. Implement precise measurement and classification methods for neuropathic lesions: These measurements help in tracking the progression of the disease over time, evaluating the effectiveness of treatment interventions, and monitoring the response to therapy. Accurate and reliable measurements allow healthcare professionals to make informed decisions.

Existing state-of-art method/s in the proposed project:

* HoG
* SURF
* SVM
* CNN

Importance of the proposed project:

1. Early Detection and Timely Intervention: This improves the diabetic neuropathy treatment outcomes and reduce the risk of severe complications.
2. Objective and Accurate Assessment: Segmentation ensures objective and precise lesion assessment, enhancing the accuracy of patient diagnosis and monitoring.
3. Enhanced Patient Care: Personalized care plans driven by accurate measurements optimize patient treatment and interventions.
4. Research Advancements: The project supports research into diabetic neuropathy causes and treatments by providing standardized lesion analysis.

Work Plan:

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| *Sl. No.* | *Component/Work Elements or Milestones/Targets* | *Expected Completion*  *(Day/Month)* |
| 1. | Dataset Preparation | 15th October 2023 |
| 2. | Implementation of HOG and SURF for Segmentation | 22nd October 2023 |
| 3. | Implementation of SVM for Lesion Classification | 25th October 2023 |
| 4. | Implementation of CNN for Segmentation and Classification | 3rd November 2023 |
| 5. | Model Comparison, Analysis, and Report Writing | 10th November 2023 |