Machine Learning Project:
Using Machine Learning for Diabetic Retinopathy Image Classification

Course: CSCI 4980 Applied Machine Learning
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(1) Dataset Description:

The dataset comprises high-resolution retinal images suitable for training and evaluating automated systems for Diabetic Retinopathy (DR) detection and grading. The images capture various imaging conditions, reflecting real-world clinical scenarios. Each image has been meticulously assessed by a medical professional for the presence of DR and assigned a corresponding grade on a scale between 0 and 1, with the following interpretation:
Grade 0: Diabetic Retinopathy present
Grade 1: No Diabetic Retinopathy

This rich dataset holds immense potential for advancing the development of automated DR detection and grading algorithms. Its large size, encompassing diverse image conditions, allows for robust training and reliable performance evaluation. Moreover, including expert-annotated grades provides valuable ground truth for training and assessing model performance.

The dataset's key characteristics include:

This comprehensive dataset will be invaluable for researchers and developers working on automated DR detection and grading systems, ultimately contributing to improved early detection, timely intervention, and personalized treatment for individuals with diabetes.
The dataset used for this project consists of fundus images categorized into three groups: train, test, and validation.

It includes images with and without DR, with the following breakdown:
Train: 1050 DR images, 1026 non-DR images
Test: 113 DR images, 118 non-DR images
Validation: 245 DR images, 286 non-DR images

The link and the extended description of the dataset are given below:
Diabetic Retinopathy Detection | Kaggle

(2) Research Questions:

(i) How do the performances of various pre-trained models compare for DR diagnosis?
(ii) Does the ViT model outperform the CNN-based models in terms of accuracy, sensitivity, and specificity?
(iii) We hypothesize that the vision transformer model will achieve superior accuracy compared to all convolutional neural network (CNN) based pre-trained models for DR diagnosis.

(3) Data Visualization:

(i) Confusion matrices for each model to visualize the true positive, true negative, false positive, and false negative rates.
(ii) Receiver operating characteristic (ROC) curves to compare the sensitivity and specificity of each model.