Classification of Diabetic Retinopathy Disease Levels by Extracting Topological Features Using Graph Neural Networks

Abstract:

Diabetic retinopathy is a severe eye condition affecting millions of people worldwide, and early detection is crucial for preventing vision loss. This project aims to classify the severity levels of diabetic retinopathy from retinal images by extracting topological features using Graph Neural Networks (GCNN). The model utilizes TensorFlow for training and incorporates Python libraries such as Pillow and NumPy for image processing. Django is used as the web framework to provide an interface for uploading and analyzing retinal images.

Objectives:

- Develop a robust model to classify diabetic retinopathy severity levels.
- Utilize Graph Neural Networks to extract and analyze topological features from retinal images.
- Create a user-friendly web interface using Django for image uploads and analysis.

Technology Stack

- Programming Language: Python
- Frameworks: TensorFlow, Django
- Libraries: Pillow, NumPy

Methodology

- Data Collection: Acquire a dataset of retinal images labeled with diabetic retinopathy severity levels.
- Image Preprocessing: Use Pillow and NumPy to preprocess images for analysis.
- Feature Extraction: Implement Graph Neural Networks to extract topological features from the retinal images.
- Model Training: Train the GCNN model using TensorFlow to classify the severity levels.
- Web Application: Develop a Django-based web application for image upload and model prediction.

Results

The model successfully classifies diabetic retinopathy severity levels with high accuracy. The web application provides a seamless interface for uploading and analyzing retinal images, making it accessible to medical professionals for early detection and diagnosis.

Conclusion

This project demonstrates the potential of using Graph Neural Networks for medical image analysis, particularly in the early detection of diabetic retinopathy. The combination of advanced machine

learning techniques and a user-friendly web interface offers a promising solution for healthcare providers.

Future Work

Improve the model accuracy with larger and more diverse datasets.

Integrate additional features such as real-time analysis and patient data management.

Explore the application of this methodology to other medical imaging challenges.