Low-Level Design (LLD) Document

Retinal Disease Detection System

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1. Problem Statement

The goal of the project is to build a deep learning model that predicts whether a user has retinal diseases or not, using a Kaggle dataset and computer vision techniques.

2. System Architecture

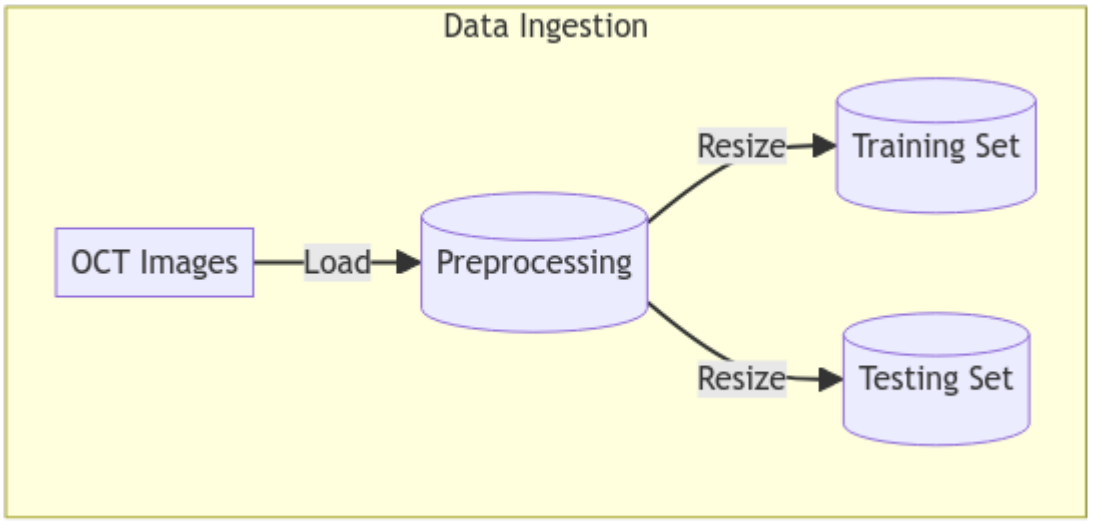
The system architecture will consist of the following major components:

- Data Ingestion Module
- Data Validation Module
- Data Preprocessing Module
- Model Training Module
- Model Evaluation Module
- Model Deployment Module

3. Data Ingestion Module

We will use the Kaggle API to download the retinal disease dataset. The module will:

- Authenticate and connect to Kaggle.
- Download the specified dataset.
- Extract and organize the data into appropriate directories.



4. Data Validation Module

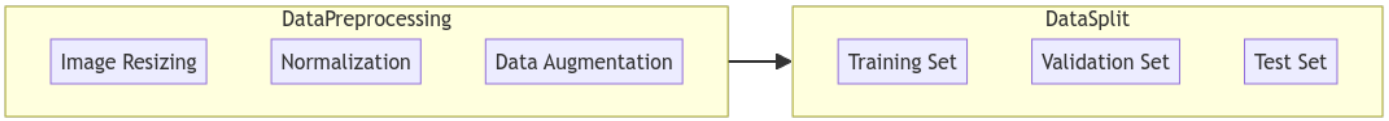
The Data Validation Module will perform the following tasks:

- Verify the integrity of downloaded image files.
- Check for corrupt or unreadable images.
- Validate the format and content of the labels file.
- Ensure consistency between image files and label entries.

5. Data Preprocessing Module

The Data Preprocessing Module will carry out the following operations:

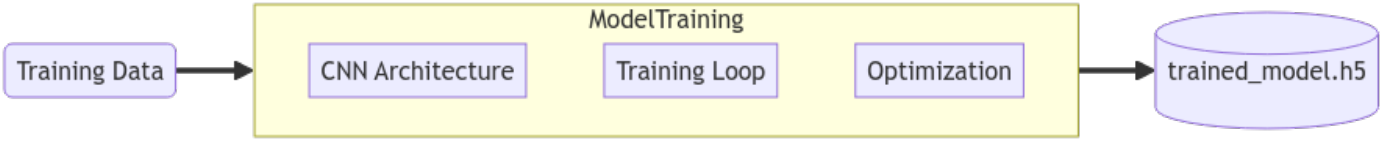
- Image resizing to ensure uniform dimensions.
- Normalization of pixel values.
- Data augmentation techniques (e.g., rotation, flipping, brightness adjustment).
- Splitting data into training, validation, and test sets.



6. Model Training Module

The Model Training Module will:

- Implement a convolutional neural network architecture suitable for retinal disease detection.
- Set up the training pipeline using a deep learning framework. (Pytorch)
- Train the model on the preprocessed dataset.
- Implement techniques to prevent overfitting (e.g., dropout).



7. Model Evaluation Module

The Model Evaluation Module will assess the model's performance using appropriate metrics such as:

- Accuracy
- Precision
- Loss curves

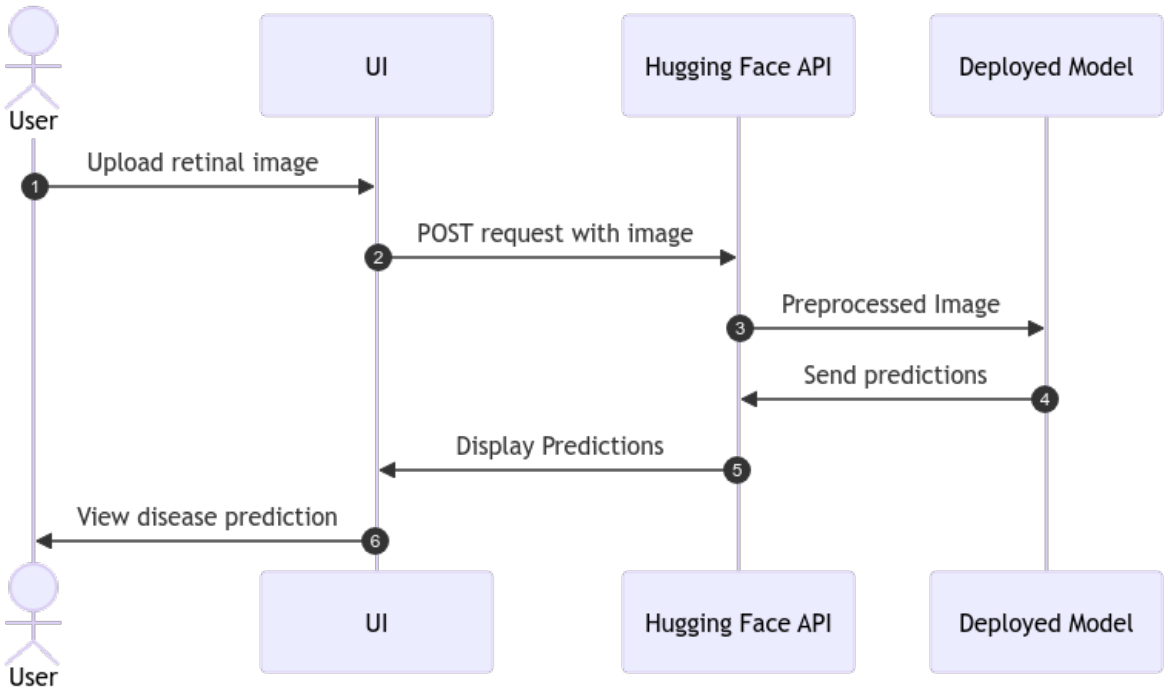
8. Model Deployment Module

The Model Deployment Module will:

- Convert the trained model to a format compatible with Hugging Face's model hosting.
- Upload the model to Hugging Face's model hub.
- Set up the necessary configuration for inference via Hugging Face's API.

9. User Interface

The project will have a user interface hosted on Hugging Face Spaces, where users can upload retinal images, and the model will provide disease predictions.



10. Model Monitoring and Maintenance

The deployed model will be continuously monitored for performance and accuracy. If the model's performance degrades over time, retraining and updating the model will be performed to maintain its effectiveness.

11. Documentation and Collaboration

The entire project, including code, data, and model documentation, will be uploaded on GitHub. Collaborators can enhance the project by improving the model architecture, preprocessing techniques, or user interface.

12. Conclusion

This LLD document outlines the structure and components of the Retinal Disease Detection System. It serves as a guide for development, implementation, and maintenance, ensuring a systematic approach to building an effective computer vision solution for retinal disease detection.