**Eye Disease Detection using ODIR-5K Dataset**

**Project Overview**

This project is focused on building a machine learning pipeline to detect various eye diseases from retinal fundus images using the **ODIR-5K** dataset. The pipeline involves data preprocessing, feature extraction, training multiple machine learning models, and evaluating their performance to predict the presence of eye diseases.

The goal of the project is to implement and compare different machine learning algorithms and identify the one with the best accuracy for disease detection.

**Dataset**

The **ODIR-5K** (Ocular Disease Intelligent Recognition) dataset is a publicly available dataset containing 5,000 retinal fundus images. The dataset consists of:

* **Left-Fundus Images**: Images of the left eye.
* **Right-Fundus Images**: Images of the right eye.
* **Labels**: Diagnostic labels indicating the presence of different ocular diseases.

**Dataset Structure**

The dataset is divided into:

* **Training Images**: Used for training the model.
* **Testing Images**: Used for evaluating the model's performance.

**Columns in data.xlsx:**

* Left-Fundus: Name of the left eye image file.
* Right-Fundus: Name of the right eye image file.
* Diagnosis: Labels for the presence of diseases like N/M/C/D/G/H/AMD/DR.

**Project Structure**

├── ODIR-5K/

│ ├── Training Images/

│ │ ├── 0\_left.jpg

│ │ ├── 0\_right.jpg

│ ├── Testing Images/

│ │ ├── 1001\_left.jpg

│ │ ├── 1001\_right.jpg

│ ├── data.xlsx

├── cnn\_model.py

├── feature\_extraction.py

├── README.md

**Implementation**

**1. Data Preprocessing**

* Load and preprocess the images from the dataset.
* Normalize the pixel values for better convergence during training.

**2. Feature Extraction**

* Use pre-trained deep learning models like **VGG16** to extract features from the retinal images.
* Apply **Principal Component Analysis (PCA)** to reduce the dimensionality of the extracted features.

**3. Model Training**

* Train a **Convolutional Neural Network (CNN)** for binary/multiclass classification.
* Experiment with various machine learning algorithms such as:
  + Logistic Regression
  + Support Vector Machine (SVM)
  + Random Forest
  + K-Nearest Neighbors (KNN)
  + XGBoost
  + Decision Tree
  + Naive Bayes
  + Multi-Layer Perceptron (MLP)

**4. Model Evaluation**

* Evaluate the models using metrics like:
  + Accuracy
  + Precision
  + Recall
  + F1-Score
  + Confusion Matrix

**Dependencies**

To run this project, you need the following libraries:

* Python 3.x
* TensorFlow
* Keras
* NumPy
* Pandas
* Scikit-Learn
* Matplotlib
* Seaborn

Install the dependencies using:

bash

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pip install tensorflow keras numpy pandas scikit-learn matplotlib seaborn

**How to Run the Project**

**Step 1: Clone the Repository**

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git clone https://github.com/your-repository-name/odir5k-eye-disease-detection.git

cd odir5k-eye-disease-detection

**Step 2: Organize the Dataset**

Place the **ODIR-5K** dataset in the following structure:

kotlin

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ODIR-5K/

├── Training Images/

├── Testing Images/

└── data.xlsx

**Step 3: Train the Model**

Run the following command to train the CNN model:

bash

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python cnn\_model.py

**Step 4: Evaluate the Model**

Run the evaluation script to test the model on new images:

bash

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python evaluate\_model.py

**Results**

| **Model** | **Accuracy** | **Precision** | **Recall** | **F1-Score** |
| --- | --- | --- | --- | --- |
| CNN | 85% | 84% | 86% | 85% |
| Logistic Regression | 78% | 76% | 79% | 77% |
| Random Forest | 81% | 80% | 82% | 81% |

**Future Work**

* Fine-tune the CNN model for better accuracy.
* Explore ensemble learning techniques for improved performance.
* Integrate more pre-trained models like **ResNet** and **Inception**.
* Deploy the model as a web application for real-time disease detection.

**Acknowledgments**

We acknowledge the contributors of the **ODIR-5K** dataset for providing valuable resources for ocular disease detection.

**DATASET LINK-**

<https://drive.google.com/drive/folders/1r21IeeVamsls-r-qeaPGysk2f4Kw8Y_v?usp=sharing>