PANIMALAR ENGINEERING COLLEGE

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CS8811 PROJECT WORK

REVIEW

DIABETIC RETINOPATHY DETECTION USING IMAGE PROCESSING

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BATCH NO: D6

ABSTRACT

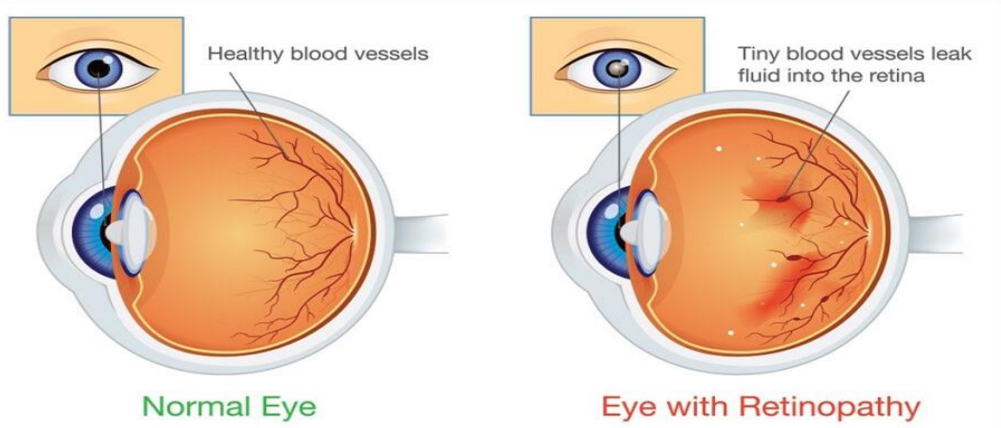
- **Diabetic retinopathy** is a leading problem throughout the world and many people are losing their vision because of this disease. The disease can get severe if it is not treated properly at its early stages.
- The damage in the retinal blood vessel eventually blocks the light that passes through the optical nerves which makes the patient with Diabetic Retinopathy blind. Therefore, in our research we wanted to find out a way to overcome this problem and thus using the help of **Convolutional Neural Network** (ConvNet), we were able to detect multiple stages of severity for Diabetic Retinopathy.
- There are other processes present to detect Diabetic Retinopathy and one such process is manual screening, but this requires a skilled ophthalmologist and takes up a huge amount of time. Thus our automatic diabetic retinopathy detection technique can be used to replace such manual processes and the ophthalmologist can spend more time taking proper care of the patient or at least they can decrease the severity of this disease.

LITERATURE SURVEY

TITLE	DESCRIPTION
Szegedy, C., Vanhoucke, V., Ioffe, S., Shlens, J. and Wojna, Z., 2016. Rethinking the inception architecture for computer vision. In Proceedings of the IEEE conference on computer vision and pattern recognition (pp. 2818-2826)	Feature extraction based classification methods need expert knowledge in order to detect the required features, and they also involve a time consuming process of feature selection, identification and extraction. Furthermore, DL based systems such as CNNs have been seen to outperform feature extraction based methods . DL training for DR classification have been performed in two major categories: learning from scratch and transfer learning.
Mohammadian, S., Karsaz, A. and Roshan, Y.M., 2017, November. Comparative Study of Fine-Tuning of Pre-Trained Convolutional Neural Networks for Diabetic Retinopathy Screening. In 2017 24th National and 2nd International Iranian Conference on Biomedical Engineering (ICBME) (pp. 1-6). IEEE	In order to avoid the time and resource consumed during DL, Mohammadian et al. fine-tuned the Inception-V3 and Exception pre-trained models to classify the Kaggle dataset into two classes. After using data augmentation to balance the dataset, reached at an accuracy score of 87.12% on the Inception-V3, and 74.49% on the Exception model.
Mateen, M., Wen, J., Song, S. and Huang, Z., 2019. Fundus Image Classification Using VGG-19 Architecture with PCA and SVD. Symmetry, 11(1), p.1.	By making use of SVMs with fully connected layers based on the VggNet-19 model, Mateen et al. reached at an accuracy of 98.34% when classifying DR on the Kaggle dataset. The Kaggle dataset , which contains 35126 labeled fundus images, has been exhaustively used for DL based classification of DR research purposes.

PROBLEM STATEMENT

- The main objective of the project is to detect diabetic retinopathy to stop blindness before it is too late. This is done by detecting the stage of Diabetic retinopathy using Fundus photograph images with help of transfer learned approach of EfficientNet-B5 model.
- We detect this by classifying the images of retina of patient into five labels numbered from 0 to 4 where each label named as Normal, Mild DR, Moderate DR, Severe DR, Prolific DR respectively represents the Complication of the disease using Deep transfer learning and classification techniques. From these 5 stages one stages is observed as an output label for the given input fundus image.



DEVELOPMENT ENVIRONMENT

- **SOFTWARE REQUIREMENTS**

  Operating System - Windows 10

  Language - Python

  Database - Heidi SQL

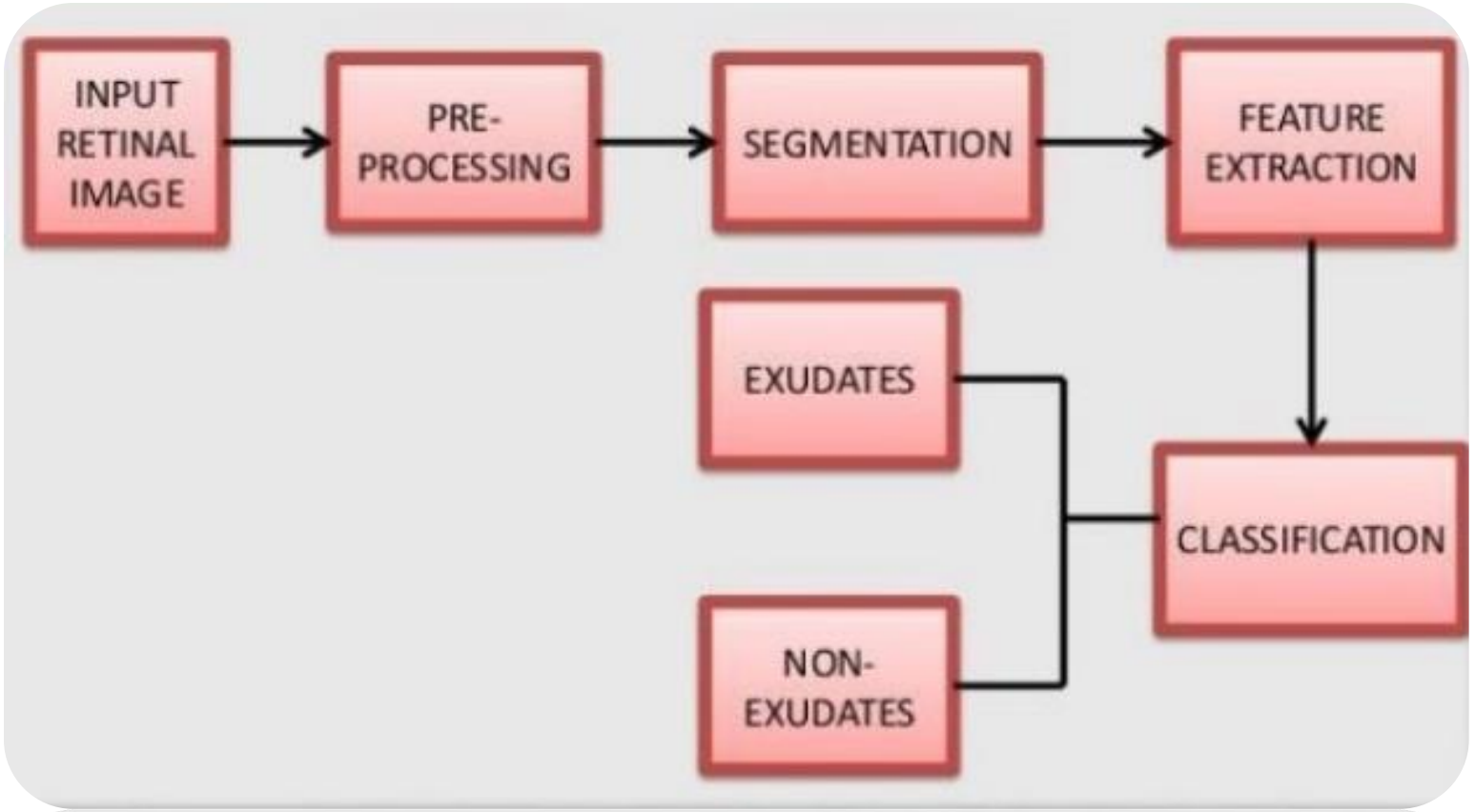
  Libraries used - matplotlib,numpy,pillow,scikit-learn,torch, torch-vision,tkinter

  Integrated Development Environment - Visual Studio

- **HARDWARE REQUIREMENTS**

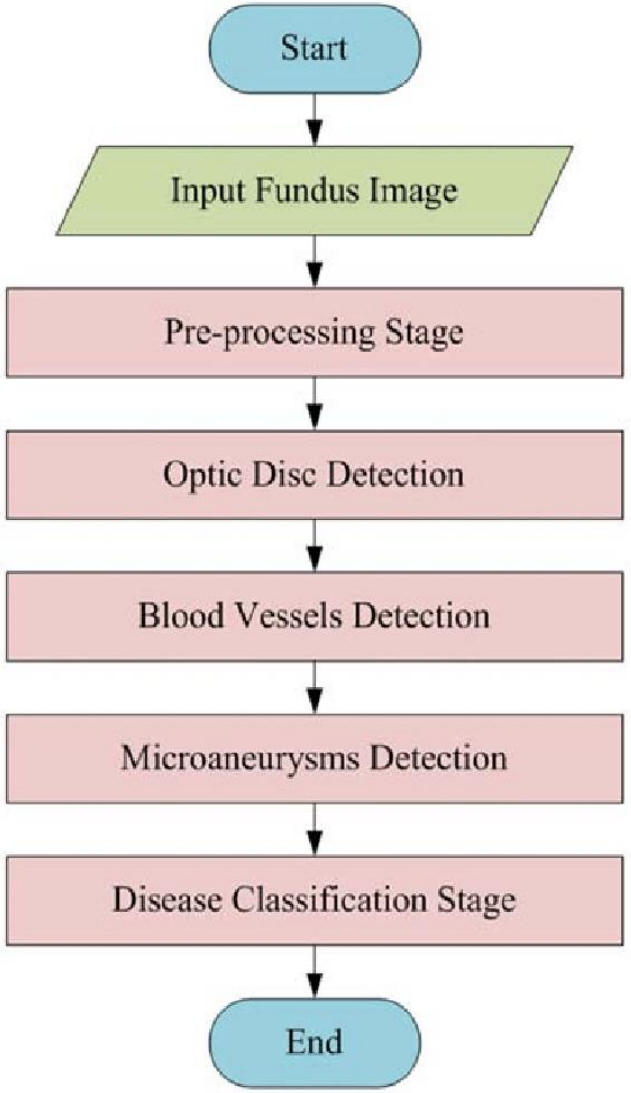
  Ram size - 4GB or 8GB

SYSTEM ARCHITECTURE OF DIABETIC RETINOPATHY DETECTION

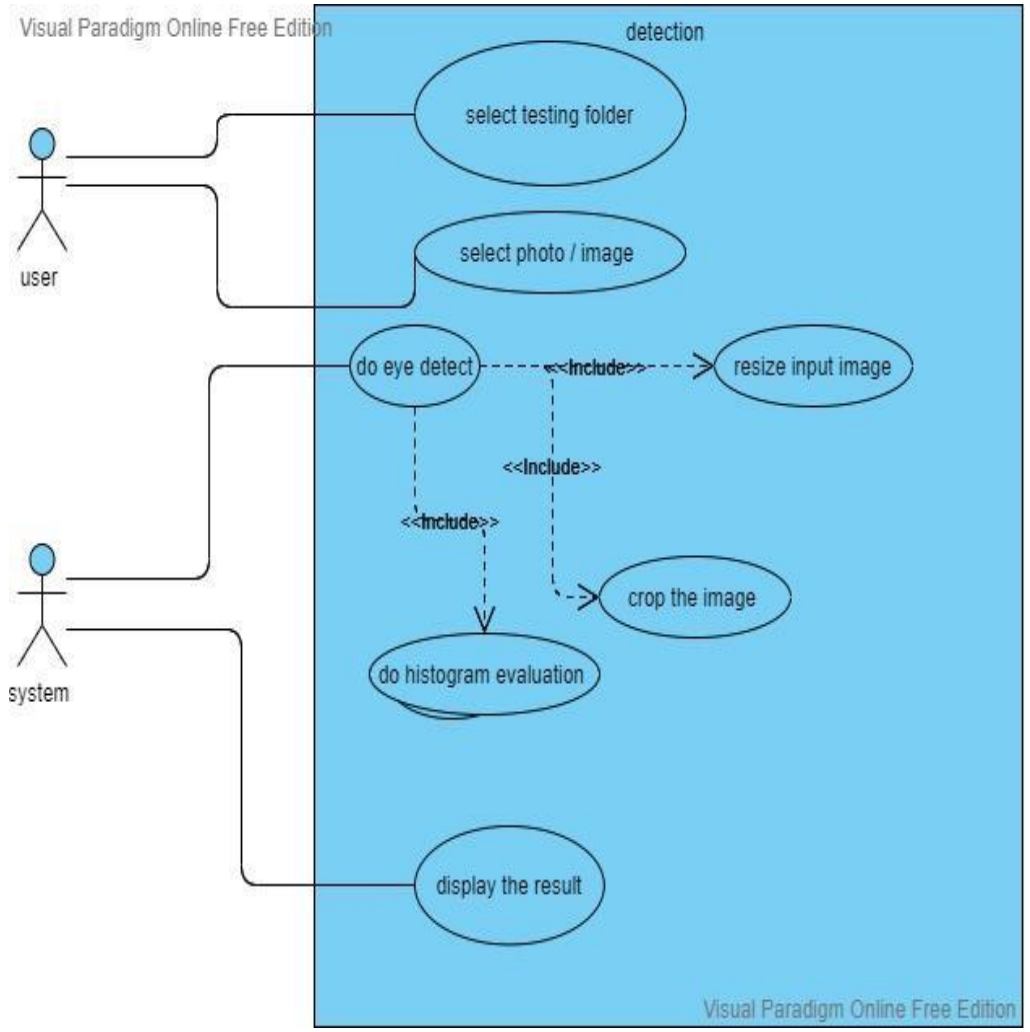


SYSTEM DESIGN

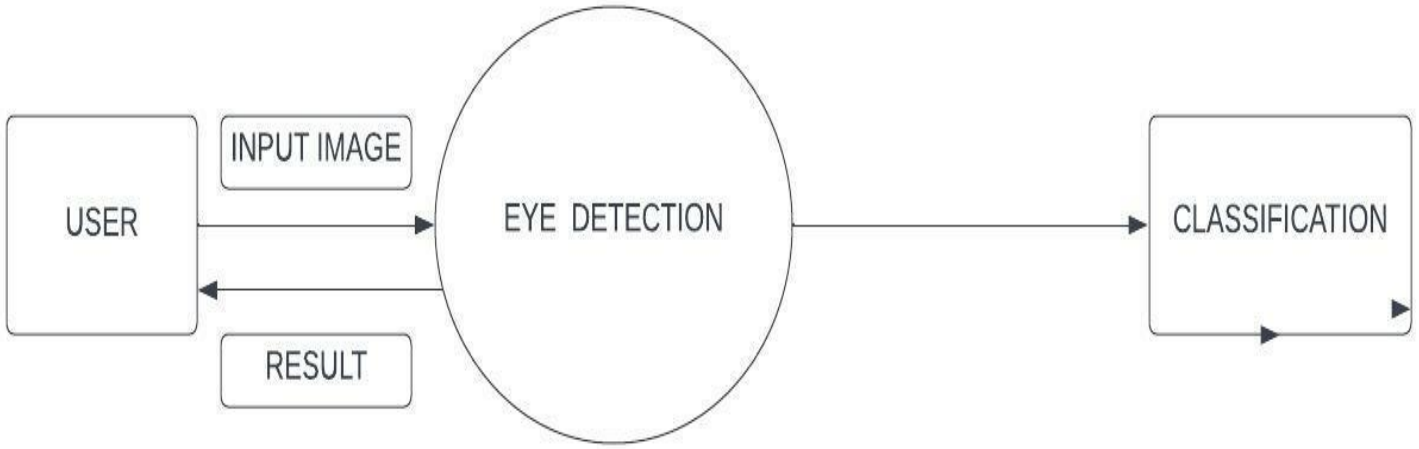
FLOWCHART OF DIABETIC RETINOPATHY DETECTION



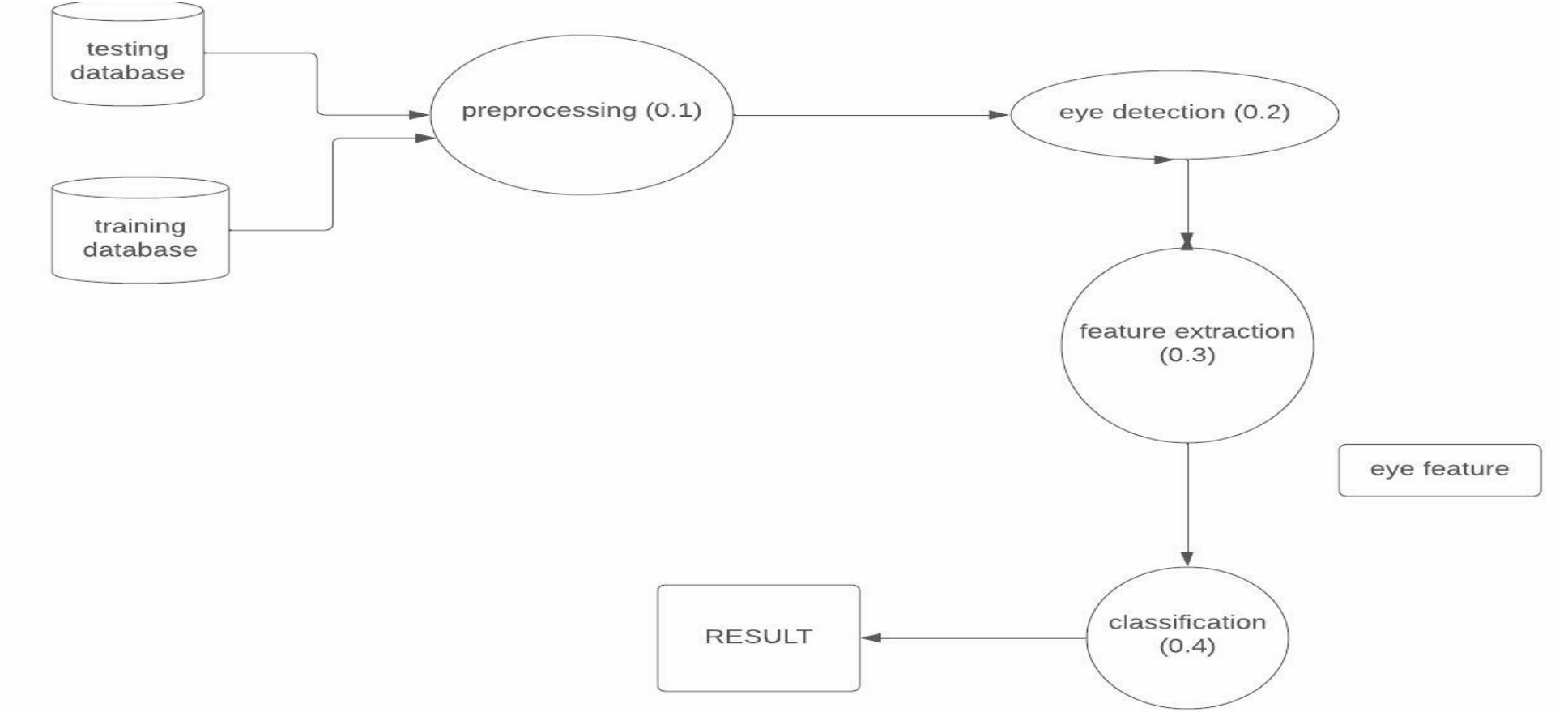
USE CASE DIAGRAM OF DIABETIC RETINOPATHY DETECTION



DATA FLOW DIAGRAM [DFD] OF DIABETIC RETINOPATHY DETECTION



DATA FLOW DIAGRAM [DFD] OF DIABETIC RETINOPATHY DETECTION



MODULE DESCRIPTION

LOGIN MODULE :

• If user doesn’t have an account, then user needs to create an account with a user name and password and click on sign up. User can able to login into the system once account is created successfully.

• If he/she is already an existing user, then they can able to login with their credentials. User should enter the correct credentials otherwise it will display an error.

IMAGE UPLOAD MODULE :

• In this page, user needs to upload the image for detection purpose.

• User should select the “upload image” option and select the required image from the available list present in their system.

RESULT PAGE :

- In this page, the user can able to view the output.

- After uploading the image, the system will predict the severity level of the disease and display the output in which the user can able to know the stage type.

DATABASE MODULE :

- Every user’s details are updated in this module.
- User can able to view their account details and the displayed stage level in this module.

PROJECT EXECUTION (IN STEPS)

Step 1: Collection of dataset images where images are trained and classified as (0 - No DR ,1- Mild DR,2 - Moderate DR, 3 - Severe DR, 4 - Proliferative DR)

Step 2: Image is uploaded by user

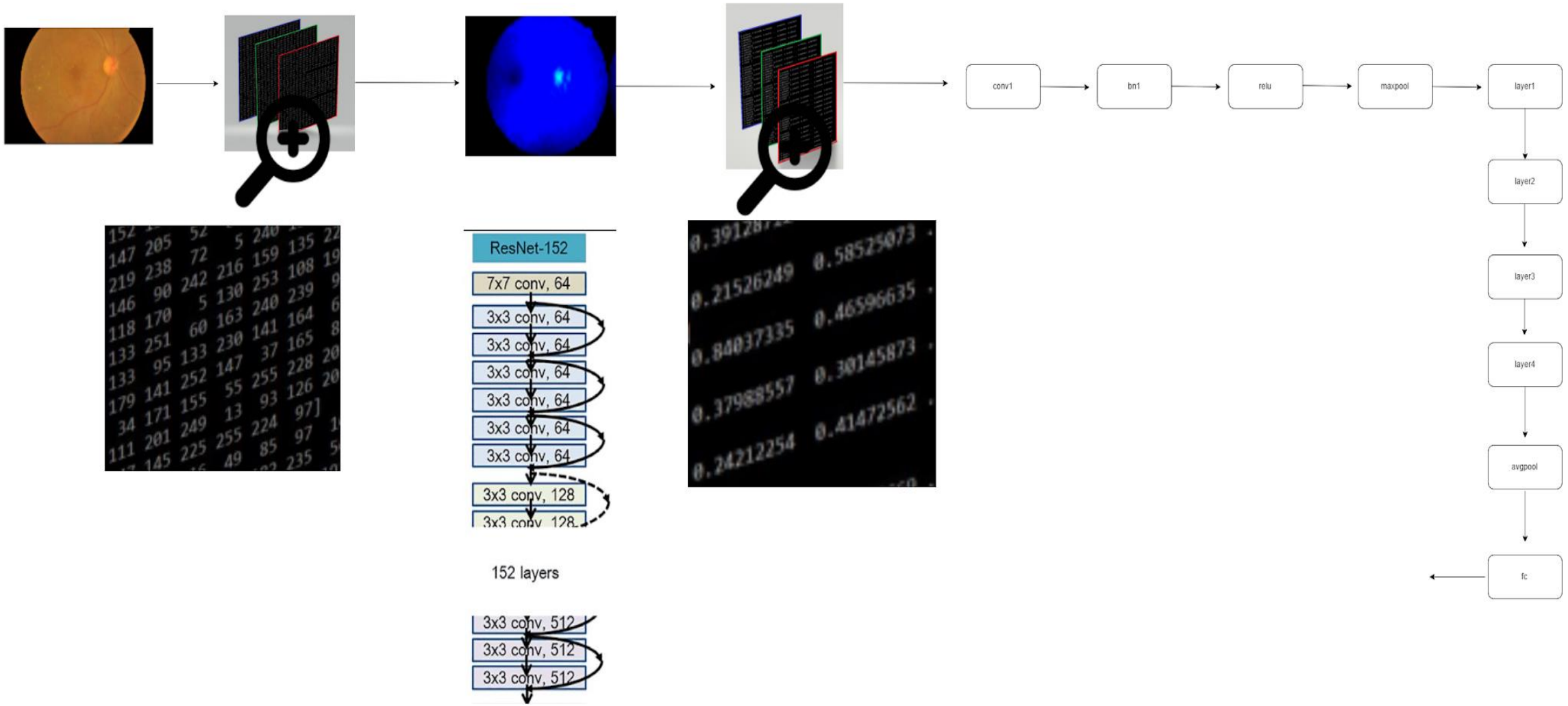
Step 3: Image is converted from BGR format into RGB format

Step 4: Image is cropped

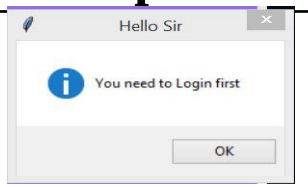
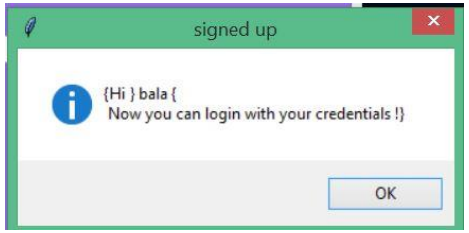
Step 5: After cropping the image, it is converted into gray scale to resize the image and detect the type of stage

Step 6: Image is classified and output is predicted which is displayed to the user based on the stage level (0 - No DR ,1- Mild DR , 2 - Moderate DR ,3 - Severe DR , 4 - Proliferative DR)

CNN PROCESS OF DIABETIC RETINOPATHY DETECTION



TESTING RESULTS

Test case id	Description	Example Inputs	Excepted output
1	If user click on upload image	Username = NIL Password = NIL	
2	If username is correct and password is wrong or username is wrong and password is correct	Actual Username = mani Actual password = 12345 Entered Username=abcd Entered password = 1245	
3	If user enter correct username and password and clicking on sign up	Username = bala Password = 12345	

SCREENSHOTS

Fig 1. Graphical User Interface of the project

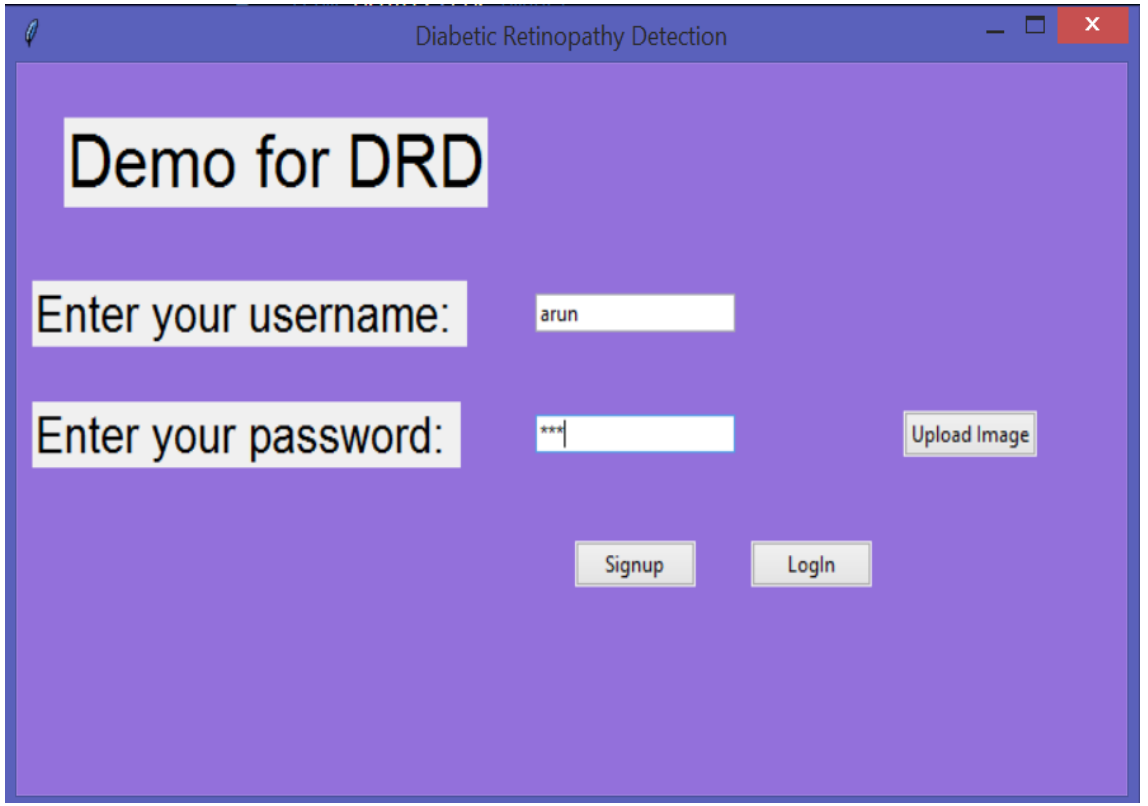


Fig 2. Login Page

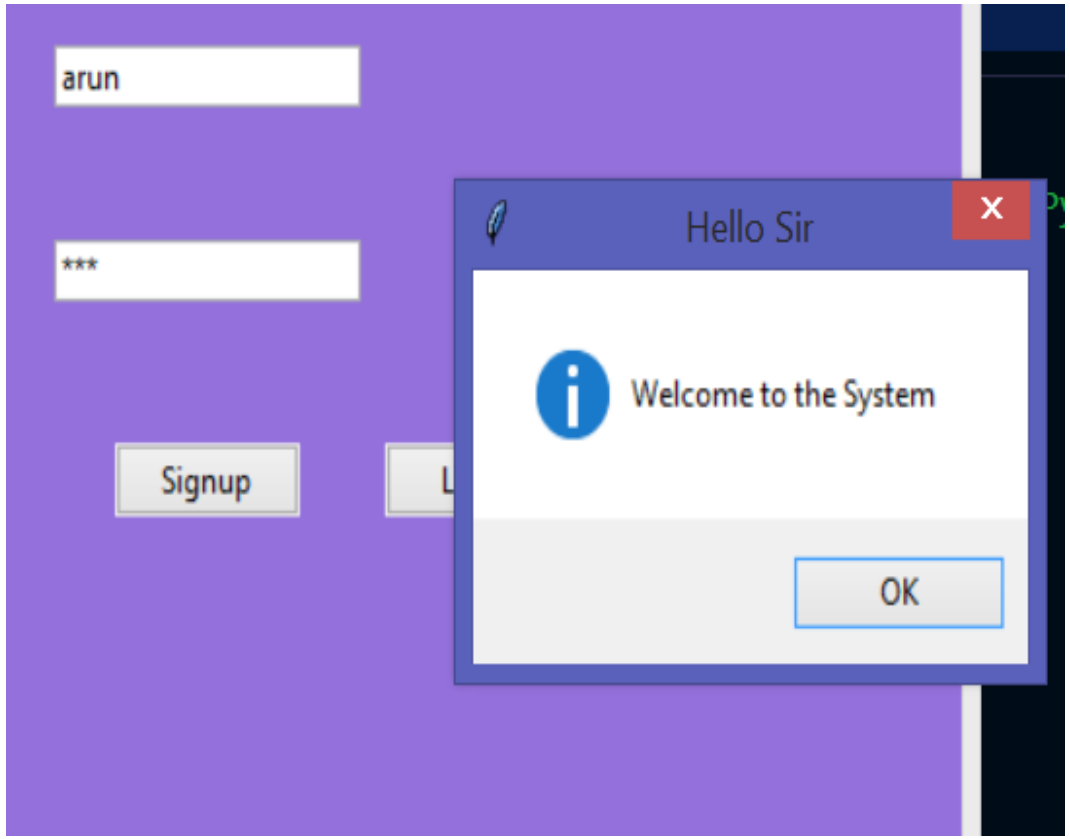


Fig 3. Successful Login

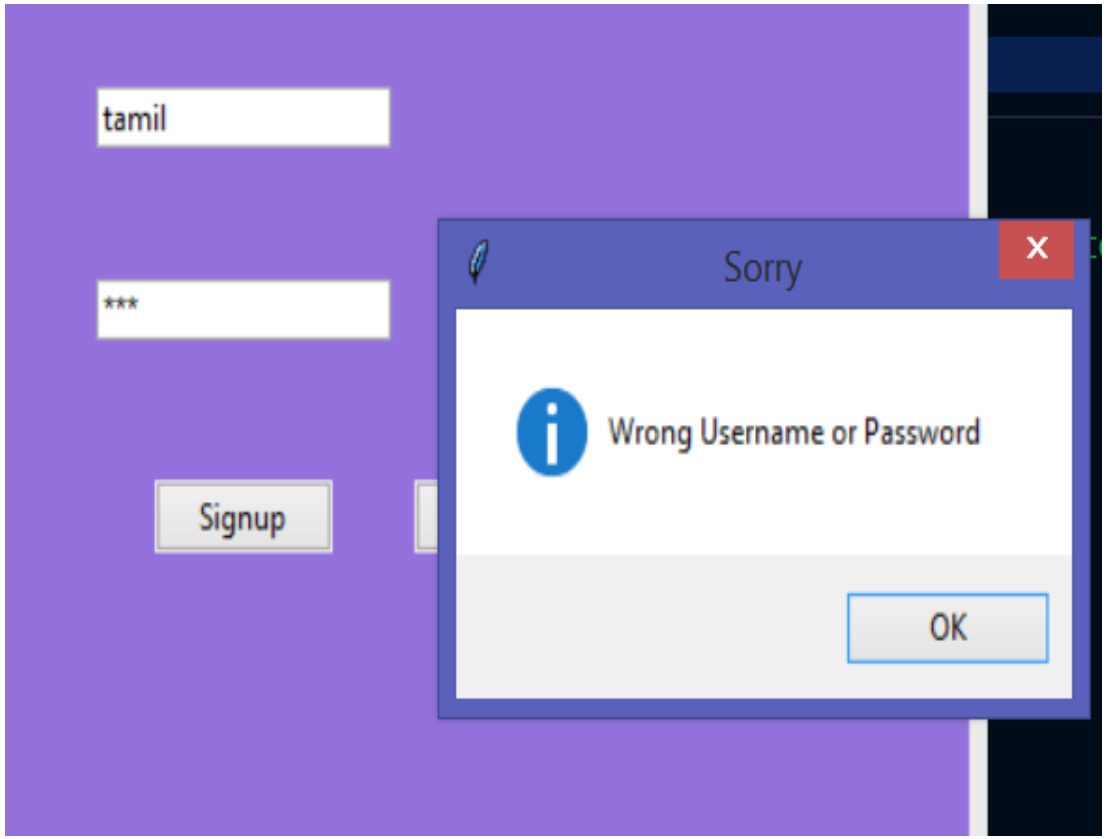


Fig 4. Incorrect Credentials / Logging without Signup

Fig 5. Uploading image for prediction report

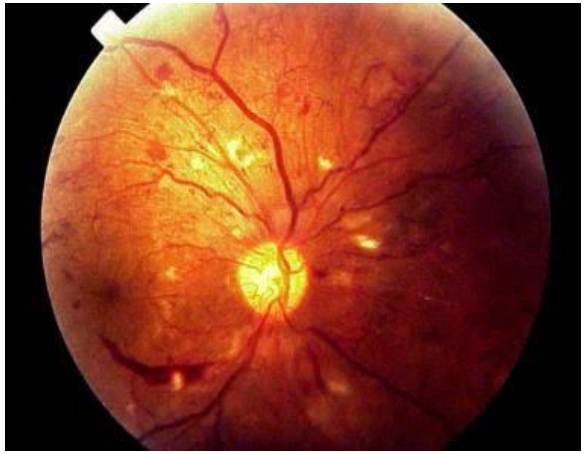


Fig 6. The Image

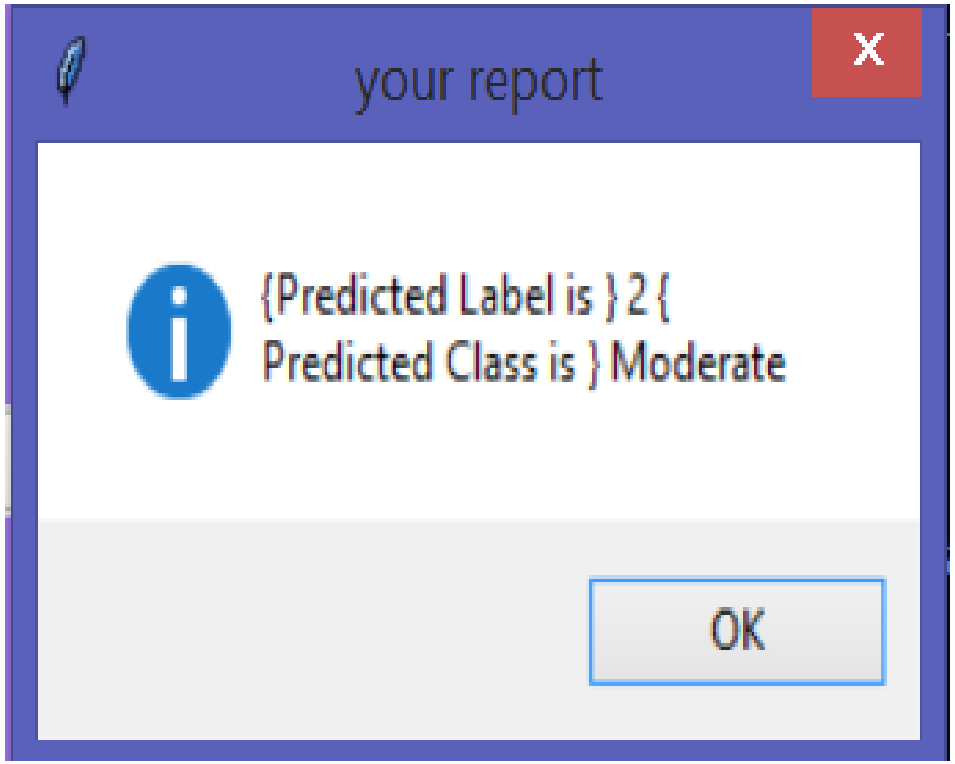


Fig 7. Result/Report

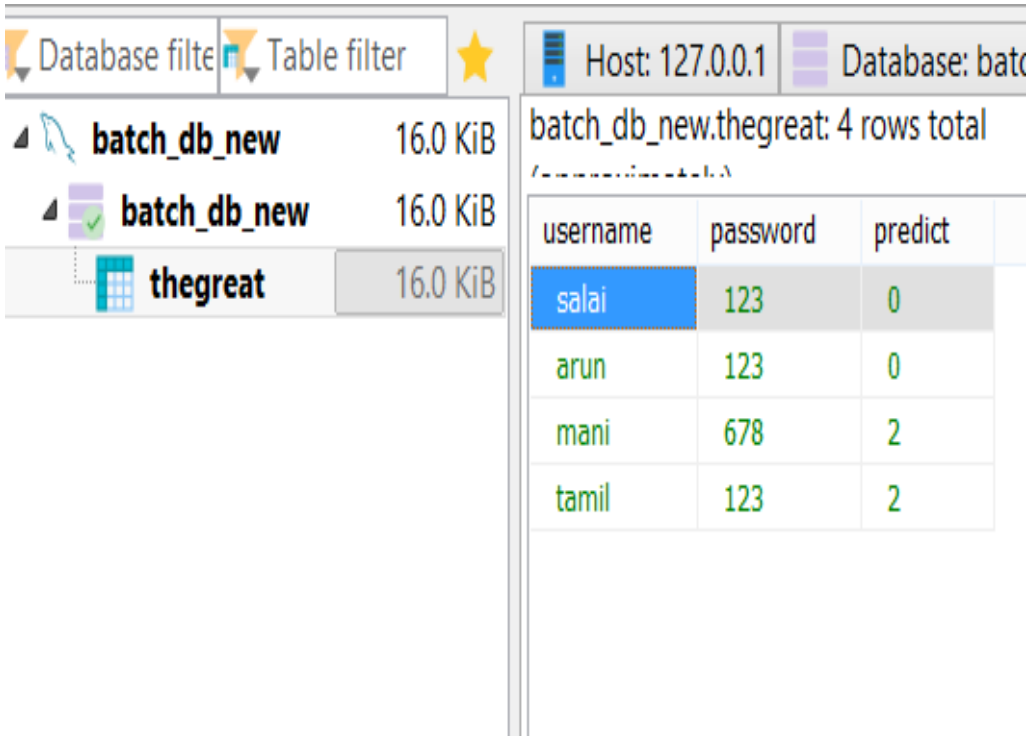


Fig 8. Database Updation

CONCLUSION

- In this project, transfer learning is implemented to classify DR into 5 classes with a much-reduced training data than other previous DR classification techniques employed. This was done to design a way to train a DL model that performs well on unseen data by efficiently learning from small dataset because training data is limited in healthcare.

- Our model has reached at an accuracy that is higher than other techniques that have used transfer learning on the whole Kaggle DR challenge dataset for multi-class classification. Our model has reached at a superior performance on account of the selected training algorithm, which is batch gradient descent with ascending learning rate, and the quadratic weighted kappa loss function.

- Deep learning techniques that can learn from small dataset to categorize medical images should be utilized to classify DR, as this can be transferred to other medical image classification problems facing the challenge of insufficient training data. Experiments should be done to compare performances of other pre-trained deep convolutional Networks.

REFERENCES

1. Szegedy, C., Vanhoucke, V., Ioffe, S., Shlens, J. and Wojna, Z., 2016. Rethinking the inception architecture for computer vision. In Proceedings of the IEEE conference on computer vision and pattern recognition (pp. 2818-2826
2. Mohammadian, S., Karsaz, A. and Roshan, Y.M., 2017, November. Comparative Study of Fine-Tuning of Pre-Trained Convolutional Neural Networks for Diabetic Retinopathy Screening. In 2017 24th National and 2nd International Iranian Conference on Biomedical Engineering (ICBME) (pp. 1-6). IEEE
3. Mateen, M., Wen, J., Song, S. and Huang, Z., 2019. Fundus Image Classification Using VGG-19 Architecture with PCA and SVD. Symmetry, 11(1), p.1.