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Name: B . Hari Prasad
Register Number: 192210577
Guided by Dr. M . Prabhu

Detection of Diabatic Retinopathy in Retinal Images using Convolutional Neural Networks Algorithm and Comparing with Random Forest Algorithm

INTRODUCTION

- Diabetic retinopathy poses a significant threat to individuals with diabetes, highlighting the need for accurate and timely detection methods.
- Convolutional neural networks (CNNs) have emerged as powerful tools for automated image analysis, holding promise for improving the diagnosis of diabetic retinopathy.
- This study aims to leverage CNN algorithms to detect diabetic retinopathy in retinal images.
- Additionally, we will compare the performance of CNNs with the Random Forest algorithm, a commonly used method in machine learning.
- By evaluating the efficacy of these algorithms, we seek to enhance the accuracy and efficiency of diabetic retinopathy diagnosis.
- Ultimately, our findings could contribute to improved patient outcomes and more effective healthcare delivery in diabetic.

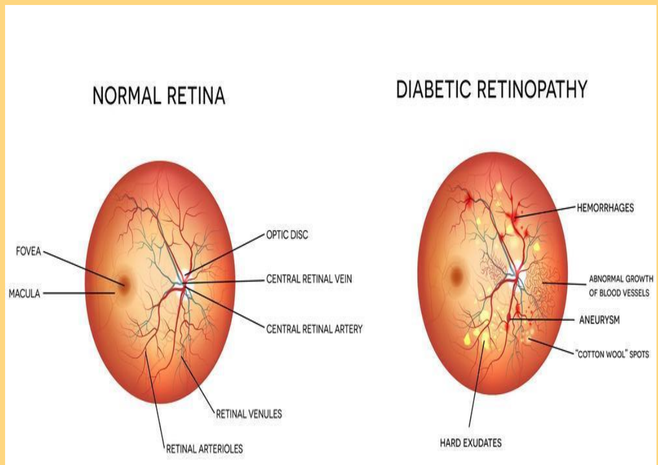


Figure 1.Stages of Diabetic Retinopathy

MATERIALS AND METHODS

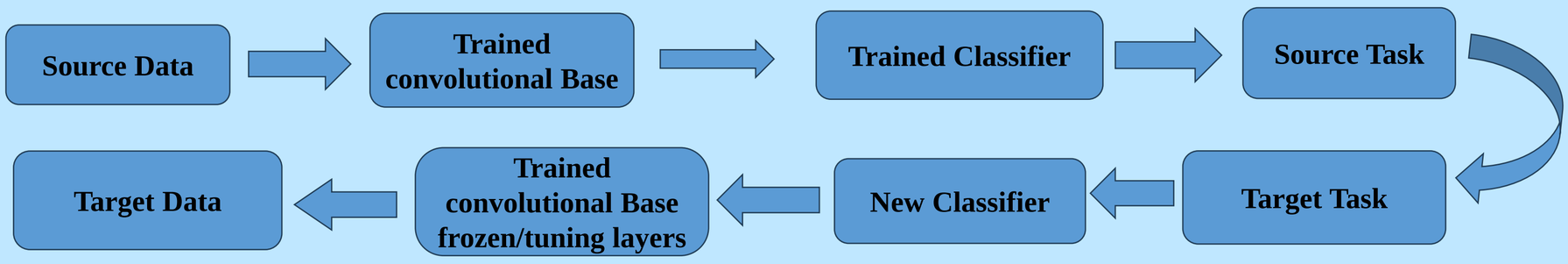
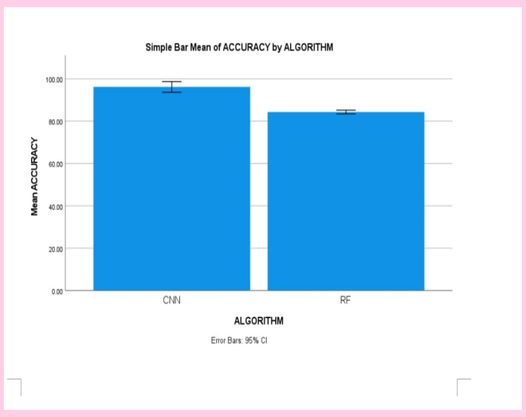


Figure 2. Process Of Diabetic Retinopathy in Stages

- As the regional CNN only detects objects, a CNN structure is needed for classification.
- For these reasons, Faster RCNN and CNN were used together, and a 2-stage method was developed.
- Based on the abovementioned shortcomings, a 2-stage method was proposed where all types of DR datasets could be trained using DL completely without preprocessing in traditional ways.
- If it is explained in more detail, since the use of CNN directly to classify DR is insufficient, the lesions should be clarified by preprocessing. In order to clarify the lesions, the region of interests(ROIs) of the lesion must be determined first.

RESULTS



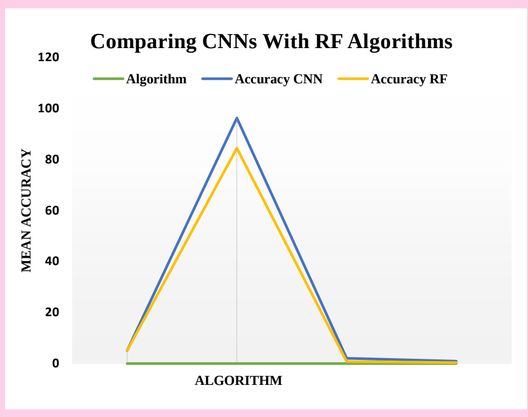


Figure 3. Convolutional Neural Networks and Random Forest

Table 1. Group Statics Comparing CNNs With RF Algorithm					
	Algorithm	N	Mean	Std.Deviation	Std.Error.Mean
Accuracy	CNN	5	96.2	2.02855	.90719
	RF	5	84.32	.71554	.32000

- CNNs: Achieve higher accuracy (99.2%) in image-based tasks due to their ability to learn spatial hierarchies of features through deep layers of the network.
- RF: With an accuracy of 84.32%, RF is generally less effective for image recognition tasks..
- Comparing the performance of Convolutional Neural Networks (CNNs) and Random Forest (RF) algorithms, especially when applied in contexts such as image recognition (where CNNs have been tested with a 99.2% accuracy versus RF with 84.32% accuracy), offers a clear picture of the strengths and limitations of these methodologies.

DISCUSSION AND CONCLUSION

- Highlight the strengths of the Random Forest algorithm, such as its ability to handle high-dimensional data, resistance to overfitting, and interpretability of results.
- Discuss the data requirements for both algorithms, including the amount of labeled data needed for training, data preprocessing steps, and any specific data augmentation techniques employed.
- Identify which algorithm (CNNs or Random Forest) performed better in detecting diabetic retinopathy in retinal images based on the evaluation metrics discussed in the discussion section.
- Summarize the advantages of using CNNs for this task, such as their ability to automatically learn relevant features from raw data and their high performance in image classification tasks.
- Highlight any advantages of the Random Forest algorithm observed in the study, such as its interpretability and robustness to overfitting.

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