iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 9 **Issue:** VI **Month of publication:** June 2021

DOI: https://doi.org/10.22214/ijraset.2021.35237

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 9 Issue VI Jun 2021- Available at www.ijraset.com

Eye Blindness Detection (Diabetic Retinopathy) using ResNet Convolutional Neural Network

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Abstract: This paper proposes a system to detect diabetic retinopathy faster using Resnet Convolutional neural network. Diabetic retinopathy is an eye condition that can cause vision loss and blindness in people who have diabetes. Diabetic retinopathy affects up to 80 percent of those who have had diabetes for 20 years or more. At least 90% of new cases could be reduced with proper treatment and monitoring of the eyes.
Keywords: Diabetic Retinopathy, Resnet CNN, Deep Learning.

I. INTRODUCTION

Diabetic retinopathy, also known as diabetic eye disease, is a medical condition in which damage occurs to the retina due to diabetes mellitus. It is a leading cause of blindness in developed countries. Diabetic retinopathy affects up to 80 percent of those who have had diabetes for 20 years or more. At least 90% of new cases could be reduced with proper treatment and monitoring of the eyes. Commonly this disease is detected at very later stage due to the unavailability of doctors and so it becomes untreatable. The diabetes pandemic requires new approaches to improve the detection and prevention**..** Thus our proposal is to train a big and varying dataset using a CNN deep learning ResNet model. Deep learning models are best known for identifying the small features in an image. The content of this paper is divided into five sections. In the first section, the background is introduced along with the motivation and purpose of this paper. In the second section, the technology and documents that are related to this paper are mentioned. In the third section, the structure of the system built in this paper is explained. In the fourth section, the construction of the system is presented in detail. In the last section, conclusions are made along with future enhancement possibilities.

II. TECHNOLOGIES USED

A. Deep Learning

Deep learning is a computer software that mimics the network of neurons in a brain. It is a subset of machine learning and is called deep learning because it makes use of deep neural networks. Deep learning algorithms are constructed with connected layers. The first layer is called the input layer and the last layer is called the output layer. All layers hidden between are called hidden layers. A deep neural network provides state of the art accuracy in many tasks, from object detection to speech recognition. They can learn automatically, without predefined knowledge explicitly coded by the programmers.

B. Python

Python is a free, open-source programming language. Python is also a great visualization tool. It provides libraries such as Matplotlib, seaborn and bokeh to create stunning visualizations. Python is the most popular language for machine learning and deep learning. Python strives for a simpler ,less-cluttered syntax and grammar while giving developers a choice. Python is meant to be an easily readable language. Its formatting is visually uncluttered, and it often uses English keywords where other languages use punctuation.

C. Pandas

Pandas is a popular Python package for data science, and with good reason: it offers powerful, expressive and flexible data structures that make data manipulation and analysis easy, among many other things. The Data Frame is one of these structures. Pandas is built on top of the NumPy package, meaning a lot of the structure of NumPy is used or replicated in Pandas. Data in pandas is often used to feed statistical analysis in SciPy, plotting functions from Matplotlib, and machine learning algorithms in Scikit-learn.

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D. Numpy

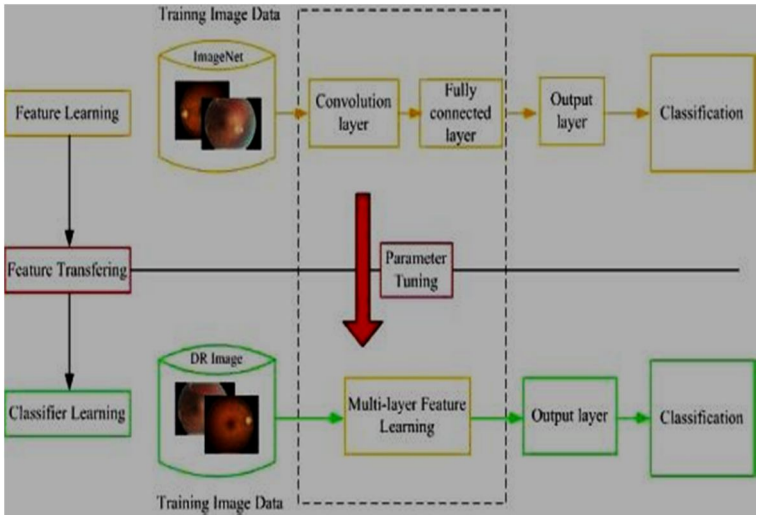
Numpy is the core library for scientific computing in Python. It provides a high-performance multidimensional array object, and tools for working with these arrays. If you are already familiar with MATLAB, you might find this tutorial useful to get started with numpy. NumPy is a Python library that is the core library for scientific computing in Python. It contains a collection of tools and techniques that can be used to solve computer mathematical models of problems in Science and Engineering.

E. Matplotlib

Plotting of data can be extensively made possible in an interactive way by Matplotlib, which is a plotting library that can be demonstrated in Python scripts. Plotting of graphs isa part of data visualization, and this property can be achieved by making use of Matplotlib.One of the free and open-source Python libraries which is basically used for technical and scientific computing is Python SciPy. Matplotlib is widely used in SciPy as most scientific calculations require plotting of graphs and diagrams.

III. SYSTEM ARCHITECTURE

The Architecture explains how the patient's images are uploaded and with the help of our large dataset,the data is preprocessed and our model is trained to classify whether the patient has Diabetic retinopathy,if yes it classifies the severity of diabetic retinopathy.



IV. SYSTEM IMPLEMENTATION

The proposed system consists of four modules. The image data is analyzed using exploratory visualization. Then using that information, required preprocessing of the images is done. Preprocessing of images extracts the features that causes the disease and thus increases accuracy. A ResNet convolutional neural network model is created and the images are fed into the model for training. After training, the model is optimized by hyper parameter tuning. Finally the test data is used to predict the accuracy of the model in detecting thoracic disease or not. Performance analysis is done using loss & accuracy graph, ROC curve and confusion matrix.

A. Image Analysis and Visualization

first step in your data analysis process. Here, you make sense of the data you have and then figure out what questions you want to ask and how to frame them, as well as how best to manipulate your available data sources to get the answers you need. You do this by taking a broad look at patterns, trends, outliers, unexpected results and so on in your existing data, using visual and quantitative methods to get a sense of the story this tells.

B. Image Pre-processing

Sometimes you may find some data missing in the dataset. We need to be equipped to handle the problem when we come across them. Obviously you could remove the entire line of data but it may lead to removing crucial information unknowingly which will cause a lot of errors in the prediction phase. One of the most common ideas to handle the problem is to take a mean of all the values of the same column and have it to replace the missing data.

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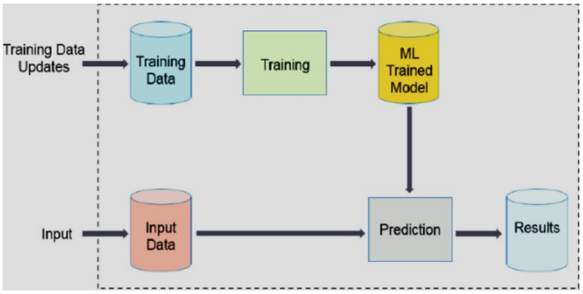
The library that we are going to use for the task is called Scikit Learn preprocessing. It contains a class called Imputer which will help us take care of the missing data.

C. Model Creation & Training

In the proposed method the network will be implemented for feature and classification though ResNet proved success in solving problems in medical imaging. Training very large medical data having many parameters but limited numbers of samples has a problem of overfitting can be well adapted by ResNet. It has reduced the number of parameters to learn by a simple network to speed up training on a selective typical value. From the input image pixels are used directly to feed the network for image classification.



V. CONCLUSION AND FUTURE WORK

In this work, through a collection of different eye retina images, we demonstrated how to classify eye blindness level accurately. The proposed system showed us that ResNet could aid in the detection of the diabetic retinopathy disease .We constructed our model using various techniques such as data augmentation and windowing. In rural places, due to lack of medical infrastructure diabetic retinopathy disease is not analysed by expert doctors. Clinical implementation of this algorithm can help decrease financial costs since the algorithm currently utilizes only easily obtainable clinical data such as fundal images. The high value of sensitivity shows how dependable this technology can be for implementation in real-world scenarios. In future, we can create a website where anyone can upload the eye image and get the output in the form of eye blindness level .This website can be developed for the public which can be accessed by everyone.

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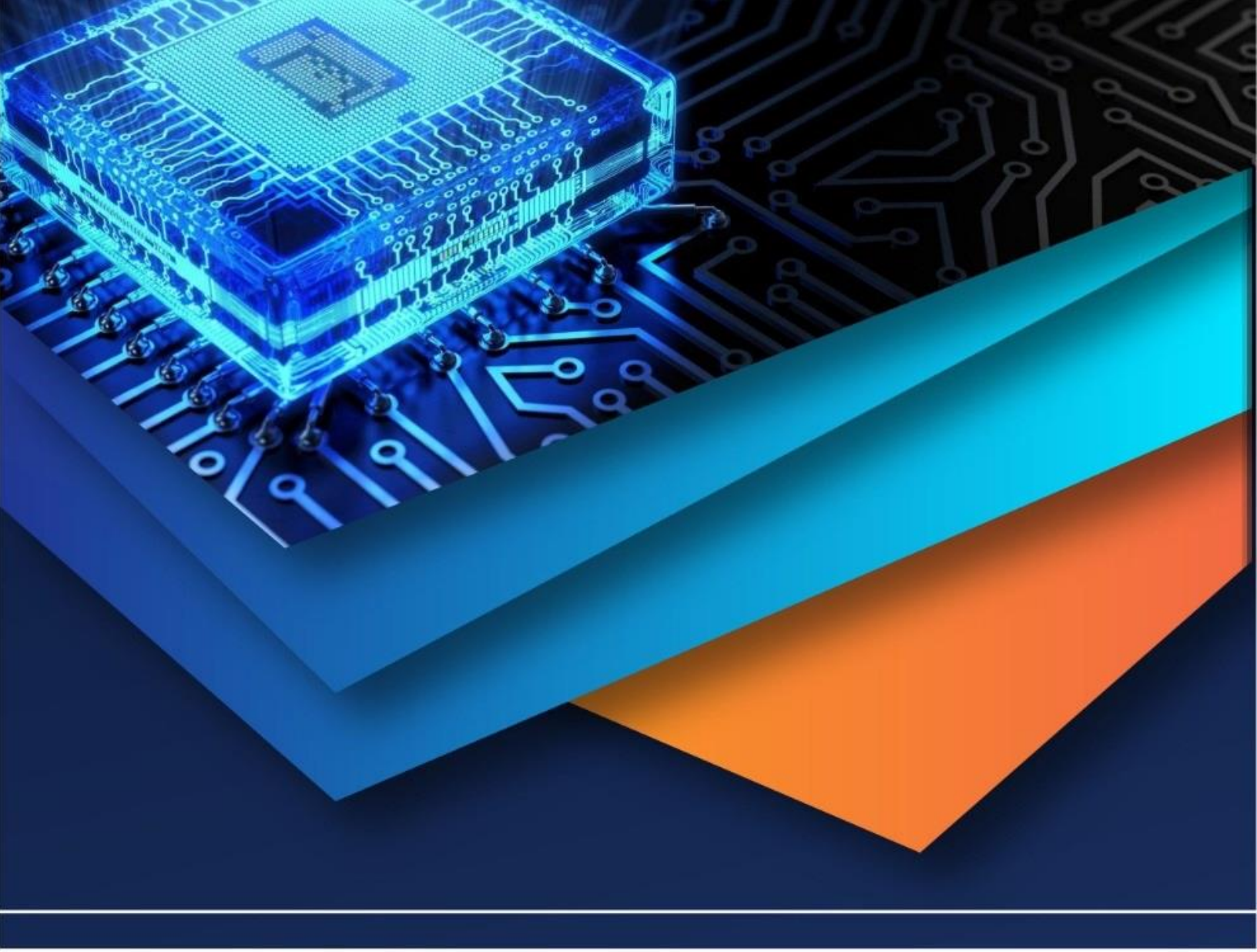

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