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A Research on Deep Learning Model for Diabetic Retinopathy Detection

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Abstract – Deep learning methods based on image processing, illness detection, and risk assessment are becoming more successful in healthcare. This research article proposes a model for diabetic retinopathy diagnosis using FastAI, where the outputs are improved by utilizing the Fast AI library and less code. This Convolution Neural Network (CNN) model is successful in terms of image processing, and it was trained using Google Colab's GPU system. The neural network that has been pre-programmed will assist in obtaining a fast and accurate result. This suggested approach compares pictures of diabetic retinopathy to normal retina scans. A modified algorithm with a bigger dataset may be developed in the future to identify all phases of diabetic retinopathy. This CNN is designed to help ophthalmologists diagnose patients.

Keywords – Convolution Neural Network, Deep Learning, Diabetic Retinopathy Detection;

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INTRODUCTION

The main eye problem is widely recognized as a diabetic consequence. 30% of diabetics show symptoms of retinopathy, and 30% have vision problems. Furthermore, the figure is rising. By 2040, these figures are expected to be considerably higher. Diabetes mellitus puts you at risk for a variety of severe health problems. There are macro and micro vascular complications associated with diabetes. Damage to larger blood vessels is referred to as macro, whereas injury to smaller blood vessels is referred to as micro. These types of vascular damage include nephropathy, which causes renal incapacity, retinopathy, which causes vision impairment, and neuropathy, which causes nerve damage and leads to failure of normal functioning. (See Figure 5.1).

The use of AI in healthcare has already proved to be a viable idea in a number of areas. Because they execute difficult tasks for image diagnosis, the biggest use of AI in health care has striking similarities to ophthalmology. Artificial intelligence has many benefits in medicine. Artificial intelligence is mostly used by ophthalmologists to deal with problems. If a practitioner needs to maintain control over their professional future, they must have intelligent algorithms as well as educate themselves and become well-informed on how to use, evaluate, and apply deep learning in a good manner. With the assistance of competent algorithms from image datasets and easy notice and predict structures of pictures, this assists the practitioner and helps them reduce investigative and human mistakes.

INNOVATION IN THE PROPOSED RESEARCH:

Many researchers have contributed to the field of diabetic retinopathy. Those provided and implemented a variety of machine learning methods, as well as made related efforts in the health care and data science areas. As additional deep learning procedures, packages, and libraries become available, this may become a major factor in the model's success. As a result, the researcher has embraced the new technique and platform in comparison to current diabetic retinopathy methods, taking into account the outputs and results. The GPU from Google Colab was utilized in this deep learning model. The dataset is available for download from the Kaggle competition's website. This picture data is then stored on the server's own memory, and the urls of each image are transferred into an excel sheet.

DIABETIC RETINOPATHY:

Diabetes, also known as diabetes mellitus, is a disease that occurs when the human body is unable to properly utilize and retain sugar. Because sugar is produced in the bloodstream, the human

blood sugar level, also known as glucose, increases.

Diabetic Retinopathy is caused by an increase in glucose levels in the blood. This causes damage to the small arteries and veins in the eyes. Sensing light emissions is the function of the human retina. This light then transmits these signals to the human intellect through optic nerve fibers. This diabetic complication may cause impaired vision, as well as the leakage of eye fluids or bleeds in the retinal blood vessels (Fig 1). At the most severe stage, abnormal blood arteries and veins form on the superficial surface of the retina, causing cell damage and impaired vision. [NEI] [American Academy of Ophthalmology]

Retinopathy progresses via four stages:

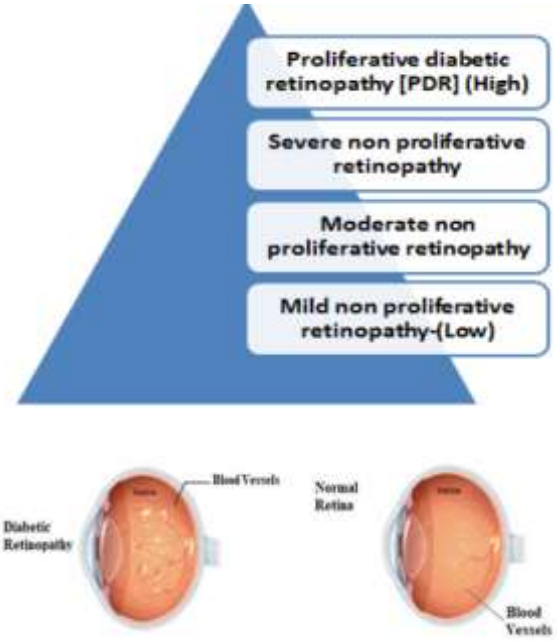
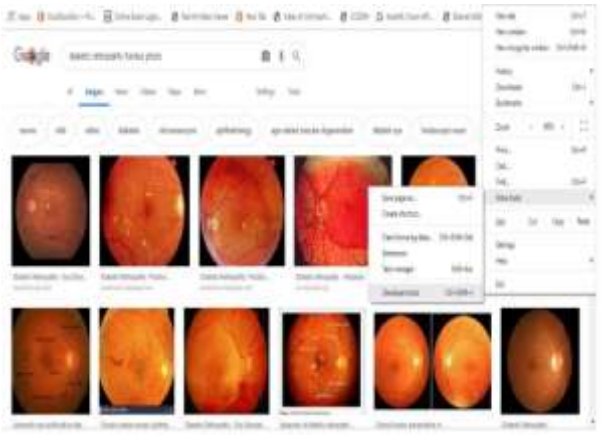


Figure 1: diabetic retinopathy and normal retina

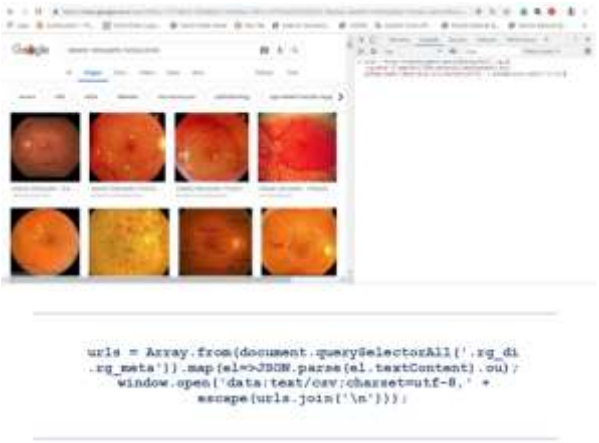
USING GOOGLE IMAGES TO CREATE YOUR OWN DATASET:

You can build your own dataset using Google pictures by following the instructions below.

Step 1: Select the Google image from the Developers Tools menu.

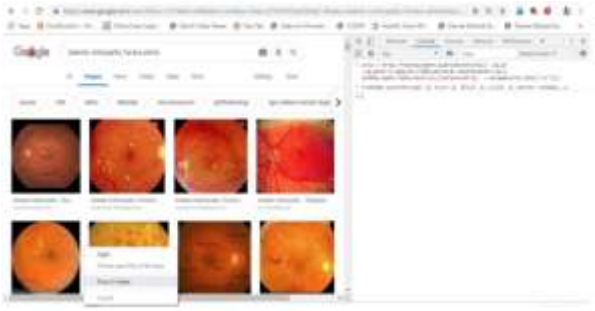


Step 2: Selecting the console tab



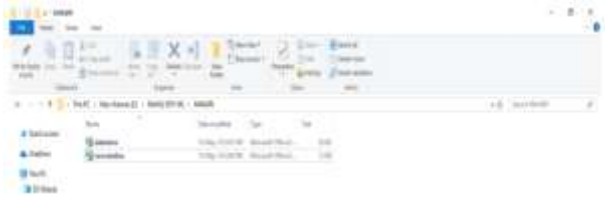
Paste the following code into the console window of your browser. The dataset is then downloaded automatically by hitting the enter key.

Step 3: If we hit enter, a file with the name download gets uploaded.



Step 4: Drag and drag this file into Excel and save it to the appropriate location.

Step 5: Save file respective memory location .csv format.



Here are two csv files with retinopathy and normal eye. For this study, the researcher utilized web-based storage and a portion of the kaggle diabetic retinopathy dataset. On a web server, the pictures dataset has been saved. For further processing, images containing a web address (URL) are saved as a dataset in comma delimited CSV format.

Steps for creating CNN using Colab runtime GPU:

1. Open Google Colab with secure Google Login ⇒ File ⇒ New Python 3 notebook.

2. Rename the file name⇒ Click on Runtime ⇒ Change Runtime Type as GPU

3. Change Runtime Type as GPU

4. Start Writing Code⇒ Set the path ⇒ Upload the Data⇒

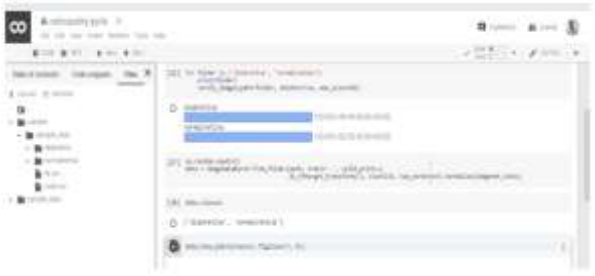
6. During each runtime recycling, the researcher will get the default message from the program that all submitted files will be destroyed.

7. Download images:

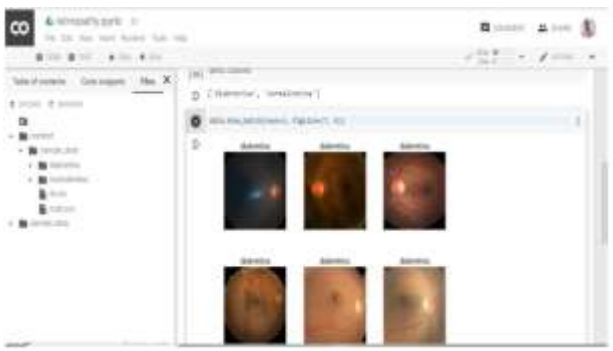
Anyone may download images using the uniform resource location in the document utilizing the capabilities supplied by Fast AI. Researchers must give the Uniform Resource Locator (URL) for the paper as well as the destination location. The feature will aid in the storing and downloading of images that cannot be seen or opened due to a problem with the viewing and display.

8. Then the removed images that cannot be opened.

9. View data:one can view the data by classes and in batch of three rows



10. Data.Show_batch ( ) function will help for showing the data



11. Create model:

There are a variety of convolutional neural network designs that may be used to build processes for strengthening applications and researchers in AI in the future. The CNN was created using the ResNet architecture by the researchers.

12. Using train Lengthening Learner:

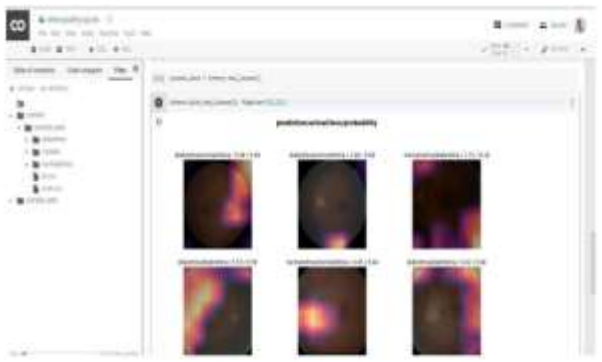
Using train Lengthening Learner, the researcher simply used the learn.fit one cycle() method.

```
[44] learn.fit_one_cycle(5)
```

epoch	train_loss	valid_loss	error_rate	accuracy	time
0	0.240868	0.621682	0.210526	0.789474	00:01
1	0.196123	0.644820	0.157895	0.842105	00:01
2	0.203185	0.662209	0.157895	0.842105	00:01
3	0.185842	0.667164	0.157895	0.842105	00:01
4	0.199340	0.659575	0.157895	0.842105	00:01

```
interp = ClassificationInterpretation.from_learner(learn)
```

13. Interpretation



14. Cleaning Up:

Not only does the poorest performance of the framework cause the most losses, but also images that are not followed throughout the gathering of input data for the picture may cause the most losses. The widget ImageCleaner may be used to reduce significant losses from the supplied input by importing the fastai (.) widgets packages. By separating the images that aren't part of the framework and removing them.

15. Putting your model in production:

The export.pkl document was created in the working directory by transferring the content object learner. It includes everything a researcher needs to install CNN. Aside from the massive size, the researcher will need to use a central processing unit for framework inference. If we don't have a GPU, it occurs automatically (i.e. test model on CPU).

16. By ensuring that the appropriate place has a document export with the extension pkl in which the researcher shapes the learner in a construction scenario.

CONCLUSION

Researchers define specificity in these two problems as the number of pictures properly classified as diabetic retina (diabretina) and normal retina (normalretina). The correctness of the pictures of the retina with an appropriate categorization is defined by the researcher. This final network was able to achieve an accuracy of 80%. It is possible to classify any number of images using Fastai libraries. The trained convolutional neural network produces a quick prediction and responds to the user right away. The following are some of the test cases that the researcher has provided. Predict the picture class for which the model was built. Google's cloud services include virtual machines with graphics processing units capable of more than 960,000 teraflops of execution for each event. With V100 and P4, P100, Tesla K80, NVIDIA, T4GPUs, DL, molecular modelling, and simulation are animated. Regardless of the scope of the amazing task at hand, anybody may benefit from the flawless GPU provided by researcher.

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