



APTOPS Blindness Detection

Diabetic retinopathy is a diabetes complication that affects eyes. Damage to the blood vessels of the light-sensitive tissue of the retina causes this complication. Diabetic retinopathy (DR) is a leading cause of vision-loss globally. Approximately one-third of 285 million people with diabetes mellitus worldwide have signs of DR. Imagine being able to detect DR before it causes problems. Early detection of DR could save millions of diabetics from losing their vision, which is the goal of a problem featured in Kaggle by [Asia Pacific Tele-Ophthalmology Society \(APTOPS\)](#).

Symptoms :

Signs and symptoms of diabetic retinopathy may include: blurred vision. the impairment of color vision. floaters, or transparent and colorless spots and dark strings that float in the patient's field of vision

Four stages of diabetic retinopathy

Diabetic retinopathy is caused by an excess of blood glucose in the blood vessels of the retina. The quickest way to know the answer to the question, "What are the four stages of diabetic retinopathy?" is to track the status of these blood vessels.

Stage 1: Mild nonproliferative retinopathy — microaneurysms

What is the first sign of diabetic retinopathy? Microaneurysms — dilated capillaries which look like a small red dot or balloon — are often the first sign of diabetic retinopathy. However, microaneurysms do not affect vision and often go unnoticed as a result.

Stage 2: Moderate nonproliferative retinopathy — blocked blood vessels

In this stage, the blood vessels in the eye become too swollen to properly provide nourishment to the retina. These changes often cause visible changes to the retina. An increased likelihood of DME is associated with patients who reach this stage of diabetic retinopathy. (Read more about DME and [macular pucksers](#) on our blog.)

Stage 3: Severe nonproliferative retinopathy — more blocked blood vessels & a call for help

At this stage, a significant portion of the blood vessels in your retina are now blocked, severely decreasing the necessary blood flow to the retina. Eventually, the retina will begin to send out signals, telling the body to grow new blood vessels.

Stage 4: Proliferative retinopathy — blood vessels grow on the retina

Stage four diabetic retinopathy is the most advanced stage of diabetic retinopathy, during which new blood vessels begin to grow on the retina. Unfortunately, these blood vessels are typically both weak and abnormal, which can lead to blood leaking into the eye, vision problems, and potentially blindness.

Sample Data for each Diagnosis Code :

The below is sample images for each diagnosis Code

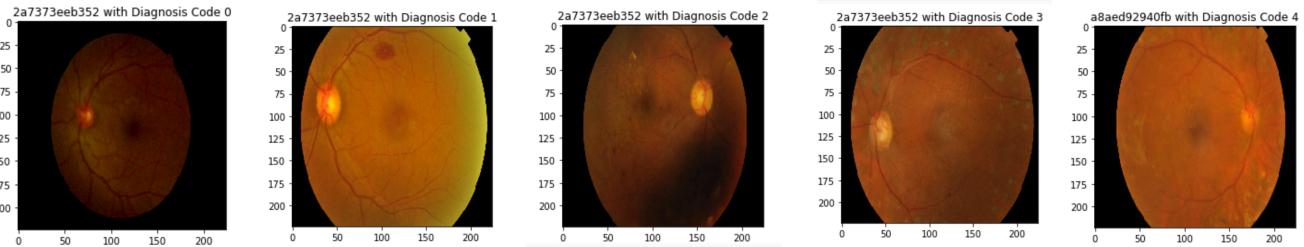
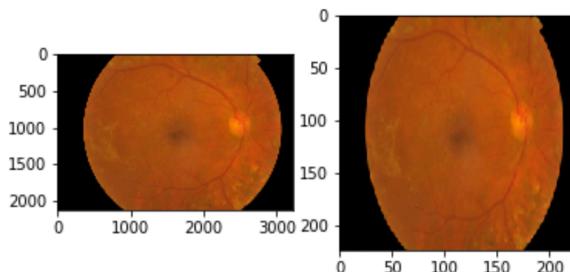


Image preprocessing Resize :

The photos will have to be reshaped prior to modeling so that all images have the same shape. This is often a small square image.

Smaller inputs mean a model that is faster to train, and typically this concern dominates the choice of image size. In this case, choose a fixed size of 224×224 pixels.

(3216, 2136)



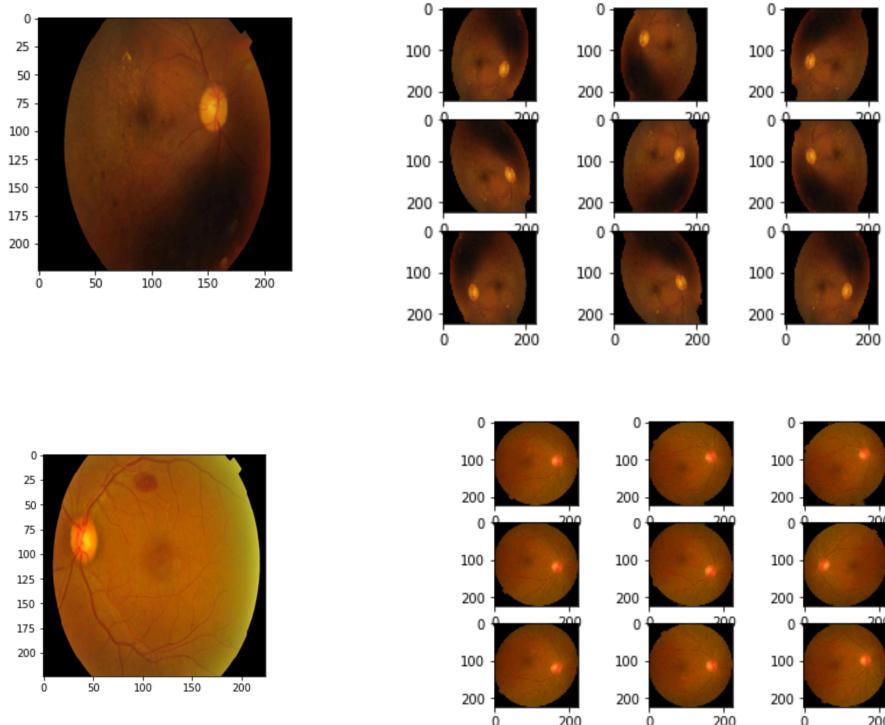
(224, 224, 3)

Image Augmentation:

Deep networks need large amount of training data to achieve good performance. To build a powerful image classifier using very little training data, image augmentation is usually required to boost the performance of deep networks. [Image](#)

augmentation artificially creates training images through different ways of processing or combination of multiple processing, such as random rotation, shifts, shear and flips, etc.

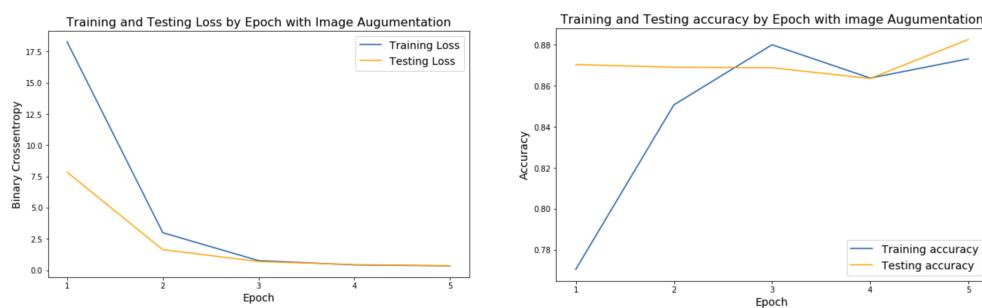
Sample Image Augmentation :



Base CNN Layer (Model1)

Created the base CNN layer and have the accuracy 0.85 after Image Augmentation.

Accuracy & Loss With Image Augmentation :

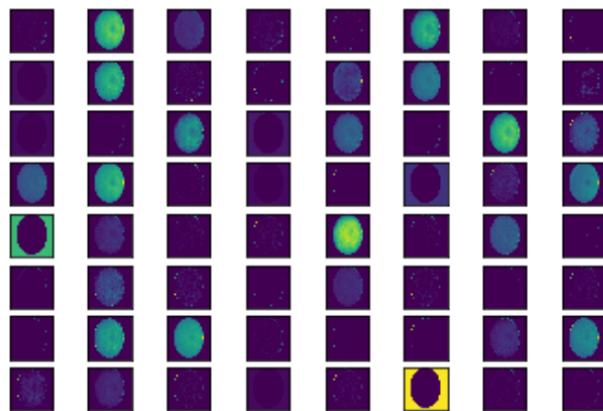


VGG16 Learning Transfer:

With Learning Transfer from pertained model VGG16 the accuracy has improved to 0.91.

Layer 1 Output : 64

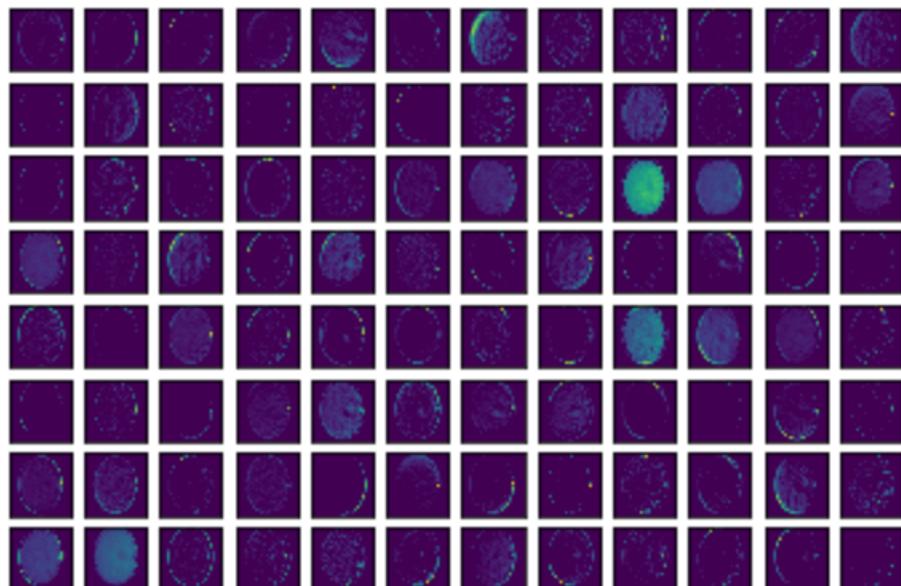
Filter



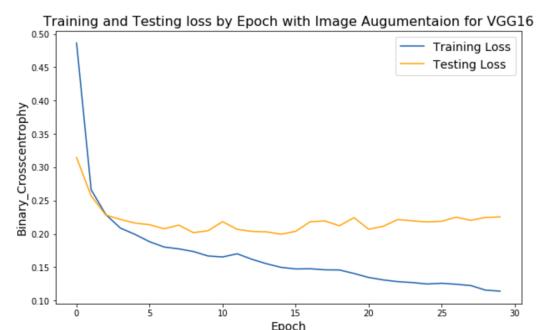
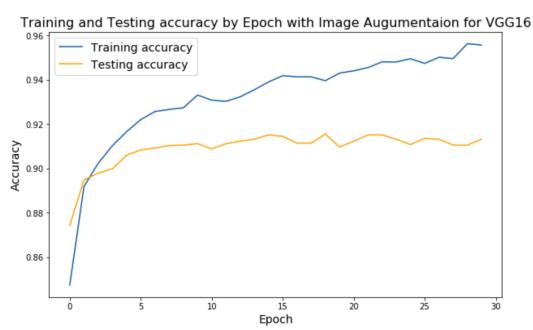
Layer 5

Output : 128

Filters



Accuracy/ Loss



Conclusion :

The deployed deep Learning Model to diagnose the stages of Diabetic Retinopathy wont require clinician to diagnose the stage. Model can be used for initial Screening. Deep learning offers the opportunity to improve clinical outcomes in medicine, enabling healthcare providers to serve growing patient populations, and providing care givers with the tools they need to focus on patients with critical conditions.