

Introduction

- Neural Networks are a form of AI which operates in a similar way to biological brains.
- Layers of artificial “neurons” are connected with weights and biases
- These weights and biases can be “trained” by showing them the correct data, passing the data through the network, and backpropagating

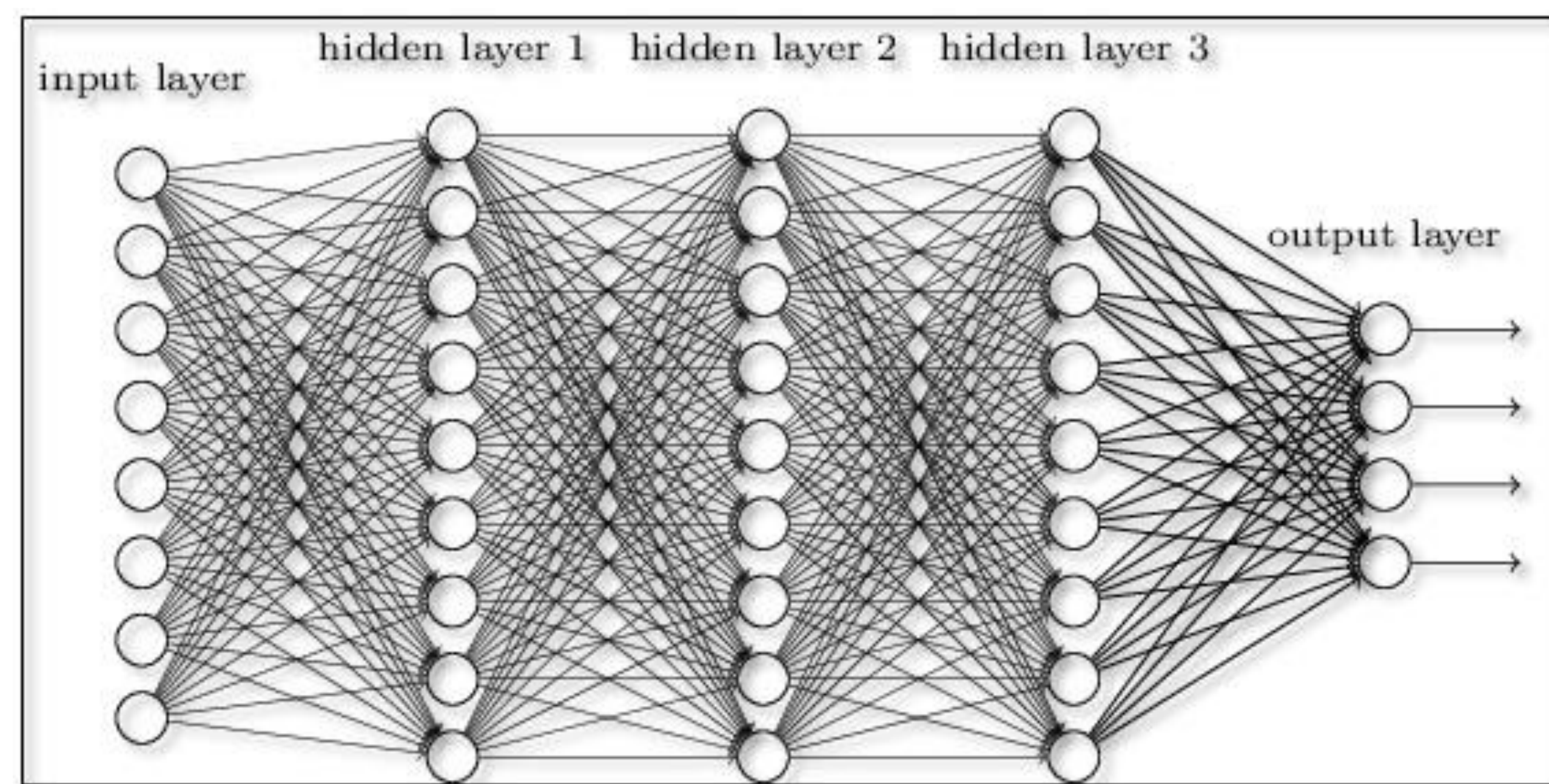


Figure #1 Illustration of a traditional neural network

- Convolutional Neural Networks (CNNs) use feature maps (also called kernels) in place of weights and biases
- These feature maps pass over the image, and are especially useful in image recognition because important features are extracted

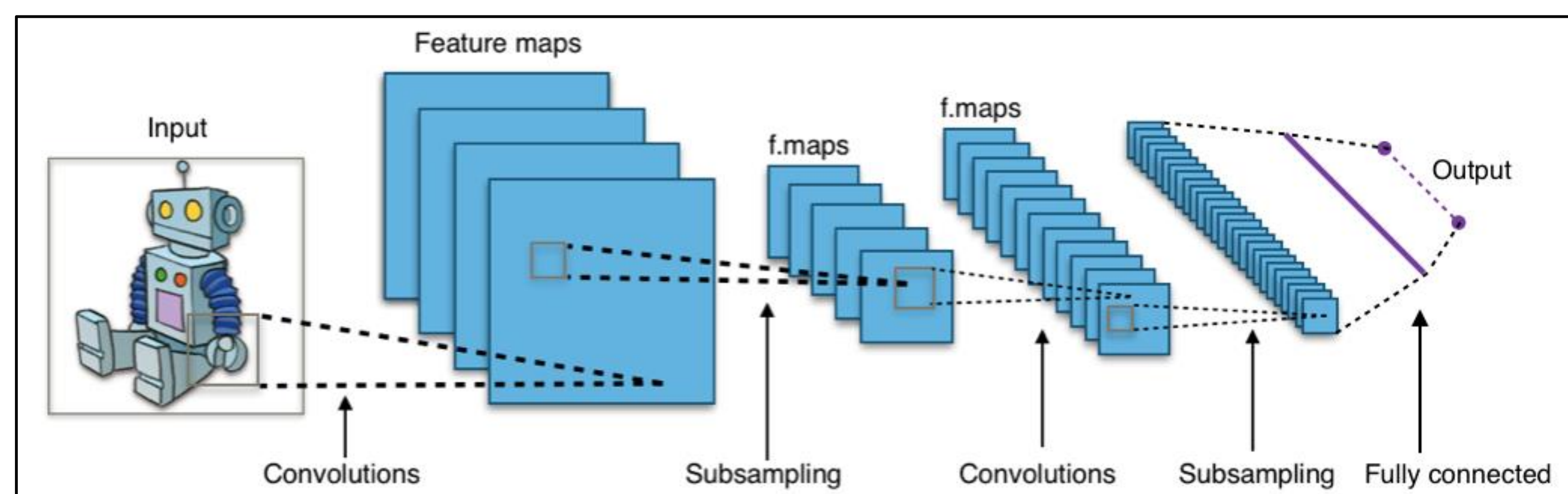


Figure #2 Illustration of a convolutional neural network

- Subsampling is a technique used to increase training speed by reducing the size of the dataset
- This is normally done with the avgpool and maxpool methods

Sponsor Information + Problem Statement

- The Nevada National Security Site (NNSS) is a US Department of Energy facility dedicated to maintaining the US’ nuclear stockpile
- The NNSS has developed an algorithm in-house called Variable Stride
 - This algorithm aims to accelerate CNNs by dynamically subsampling images
 - If successful, variable stride will be used on the NNSS’ classified datasets
- The non-classified data that will be used to test the algorithm is diabetic retinopathy data
 - Binary classification of the disease between stage 1 (healthy), and stage 4 (advanced)

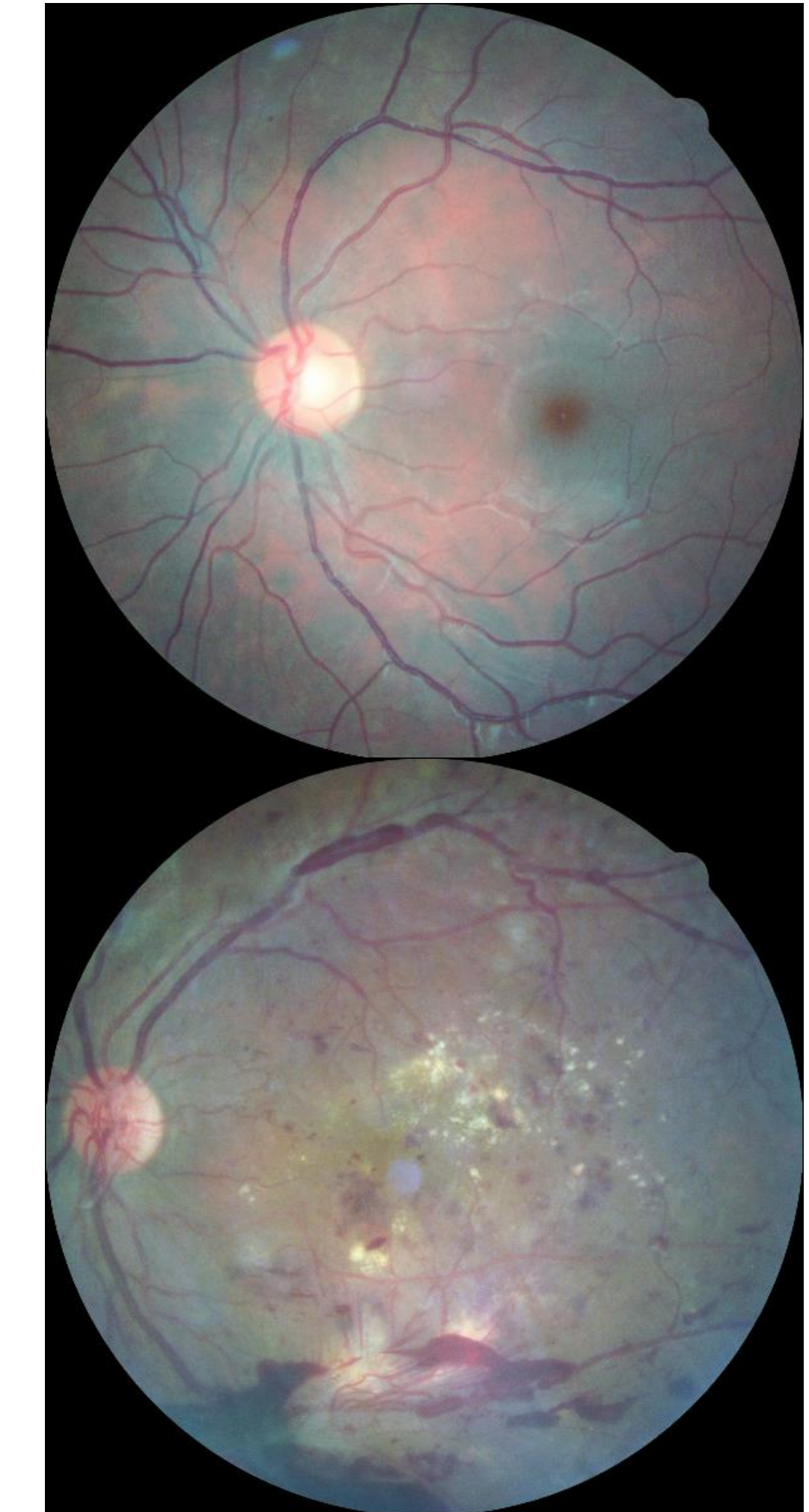


Figure #3 Comparison between a healthy retina (top), and a retina affected by stage 4 diabetic retinopathy (bottom)

Tasks + Progress

- The goal of this research is to determine if Variable Stride is a viable alternative to maxpool and avgpool
- Variable stride has been successfully implemented in a CNN
- A test is being developed to evaluate the algorithm in terms of the true/false positive rejection rate

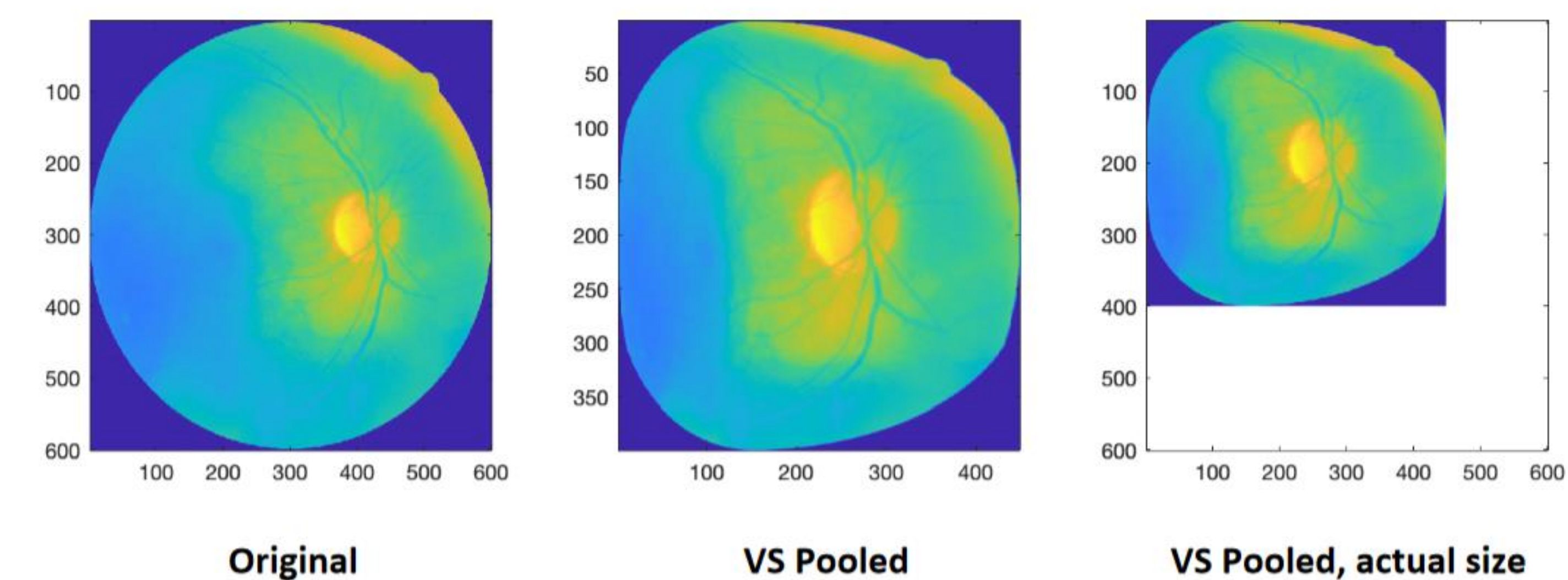


Figure #4 Demonstration of the subsampling produced by Variable Stride