

**TENSORFLOW: MACHINE LEARNING FOR MEDICAL IMAGING**

by

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# Acknowledgements

# Abstract

TensorFlow is an open source library used to train and develop machine learning models. This dissertation discusses its current and future uses in the area of medical imaging and diagnosis. In addition to this I am going to explain how I developed my own TensorFlow application to detect diabetic retinopathy from digital retinal images.

# Literature Review

**Current uses of machine learning in medical imaging**

Many areas of medicine rely on medical imaging to create visual representations of the body for symptom diagnosis and prescribing treatment to patients. Medical imaging covers a wide range of techniques including x-rays, ultrasound and fundus photography to detect problems in every part of the body; however, creating these images is only the first step in diagnosis. Once these images have been taken they must be analysed by healthcare professionals – this can be a lengthy process as some images can be hard to read – even for experts. Because of this, and the sheer number of scans that medical professionals have to go through, lengthy delays between scan and treatment often occur – which can be a serious problem if someone urgently needs care.

This is where machine learning comes in. Using convolutional neural networks (ConvNets) deep-learning systems can automatically detect abnormalities in seconds as well as prioritize the care of the patients that urgently need it. This can rapidly reduce the wait between scan and treatment for the patient and can potentially save lives/prevent symptoms from worsening further.

Research for using machine learning in medicine is already underway. DeepMind (DeepMind, 2018), a Google subsidiary has been collaborating with Moorfields Eye Hospital since 2016 (NHS, 2018) to develop AI applications for healthcare and has been working with UK universities and Cancer Research UK (DeepMind, 2018) to apply machine learning to cancer screening techniques.

DeepMind’s results from the collaboration with Moorfields have seen a lot of success with the system recommending the correct referral decision for 53 eye diseases with 94% accuracy (J, 2018) – this is as good as a top eye expert and can carry out referrals much faster than a person could. It still needs to go through medical trials and gain regulatory approval before it can be used in other hospitals; however it is hoped that it will help speed up the referral process for patients that urgently need care for diseases such as diabetic retinopathy and macular degeneration.

At the centre of this technology are convolutional neural networks, these are deep learning algorithms that are modeled after how humans brains perceive patterns and label objects. They work by taking an input image and assigning biases and weights to various aspects within the image; unlike more primitive image classification algorithms that require the characteristics to be predetermined, ConvNets have the ability to learn features from a dataset of images.

Every digital colour image can be represented as a matrix of pixels with channels such as red, green and blue (RGB) referring to the colour value of each pixel (imagine three 2-D matrices that overlap to form the whole image)

ConvNets, like neural networks in the brain (and other artificial neural networks) consist of neurons

Messidor dataset

Other examples of medical imaging and machine learning

# Methodology

<https://ujjwalkarn.me/2016/08/09/quick-intro-neural-networks/>

https://ujjwalkarn.me/2016/08/11/intuitive-explanation-convnets/

First had to sort messidor data base, excel spreadsheet, python program, then had to convert images from tiff to jpg – too large and pre built model wouldn’t accept them

Then had to balance the classes – why? How? Over & under

# Design, Development & Evaluation

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