GRØN DYST Diabetic Retinopathy

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INTRODUCTION

Thirty-nine million people in the world are blind, and the majority lost their sight due to curable and preventable diseases. But how do you test and treat people who live in remote areas, where expensive, bulky eye equipment is hard to come by? In March 2015 peekvision.org[1] launched the world's first 3D printable, $80 attachment that enables mobile phones to take pictures of the retina. However, medical examination is still costly and time-consuming. I propose an algorithm using state of the art techniques to automatically identify diabetic retinopathy (world's leading cause of blindness) in crude and noisy retina images.

THEORY & METHODS

Since Krizhevsky's[2] breakthrough on building large neural networks for image recognition, an entire new field within artificial intelligence has developed. The algorithm proposed uses the most recent papers and setup within this field to handle the noisy nature of medical pictures from mobile phones.[3]

Results

The results are based on training models on the Kaggle challenge dataset from California Healthcare Foundation[4]. A physician's accuracy is estimated to be at 0.78, my results so far has gotten up to 0.30 accuracy using a fairly small and simple network, with heavily down sampled images (originals are 3000x5000, mines are 256x256).

Picture size	Very small(1 layer)	Small(2-3 layers	Medium(5-10 layers)	Large(20+)
96x96	**0.09**	**0.153**	**n/a**	**n/a**
256x256	**0.142**	**0.301**	**n/a**	**n/a**
512x512	**n/a**	**n/a**	**n/a**	**n/a**

Table of accuracy

Discussion

The heuristics within neural networks are to build large ones (like a brain, the bigger the better). As my network is still relatively small (building larger needs more processing power and time to fine tune). As the accuracy is still increasing when more complexity is added (image size and layers), the potential for reaching a better accuracy with larger neural networks is high.

Relation to environment

About 40-45% of diabetics have some stage of retinopathy, and as environmental chemicals and toxics has proven a role in the development of diabetes[5], algorithms like mine could be a critical tool in preventing environmental related diseases. Especially as later stages of retinopathy is predominant in rural areas of economical weak countries.

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[1] Peek Vision - http://www.peekvision.org/
[2] Krizhevsky et al. (2012) – ImageNet Classification with Deep Convolutional Neural Networks, http://www.cs.toronto.edu/~fritz/absps/imagenet.pdf
[3] Stanford, Convolutional Neural Networks - http://cs231n.stanford.edu/
[4] Kaggle - https://www.kaggle.com/c/diabetic-retinopathy-detection
[5] Thayer et al. (2012), Role of Environmental Chemicals in Diabetes and Obesity