CASE STUDY

Nimbus Research Centre

MTU
Ollscoil Teicneolaíochta na Mumhan
Munster Technological University

COMPANY

MDCL

MDCL is a start-up based in Dublin 8, focussed on the application of AI to aid Ophthalmologists and medica practitioners alike in expediating patient medical diagnoses.

Their current focus is the development of an AI-vision platform with the capacity to assess patient retinas for the early stage detection of Diabetic Retinopathy - the leading cause of blindness in the working-age population of the developed world.

The condition is estimated to affect over 93 million people. In this instance, Nimbus, as a Tec gateway, facilitates a unique environment where Endocrinology, technology and business development can co-exist to realise their individual potential as a unit

mdcl

🌐 www.mdcl.io

WHY?

PROJECT GOAL

The need for a comprehensive and automated method of diabetic retinopathy screening has long been recognised, and previous efforts have made good progress using image classification, pattern recognition and machine learning. Utilising retinotopic images as data inputs, the objective of this research was to create a novel model and validate its clinical potential.

MDCL wanted to investigate the potential of an automated intelligent screening process to review retinal images which could be used by healthcare professionals in detecting Diabetic Retinopathy. The intention being that an AI-vison or machine learning algorithm would assist in the initial screening of between 80-85% of retinal photographic images sent forward for an in-depth review. Our aim was to achieve this by introducing a third "Undetermined" category to the two current categories, "Diabetic Retinopathy" and "No Diabetic Retinopathy", used by professional medical graders of retinal images. This in turn would lead to a saving in retinal grader time and is expected to improve the accuracy of a "No Diabetic Retinopathy" diagnoses, i.e. diabetes retinopathy is not present. This strategy rests on being able to say 100% the proportion of those diagnosed as normal are actually normal – thus mitigating against false negatives.
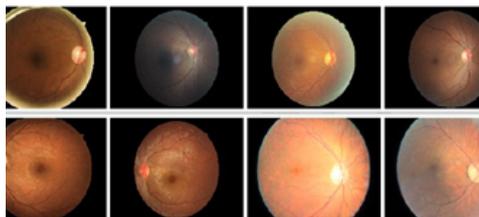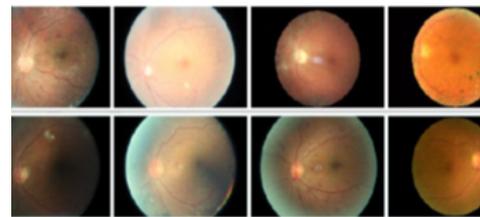

Fig 1. No Retinopathy

Fig 2. Proliferative Retinopathy

PROJECT CHALLENGES

A topical issue in machine learning is the accuracy of the training data and how well this data is labelled or annotated. For example, Figure 1 shows us images with no retinopathy (denoted class 0), whilst Figure 2 depicts examples to the other end of the scale, class 4, proliferative retinopathy.

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It has been demonstrated by Google that even professional graders can disagree to a large extent about diagnosis, grade or severity of retinal deficiency presented within an image. Thus, a pool of graders needs to assess each database to ensure that the data is as accurate as possible. Furthermore, the variance between images of the eyes is extremely high.

HOW?

PROJECT SOLUTION

The initial stage of this research evaluated an in-house dual classification model developed by MDCL to diagnose retinal images, i.e. "No Diabetic Retinopathy" or "Diabetic Retinopathy".

This work then developed and appraised a third classification – "Undetermined", which would be flagged for a subsequent rescreening by professional optical graders. This work has shown that while this three class schema does not help with the precision of the "No Diabetic Retinopathy" category it does help with a separation of the mild to moderate category from the more severe cases.

In this research, a Kaggle dataset was used to evaluate all models investigated. This comprised a large corpus of retinal images representing different cameras, locations and annotated by different graders – hence a noisy dataset. Consequently, a number of data pre-processing steps were applied in terms of standardising the images to a baseline and to optimally highlight key features and attributes. Additionally, another smaller Asia Pacific Tele-Ophthalmology Society (APTOS) dataset was evaluated.

IMPACT FOR THE COMPANY

This research demonstrated a 12% improvement in the detection of severe retinopathy through the utilisation of the developed novel three category schema versus the traditional or standard two classification approach. The severe cases are those that are most concern, so this improvement in capture rate is very important to us.

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WHAT OUR CLIENT HAS TO SAY

CLIENT TESTIMONIAL

"*It was mdcl's privilege to work with Dr Conor Lynch and Rose Bain of the Nimbus Research Center.*

The independent analysis and extended validation and development of our diabetes retinopathy artificial intelligence project by the Nimbus team greatly increased our confidence factor and gave us a much improved understanding on the main technical challenges to commercialisation. Furthermore to the insightful R&D executed by Nimbus, the team assisted in expanding our industry contact network and enhanced our business insight. Technical knowledge, persistence and engaged project participation are highly valued by mdcl and Nimbus consequently have our respect and thanks for the excellent study they completed on our behalf." Sean McMahon MDCL Co-Founder