Title

Deep Learning Techniques for DME Classification on SD-OCT images

Institution : University of Consortium (HWU, UDG, UB), Associated Partner

Universiti Teknologi PETRONAS, Ipoh, Malaysia

Training place

Centre for Intelligent Signal and Imaging Research, possible short stays in Singapore.

Supervisor name

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Brief Description of the project

Eye diseases such as Diabetic Retinopathy (DR) and Diabetic Macular Edema (DME) are the most common causes of irreversible vision loss in individuals with diabetes.
Early detection and treatment of DR and DME play a major role to prevent adverse effects such as blindness.
DME is characterized as an increase in retinal thickness within one disk diameter of the fovea center with or without hard exudates and sometimes associated with cysts. Spectral Domain OCT (SD-OCT)] images the depth of the retina with a high resolution and fast image acquisition is an adequate tool, compared to fundus images for DME identification.
Automated diagnosis on OCT imaging is rather new and up to our knowledge, there are few works which have been published with deep learning architectures for Diabetic Macular Edema detection or segmentation; however very recently deep architectures of various forms have been used for numerous medical applications [9]: computer aided detection , lung disease classification , hemorrhages detection on fundus images, brain segmentation , cerebral microbleeds to cite among the most recent ones. The lack of work on DME detection based on SD-OCT data is mainly explained by the lack of annotated data.
In this project, we will investigate two solutions for automated detection of DME on SD-OCT volumes based on deep learning approaches. These solutions will take into consideration the lack of data available and will concentrate only on the lesions characteristics of DME which do not appear clearly on fundus images such
as cysts or subretinal fluids.

- First Objective: It was recently shown that fine tuning of pre-trained networks such as AlexNet can perform as well as fully trained network [1] on a several sets of medical imaging and we will therefore investigate this aspect through the use of even deeper networks recently published.
- Second Objective : We will implement a selective data sampling as recently suggested by Grinsven et al. [2] and train our own network on her own data-set.

[1] Tajbakhsh, N., Shin, J.Y., Gurudu, S.R., Hurst, R.T., Kendall, C.B., Gotway, M.B., Liang, J.: Convolutional neural networks for medical image analysis: Full training or _ne tuning? IEEE Transactions on Medical Imaging 35(5), 1299{1312 (2016). doi:10.1109/TMI.2016.2535302
[2] van Grinsven, M.J.J.P., van Ginneken, B., Hoyng, C.B., Theelen, T., S_anchez, C.I.: Fast convolutional neural network training using selective data sampling: Application to hemorrhage detection in color fundus images., EEE Transactions on Medical Imaging 35(5), 1273{1284 (2016). doi:10.1109/TMI.2016.2526689

Software/Hardware needs and skills

1. MATLAB software

2. Programming skills

Open