Wrocław, 15.06.2022 r.

Streszczenie w języku angielskim

This dissertation concerns supporting the diagnosis of eye diseases with the use of increasingly rapidly developing artificial intelligence methods. As this field grows rapidly, it has become more and more data-voracious and needs a large amount of data to achieve high and stable results. In the case of medical data, access to large datasets or obtaining them is sometimes not feasible, consequently, methods of working on such limited datasets are needed to support medicine with machine learning algorithms. Therefore, this dissertation focuses on supporting the diagnosis of eye diseases with machine learning algorithms, with the additional consideration that all experiments should be carried out in the so-called low-data regime. Four different machine learning approaches are evaluated in depth, including, image classification using undervalued Scanning Laser Ophthalmoscopy images, image segmentation, feature selection, and a general approach for the low-data regime in image processing. In each approach, different machine learning algorithms were used and different approaches to dealing with a challenging dataset were compared. The obtained results, in terms of developed machine learning algorithms, show that despite the additional difficulties it is possible to work with small datasets in the context of machine learning algorithms. They also show that, with the dataset used, the best approach is to choose simple and shallow deep learning architectures, ensemble learning, and, for image data, to use data augmentation. Additionally, the classification study confirmed that Scanning Laser Ophthalmoscopy images can be successfully used to support glaucoma diagnostics as the accuracy of the classifier can reach over 96 percent. Given the challenging to access large dataset in certain medical application, the findings of the dissertation may inform future studies in the field to help overcome some of the challenges while dealing with low-data regime problems.

Dominika Suriot