INSELGRUPPE

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Advanced AI boosts clinical analysis of eye images

A fast and reliable machine learning tool, developed by the ARTORG Center, University of Bern and the Department of Ophthalmology, Inselspital brings Artificial Intelligence (AI) closer to clinical use in Ophthalmology. The novel method published in Nature Scientific Reports on September 19, 2019 presents a tool that reliably extracts meaning from extensive image data. Based on a convolutional neural network (CNN) the tool is able to provide results within seconds, thus supporting the doctor with comprehensive image analysis during a consultation with the patient.

Modern medical imaging devices allow ophthalmologists to monitor chronic eye conditions in detail. Ophthalmologists mostly choose Optical Coherence Tomography (OCT), an imaging tool that generates 3D images of the eye at extremely high resolution. But without AI support the large amount of images and information exceeds the capacity of an individual expert. The challenge of this study was, to provide AI-tools, capable of analyzing a large amount of data at very high speed to facilitate the use of all available information from image analysis during patient consultations.

The research team from Artificial Intelligence in Medical Imaging (AIMI) laboratory at the ARTORG Center for Biomedical Engineering Research, University of Bern, and the Department of Ophthalmology at Inselspital, Bern University Hospital now presents a machine learning method capable of identifying a wide range of biomarkers from OCT-scans of the retina virtually providing clinically relevant data support instantaneously.

Artificial Intelligence spots biomarkers for each disease type

“In our approach, the AI classifies patient OCT scans on the basis of disease-typical biomarkers”, explains *Prof. Dr. Raphael Sznitman*, group Head of the ARTORG´s AIMI lab. Biomarkers are landmarks and features in OCT scans that can indicate a disease or can be used to show worsening or improvement after treatment. “What sets our results apart is that our AI algorithm provides a rich biomarker characterization, able to classify scans on the basis of well understood and known indications from the clinical community. Here, we manage to identify these biomarkers autonomously, without the cost and effort of having a trained human eye specialist previously mark the structures, the technology needs to focus on.”

3D imaging monitors sight-threatening macular diseases

The most frequent eye diseases worldwide are linked to degenerative eye conditions that deteriorate the macula (part of the rear part of the eye or retina), ultimately leading to loss of sight. *Prof. Dr. med. Sebastian Wolf*, Chairman and Head of the Department of Ophthalmology at Inselspital, Bern University Hospital, as a clinician uses OCT-scans for the therapy of chronic retinal conditions, such as age-related macular degeneration (AMD) or diabetic macular edema (DME). “As patient numbers are growing, we need to develop automated AI tools in the clinical setting to assist doctors in analyzing the abundant data of OCT scans. Having accurate, comprehensive information from the analysis of a patient’s OTC at hand during the consultation, is key to improve management of such diseases in the future. The tool presented in this paper is an important step in achieving the goal of better care for the patient.”

Machine learning makes the abundance of images exploitable

To assist eye doctors in clinical routine and research, computer programs can automatically extract, summarize and present the most important information from the growing number of routinely generated OCT scans. “This automated analysis can provide a cost effective and reliable tool for doctors to avoid having to go through every image manually”, says *Thomas Kurmann PhD student at ARTORG AIMI lab*. “Our results so far are showing, that our Artificial Intelligence can consistently classify the most common disease types automatically with great precision, and identify a wide range of biomarkers typically found in pathological eye scans.”

Publication in Nature:

- **Paper published September 19th**

Experts:

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- Prof. Dr. Raphael Sznitman, Group Head Artificial Intelligence in Medical Imaging and Director ARTORG Center for Biomedical Engineering Research, University of Bern

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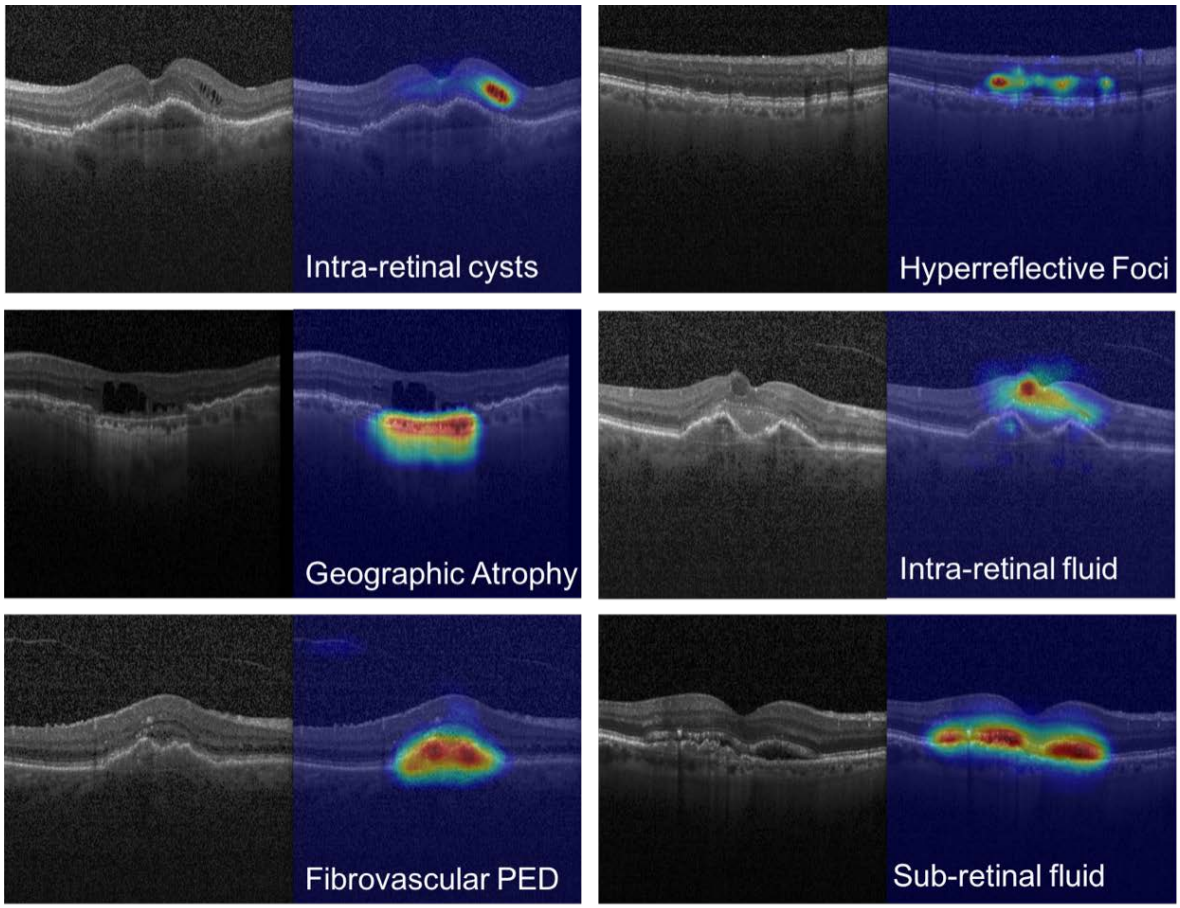

Visualization of attention maps (right hand in color) of various biomarkers on OCT Bscans (empty Bscan on the left). Attention maps or heat maps show the areas of greatest importance for the classification of each biomarker in a BScan.

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