Artificial intelligence in opthamology

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Around six years ago, high-resolution optical coherence tomography (OCT) was jointly developed by MedUni Vienna's Center for Medical Physics and Biomedical Technology and its Department of Ophthalmology. OCT is an imaging technique that, like ultrasound – but contact-free – displays accurate stratified images of the retina. With the aid of algorithms recently developed at the Medical University of

Vienna, it can be used to diagnose retinal diseases at an early stage within only a few seconds, so that the appropriate treatment can be given. Vienna is therefore regarded as a pioneer and also a driver of the digital revolution in ophthalmology, which now stands on the brink of a global breakthrough.

"In a cutting-edge paper, Google has now also taken up the theme that digital algorithms can provide accurate ophthalmic diagnoses fully automatically, in line with our developments and publications over the last few years," explains Ursula Schmidt-Erfurth, Head of the Department of Ophthalmology and Optometrics. Google cited her studies conducted on this topic at MedUni Vienna four times in its *Nature Medicine* article.

The fact that Google, along with other technology companies like IBM, is now also jumping onto the digital bandwagon in ophthalmology is to be regarded as a positive step: "This helps to move on our concept of artificial intelligence in ophthalmology and to establish it as a business model throughout the world. It will very soon be possible for every ophthalmologist anywhere in the world to access our technology – which will benefit patients and help doctors."

The pioneering role and leading position of the Vienna researchers were simultaneously recognised by a comprehensive review of the status of AI in the study and treatment of retinal diseases in the leading journal *Progress in Retinal and Eye Research*, to which the MedUni Vienna scientists were invited to contribute.

60 million pixels in 1.2 seconds

The OCT data are analysed using automated algorithms generated on the basis of artificial intelligence (AI). Both the equipment and the AI method were developed by the Medical University of Vienna, notably at

the Center for Medical Physics and Biomedical Engineering and in the OPTIMA Christian Doppler laboratory, under the supervision of Schmidt-Erfurth. In 2017, Christoph Hitzenberger und Adolf Fercher from the Center for Medical Physics and Biomedical Engineering were awarded the Dolores H. Russ Prize, the "Nobel Prize for Engineering Sciences," for the early development of OCT as a technique. This method captures 60 million pixels within 1.2 seconds and simultaneously analyses them. Says Schmidt-Erfurth: "The treating doctor can make use of this plethora of diagnostic data – and we are making this possible."

If a disease is discovered or predicted, then the treating doctor is also able to initiate the correct therapeutic steps required for the patient, very much in the spirit of precision medicine or personalised medicine. "This will benefit each of the 170 million or so people suffering from macular degeneration," says Schmidt-Erfurth. What is required is accurate analysis via digital medicine followed by individual treatment prescribed by the doctor for the individual patient at the right time.

Vision of the future: Automatic eye scanners

The first step is for all ophthalmologists and opticians to have access to digital opthalmic diagnostic techniques. The next step – and this is where Schmidt-Erfurth outlines a vision of the future, which the experts estimate might be realised in around three years time – is eye examination booths similar to the passport photograph booths found everywhere in the urban landscape. "This would allow everyone to scan their eyes anytime, anywhere and – if the result indicated a potential disease, go immediately to the appropriate doctor."

More information: Ursula Schmidt-Erfurth et al. Artificial intelligence in retina, *Progress in Retinal and Eye Research* (2018). DOI: 10.1016/j.preteyeres.2018.07.004

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