

Artificial Intelligence: Applications for Pathologies of the Anterior Segment of the Eye

Synopsis: The use of artificial intelligence (AI) provides a better understanding of data collected through biometric and imaging techniques. It can increase the accuracy or the effectiveness of solutions intended to correct certain optical defects of the eye caused by structural alterations responsible for a reduction in the transparency of the ocular media and/or refractive errors. This work has been mainly applied to the study of corneal topography and imaging, description of the ocular wavefront, ocular biometry and improving the accuracy of the power calculation of intraocular lenses.

We used AI techniques to carry out studies to characterise the alterations observed during the evolution of keratoconus, as well as the spatial distribution of corneal oedema through the use of neural networks to tomographic image analysis.

Using artificial intelligence and the results from the description of the ocular wavefront on a new basis, we were able to estimate the real impact of high degree aberrations on subjective refraction.

From a thick lens paraxial eye model, we established an analytical formula to calculate the position of the principal planes of an implant based on its geometry and the main biometric constants. This work made it possible to train an algorithm to predict the effective position of an implant, taking into account its geometry and establishing an original biometric calculation formula combining principles of paraxial optics and artificial intelligence algorithms applied to an eye model made up of thick lenses.