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Measuring Dynamical Human Cornea by Sparsely Sampled Surface Normal Vectors.

ABSTRACT - Masterthesis

Human being eye is always moving even though it is gazing on a fixed target named as fixation motion of human eye. To get stable biometry measurements an instrument is always operated in two sequential phases: alignment and measurement. Generally speaking alignment, especially precision fine alignment, is expected to be able to ensure a relatively stable measuring condition against active eye movement. Because of the fixation motion phenomenon, such an expectation could only be approximately satisfied resulting in measurement instability among measurements at separated temporal moments. Furthermore, other eye/cornea dynamics, such as tear film process, eye blinking, etc. also introduce some uncertainties to cornea measurements affecting their repeatability/stability.

Thus a conceptual reviewing task is proposed here to study on a clinic data set, which is with more than 100 eyes from various locations/time, and is generally based on clinically acceptable eye-machine alignment condition, to detect the eye dynamics including fixation eye motion, global tear film process, local tear film process, so on and so forth. This thesis mainly focuses on the fixational eye movement rather than other eye dynamics as this is an involuntary action of the eye. The study of fixational eye movement is done by a simulation concept called Direct Normal Sampler (DNS) simulator in a broader sense. The DNS uses special illuminating and measurement systems while doing the eye measurements which make the concept being unique with other market available techniques. This paper also focuses on how to compensate such dynamics from the measurement data resulting in higher repeatability without any loss of measured information.