Cellphone based Optometry using Hybrid Images

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Measurement of refractive error of the eye requires expensive equipment which are generally not portable. My goal is to greatly simplify the process, reduce its cost and use no external hardware except a mobile device. This is done by using Hybrid Images, exploiting that the eye lens behaves like an optical low-pass filter. A Hybrid Image is a combination of low spacial frequencies of one image and high spacial frequencies of another. This creates an image that is perceived in one of two ways, as a function of the viewer's distance or refractive error. My method requires a mobile device showing a series of hybrid images, to be held at a distance with the user giving simple inputs to the mobile device. This allows us to search for the standard deviation of the Gaussian point spread function, thereby calculating the myopic prescription. I also extend this to non-trivial point spread functions and estimate the Zernike coefficients, thereby calculating the wavefront and assigning prescription. In this project I discuss the approach and verify its accuracy.

Awards Won:

Third Award of $1,000

Google: Award of $2,000 for best overall project in ocean science and exploration.