Real-Time Refractive Visual Aberration Correction Display Using Dynamic Point Spread Function-Based Deconvolution

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The use of contact lenses or glasses as vision correction for optical defocus is unwieldy in many scenarios, such as virtual reality or viewing digital displays in vehicles. These inconveniences are solved for refractive visual aberrations by means of so-called computational “on-screen glasses” which make displays appear clear to those suffering from myopia, hyperopia, and higher-order aberrations (through a generalized method) without the need to wear glasses. We present the framework for creating a live vision correcting display (VCD) by employing the existing method of deconvolving the on-screen image with a point spread function (PSF) associated with the eye. We present unique contributions in terms of a) reduction of ringing artifacts through masking the pre-filtered image, b) increase of contrast and reduction of colour distortion by changing the image colour space to YUV/YCbCr (operation solely on luma channel), and c) calculating a real-time PSF by which to deconvolve the screen given spherical coordinates with respect to the image, based on distance from the screen and angular deviation; this is necessary so that the PSF does not appear distorted from non-normal angles of view relative to the screen.