Shack Hartmann wavefront sensor is a two dimensional array of lenslets which is used to detect the incoming phase distorted wavefront through local tilt measurements made by recording the spot pattern near the focal plane. Wavefront reconstruction is performed in two stages - (a) image centroiding to calculate local slopes, (b) formation of the wavefront shape from local slope measurement. Centroiding accuracy contributes to most of the wavefront reconstruction error in Shack Hartmann sensor based adaptive optics system with readout and background noise. It becomes even more difficult in atmospheric adaptive optics case, where scintillation effects may also occur. In this paper we used a denoising technique based on thresholded Zernike reconstructor to minimize the effects due to readout and background noise. At low signal to noise ratio, this denoising technique can be improved further by taking the advantage of the shape of the spot. Assuming a Gaussian pattern for individual spots, it is
shown that the centroiding accuracy can be improved in the presence of strong scintillations and background.

Reference

Centroid Detection by Gaussian Pattern Matching in Adaptive Optics

arXiv:0909.0711v1

Index Terms

Computer Science    Computer Vision

Key words

Adaptive Optics
Shack Hartmann Sensor
Wavefront Reconstruction
Centroiding