

Disparity statistics in the natural environment

Lawrence K. Cormack, Yang Liu¹, Alan C. Bovik¹

University of Texas at Austin

Stereopsis is undoubtedly useful for precise near work, but its role at viewing distances beyond a few meters is less clear. We sought to determine the statistics of naturally occurring binocular disparities in outdoor environments to find out if they could potentially play a role in vision under these circumstances. A data base of range images obtained with a scanning laser rangefinder from a wooded environment was used (Yang & Purves, 2003). Ranges along the horizontal meridian were converted to angular disparities by assuming a 6.5 cm interpupillary distance and either by 1) sampling from a histogram of fixation distances obtained from human observers in a similar wooded environment or 2) assuming that fixations are on objects and are distributed uniformly across horizontal angle in environmental coordinates. Disparities were also computed in the same manner from a simple model forest. All results indicate that the distribution of naturally occurring disparities is bell-shaped, centered roughly on zero, and spans several degrees. Suprathreshold disparities abound. Further, the distribution of naturally occurring disparities closely matches the distribution of peak disparity tuning found in area MT of macaques (DeAngelis & Uka, 2003). We thus find it likely that primate visual systems have evolved to exploit what seems to be a rich array of naturally occurring disparities in natural environments.