

EE 381K-14 MULTIDIMENSIONAL DIGITAL SIGNAL PROCESSING

Probability Models for Visual Search

Humans have a remarkable visual system one particularly intriguing feature of, which is the *active* nature of scanning the scene. Humans scan the world with the high-resolution fovea allowing the low-resolution peripheral information to guide the visual search process. The goal of my project is to understand the role of eye movement patterns in visual search tasks. Research ¹ shows the limitations imposed by low-level factors in visual search. Klarquist and Bovik ² have developed probabilistic models for visual search.

The *active* nature of scanning the visual space is accomplished by a series of *fixations* and *saccades* ³ called *scanpaths*. Information about the scene is gathered during the fixations. The term *saccade* is used to describe the process where the eye jumps to a new fixation point. No information is gathered during saccades. For my project, I propose to analyze these scan paths to develop a probabilistic model for visual search in humans. Development of such a model involves analyzing the nature of images (edges, contrast) around fixation points and trying to understand why the human eye fixated at those points. Eye tracking using remote eye trackers and eye tracking using a virtual reality helmet to confine the field of view of the subject is proposed as an integral part of the development of a model for visual search.

Development of such a probabilistic model for visual search finds practical applications in foveated video compression schemes. Most foveated video compression schemes assume that the fixation points are known apriori. An automatic fixation point selection algorithm can be developed from the probabilistic model.

¹ Geisler, W.S. and Chou, K. "Separation of low-level and high-level factors in complex tasks: visual search." Psychological Review. 1-2, 356-378, 1995

² Klarquist, W. N. and Bovik, A.C. "Adaptive variable baseline stereo for vergence control," IEEE International conference on Robotics and Automation," Albuquerque, New Mexico, April 1997

³ Yarbus. A.L, "Eye movements and Vision." Plenum Press 1967