Santhanakrishnan Ramani

SID: 105720585

**Assignment 2**

**Commentary on the Weiss, Simoncelli, & Adelson (2002) article**

The main idea of the paper is to present a system that mimics the mistakes of human motion perception and determine the conditions and parameters responsible for it, which could help in solving problems when uncertainty exists. From the past, they have found out coherent pattern motion that human perceives can be estimated using Intersection of Constraints (IOC), Vector Average (VA) or Feature Tracking (FT). The author states that human perception depending on the stimulus (influenced by relative grating orientation & speed, contrast, presentation time, and retinal location) can be consistent with IOC or FT, or closer to the VA. To find the conditions in which the human perception favors IOC or VA an optimal Bayesian estimator (‘ideal observer’) was modelled to predict using the principle of intensity conservation by assuming that the local image measurements are noisy and image velocities tend to be slow. The noise was modelled using Gaussian noise and known standard deviation, which provided a functional form for local likelihood and was dependent on the contrast of the image. The second assumption of image velocities was modelled using prior probability distribution which is also Gaussian centered at the origin. The perception of the ideal observer is given by the posterior probability which is a product of likelihood and prior using Bayes rule and is also Gaussian. The velocity estimate of the ideal observer is given by the mean or maximum of the posterior distribution. The results obtained using this model where a near fit to human perception data collected previously.

Results of the above model provided the following conclusions,

* The perceived grating speed, grating direction, line direction is mainly affected by the contrast.

Which gives us a clue stating contrast plays an important role in human perception.

Then two plaids with different characteristic were presented, for type I the direction of veridical velocity lies in between the two normal velocities, whereas for type II the veridical velocity lies outside the two normal.

* The perceived direction of type II plaid depended on the presentation time, the angle between the concepts and relative speed of the components.
* And in all the three cases there was a shift from VA to IOC when the parameter values increased.

The above results suggest that when veridical velocity lies outside the two normal, the chance of optical illusion or bias under specific conditions is more.

One thing this model wasn’t able to fit was the quasilinear dependence of perceived grating speed on contrast, and minimal dependence on total contrast. This could be an area where we could ponder upon.

As the model hasn’t taken into consideration the motions like rotation and expansions, or scenes containing multiple motions, we can’t be sure what sort of effect these can have on human perception, and how the above results could change based on these.

And as the author pointed out a different model for prior and likelihood can be used and the result of it could be compared to the other ones to find which model better fits the natural (human) system.

It is clear from the paper that coherence leads to the problems in human perception of pattern motion. By studying the conditions under which coherence does and does not occur we may learn something about the mechanisms that underly the perception of pattern motion.