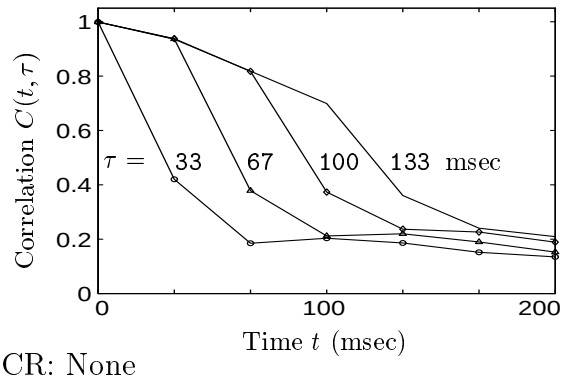
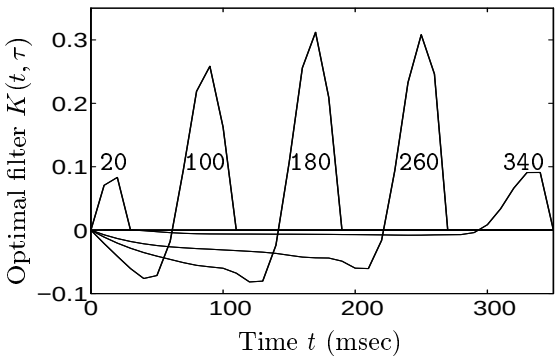
EFFECTS OF EYE MOVEMENTS ON INFORMATION PROCESSING: VISUAL INPUT STATISTICS DURING FREE-VIEWING NATURAL TIME-VARYING IMAGES Dawei W. Dong. Center for Complex Systems and Brain Sciences, Florida Atlantic University, Boca Raton, Florida.

Purpose. We want to measure the effects of eye movements on visual processing and to predict optimal coding from the measurement. **Methods**. We record gaze positions during free-viewing a video of natural activities. The recorded eye positions are used to derive the gaze-centered time-varying images from the original video. The statistical properties of the resulting images, in particular, the temporal correlations are analyzed systematically and are used to predict the optimal filter. **Results**. The measured temporal correlation $C(t, \tau)$ is a function of the time seperation t between two signals and of the relative timing τ to the most recent saccade. During fixations and smooth pursuits, there are significant and long lasting temporal correlations, i.e., the visual input is temporally redundant — even after removing spatial correlations. But macro saccades effectively remove the temporal correlation between two signals before and after a saccade (the left figure). The efficiency of coding can be further improved by removing the correlations during fixations and smooth pursuits. The predicted optimal temporal filter $K(t, \tau)$ in the time interval between two saccades is shown in the right figure, in which τ — the time since the first saccade is marked. **Conclusions**. The eye movements during natural image viewing help to improve the efficiency of visual representation through temporal decorrelation of the input signal.





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