DYNAMIC TEMPORAL DECORRELATION: INFORMATION THEORETIC AND BIOPHYSICAL MODEL OF THE FUNCTIONAL ROLE OF LATERAL GENICULATE NUCLEUS (LGN) Wilson Truccolo-Filho and Dawei W. Dong. Center for Complex Systems and Brain Sciences, Florida Atlantic University, Boca Raton, FL.

Purpose. Under natural viewing condition, the visual signal sent to the LGN is temporally redundant or inefficient. It has been proposed (Dong and Atick 1994) that LGN is concerned with improving efficiency of visual representation through temporal decorrelation. The present study investigates if well-known LGN ion channel properties (McCormick and Huguenard 1992), especially, the T-type Ca^{2+} current, can facilitate such information-theoretic optimal coding; and if so, whether the degree of temporal decorrelation can be adapted dynamically to ensure such optimization at longer time scales. **Methods**. The model LGN neuron is simulated with input stimuli from real-world time-varying light intensities. The model incorporated the quantitative kinetics of the Ca^{2+} channel and the Hodgkin-Huxley K^+ and Na^+ channels of active membrane currents. The channel parameters are similar to Mukherjee and Kaplan (1995). The leakage resting membrane potential V_r is the only variable, controllable through a simple measure of cross-correlation of the cell's output, to achieve dynamic temporal decorrelation. Natural light intensity time series of different degree of temporal correlation are used to probe the model cell responses. **Results**. Hyperpolarization of V_r activates the Ca^{2+} channel with a time constant $\sim$ 100ms which generates bursting spikes in addition to tonic spikes resulting in overall temporal differentiation on the Ca^{2+} channel time scale. For all tested natural stimuli, significant temporal decorrelation for time delays above 50ms is achievable through variable temporal filtering of the model by simply selecting a V_r between slight-depolarization to hyper-polarization for each stimulus; in the former case, relaying uncorrelated input, and in the later case, decorrelating highly correlated signals. The necessary V_r for decorrelation has a monotonic relationship to the cross-correlation at the Ca^{2+} channel time scale, which enables a plausible feedback control on a longer time scale when input statistics change. **Conclusions**. Biophysical properties of LGN cells support the role of temporal decorrelation which improves efficiency of information processing.

CR: None