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Adaption of the Brain to Contrast and Patterns of the Visual Scenes

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Thursday, May 22, 2025
11:10 am - 12:00 Noon
Building 53, Room 215
Pizza will be served!

Abstract: Neurons in the primary visual cortex adapt their responses to the statistical properties of visual patterns, including their contrast and probability of appearance within an environment. These adaptations are to maximize efficient coding. In other words, the brain tends to minimize energy consumption while keeping information processing high enough. In this talk, I will give a brief background on the topic, then present some of our recent results. We show that across adaptation states, the distribution of responses in a neural population is well-described by a zero-inflated, log-normal distribution: a mass at zero, and a log-normal distribution for the non-zero component. We find that adaptations, regardless of their function, involve variations of only a single free parameter. We demonstrate how this unique property arises in a linear-nonlinear spiking model with Gaussian inputs, where the only change due to adaptation is a shift in the mean membrane potential. The results suggest that the adaptation processes to contrast and patterns of visual scenes, which are thought to be distinct processes, have the same underlying mechanism: a universal control knob that is tuned by the brain to adapt to different environmental conditions.

Bio: I received my Bachelor's, Master's, and PhD degrees in Physics at the Shiraz University in Shiraz, Fars, Iran. I was always fascinated by the beauty of the universe, gravity, and the general theory of relativity. My dream was to become a physicist and study the universe. However, after meeting with my PhD advisor, he pointed me in a new direction, another mysterious and, in my opinion, more interesting field: neuroscience. That was a pivotal moment in my life. Since then, I have traveled around the world, lived in amazing places, and worked with amazing people to learn about the brain and how it works. Besides science, I like mountains, hiking, camping, cooking, and road trips.