

DECODING RETINAL GANGLION CELL ACTIVITY FROM STARLIGHT TO SUNLIGHT

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2:30-3:30 p.m. | Zoom

Kiersten Ruda is originally from St. Paul, Minnesota where she studied physics at St. Olaf and graduated in 2013. Then she investigated the long-term viability of brain-machine interfaces at the Food and Drug administration. Kiersten attended graduate school at Duke University and again studied the retina in the lab of Dr. Greg Field. Her doctoral work was supported by a Ruth L. Kirschstein National Research Service Award and published in an article titled "Ignoring correlated activity causes a failure of retinal population codes." After finishing her PhD in December 2020, she began her current position as a postdoctoral fellow at Harvard University and Beth Israel Deaconess Medical Center in Boston. Outside of the lab, Kiersten can be found in the mountains of New Hampshire or in the dance studio.



Vision begins in the retina, which detects photons in the environment and conveys these signals about the visual scene to the brain. Retinal ganglion cells in the optic nerve relay this message to the brain with electrical signals called action potentials or spikes. A key challenge in vision is that the brain must decode the spiking activity of ~1 million retinal ganglion cells to predict what visual scene caused that retinal spiking. Accurate decoding is required for animals to correctly sense their visual environment and take appropriate actions in response. A further challenge in vision is that between cloudy nights and sunny days, the mean number of photons in the environment changes by a trillion-fold. The retina must combat this broad range of light intensities to successfully transmit visual information to the brain. Interestingly, the nature of both signal and noise in retinal ganglion cell spiking is altered across this range of light levels, creating a rich problem of how visual messages are encoded by the retina and read out by the brain. I addressed this question by recording retinal responses to visual stimuli that ranged from nighttime to daytime light intensities. I performed these recordings with large-scale multielectrode arrays, which have 500 electrodes to record the spiking activity of hundreds of retinal ganglion cells simultaneously. I next used statistical modeling to describe the retinal responses and decode the visual stimuli, asking how changes in light conditions, like those from night to day, affect decoding performance. My results clarify what aspects of retinal ganglion cell spiking are crucial for the brain to read out visual information from starlight to sunlight. This work also has implications for building brain-machine interfaces, such as prosthetic retinas, that enable the brain to correctly interpret the signals it receives from the prosthetic across different light conditions

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