# Modulation and propagation of information in visual pathway

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## Summary:

How neuronal variability impacts neural codes is a central question in systems neuroscience, often with complex and model dependent answers [1]. Most population models are parametric [2, 3], with tacitly assumed structure of neuronal tuning and population variability. While these models provide key insights, they cannot inform how the physiology and circuit wiring of cortical networks impact information flow. Attentional modulation is an often used tool to probe the neural correlates of cortical processing, since attention is well known to improve cognitive performance in discrimination tasks, as well as attenuate population-wide response variability [4, 5]. Attention offers key constraints that have allowed our group to propose and analyze a circuit-based cortical model which recapitulates the attentional modulation of both trial averaged and trial variable response [6]. In this study, we use this model to investigate how the feedforward and recurrent structure of cortical circuits, and their attentional modulation, shape information flow within the visual system. When the stimulus has trial-to-trial fluctuations that are external to the network, the Fisher information grows sub-linearly with the number of neurons, showing signs of saturation, consistent with past models [7, 8]. We show that a network with narrow feedforward and recurrent projections can transmit almost all of the Fisher information across layers. Moreover, the attentional manipulation in our model increases transmitted Fisher information from a finite network while decreasing pairwise correlations to an extent comparable to that observed in experiments.

## References

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