we consider a model for efficient coding in a single neuron that includes the primary attributes relevant to the imaging problems: (1) non-Gaussian input statistics, (2) input noise, (3) linear noise processing, (4) output noise, and (5) metabolic cost associated with spiking. What nonlinear function best fits this model to account for the observed spiking? To make the problem tractable, we make some assumptions about the smoothness of the nonlinearity and the output distribution. We then derive an analytic form for the optimal nonlinear transfer function, and apply this theory to data by testing the optimality of the retinal ganglion cell (RGC) response. The model yields good fits to RGC mass responses, as well as their variability. The resulting parameters suggest that differences between ON and OFF cell nonlinearities (Laughlin and Falck, 1981) are due to differences in both the preprocessing of their input, and the metabolic costs of their responses.

**effect of noise and input distribution on the optimal nonlinearity**

**analytic results for the optimal nonlinearity**

**quantitative model comparison**

**summary**

**related theoretical work**

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**model noisy nonlinear neuron**

**computing mutual information**

**population analysis**

**white noise stimulus**

**data in vitro RGC responses (Laughlin and Falck, 1981)**

**quantitative model comparison**

**output noise:**

5. metabolic cost:

then, if input and output noise are additive Gaussian (and small for the purpose of [274659x22627] good fits to RGC mean responses, as well as their variability. the resulting parameters suggest that differences between ON and OFF cell nonlinearities (Laughlin and Falck, 1981) are due to differences in both the preprocessing of their input, and the metabolic costs of their responses.

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