# Neural Networks for Demixing

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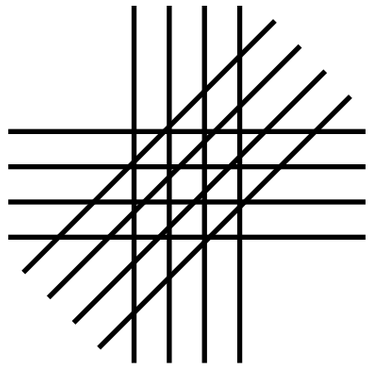
# Demixing Odors/ Orientations



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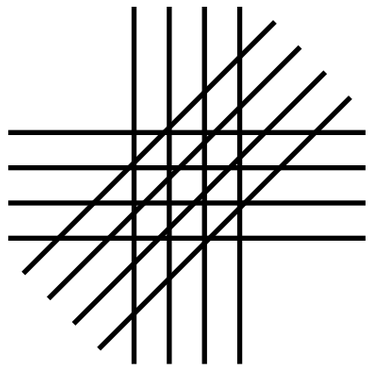

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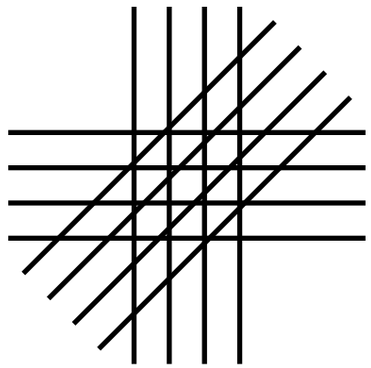


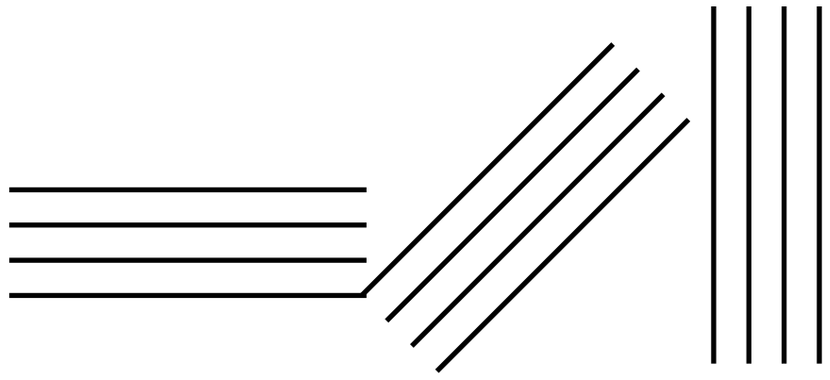
Strawberries Cake Coffee

# Demixing Odors/ Orientations

Strawberries

Cake

Coffee



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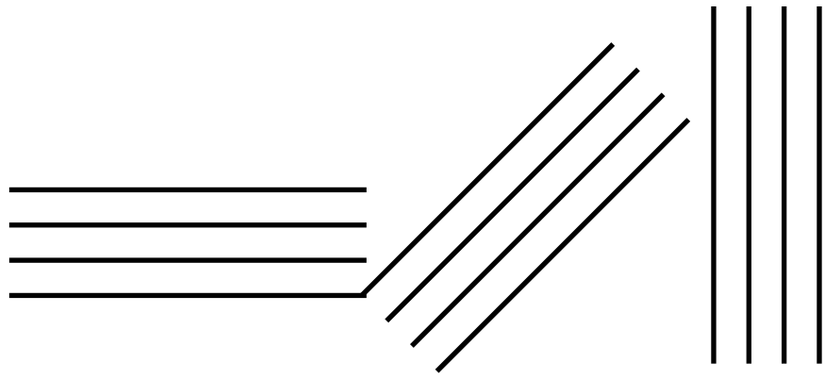
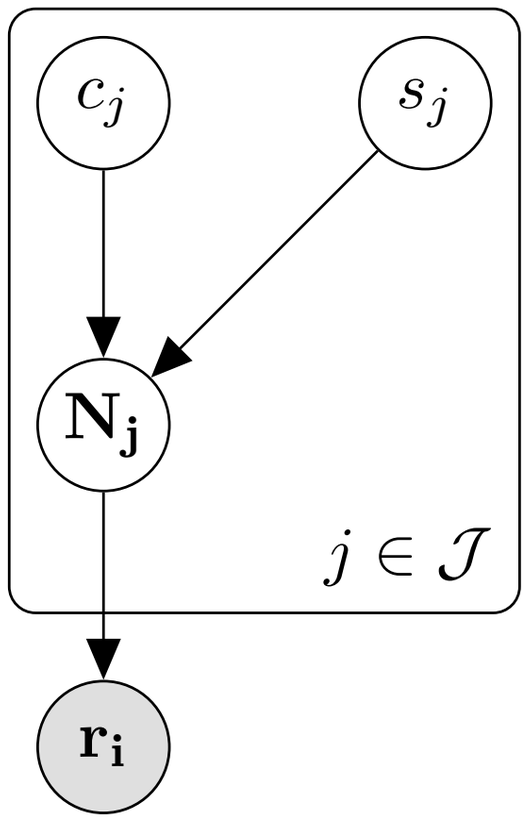


0 45 90

# Graphical Model




$s_j$ is stimulus j
$c_j$ is contrast of grating j
$r_i$ is response of neuron i
$N_{ij}$ is the response of neuron i to grating j

# Inference

Lots of evidence for multiplexing neurons in the brain (cite evidence…)

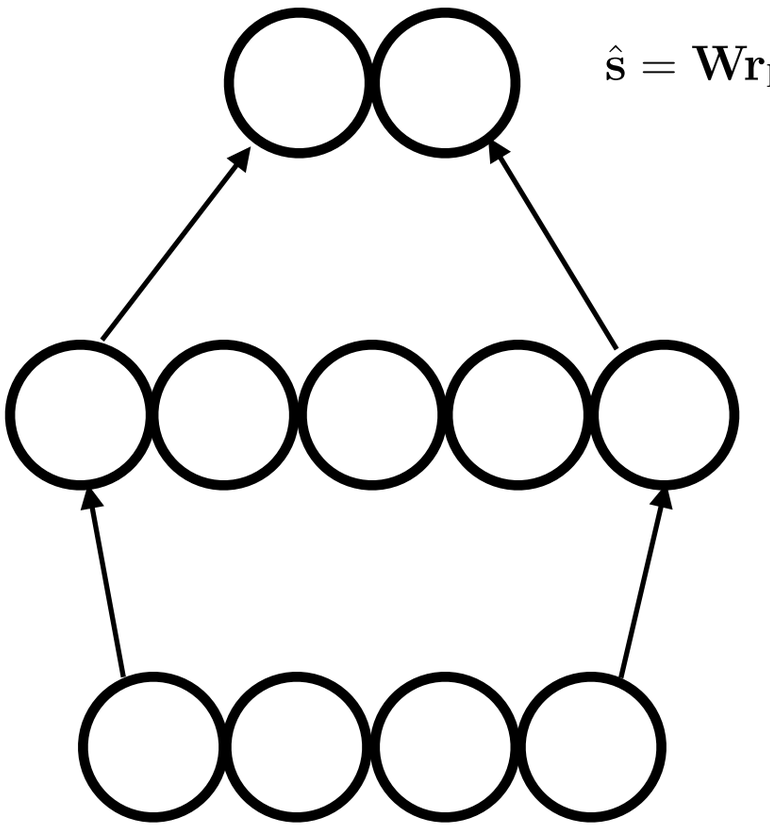
Demixing is a very general problem for the brain

But optimal Bayesian inference is intractable

Inference in neural networks is easy

How close is neural network performance to optimal?

# Neural Network Structure and Training



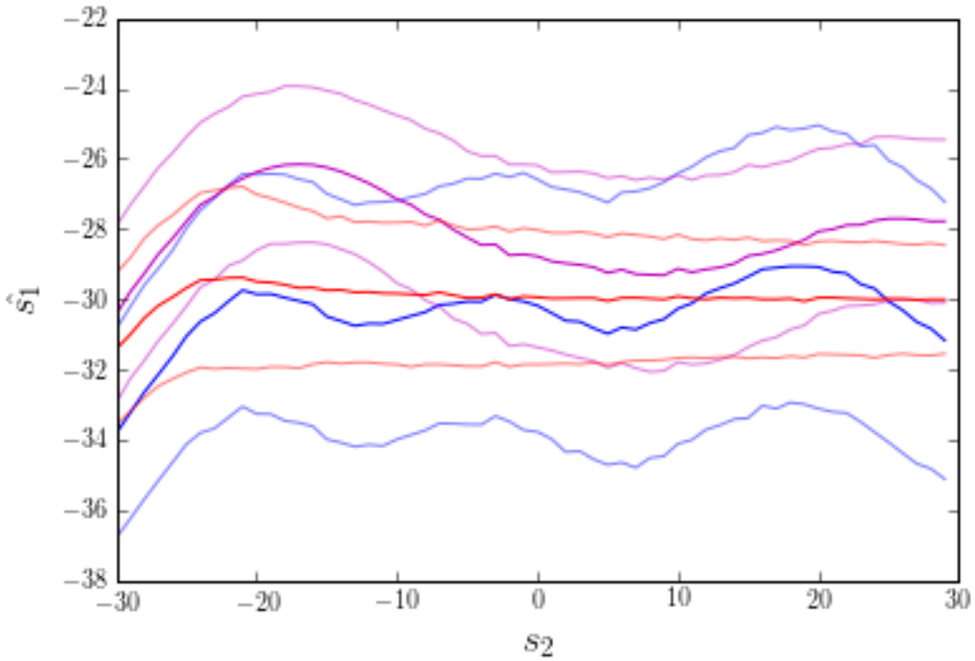
$$\hat{\mathbf{s}} = \mathbf{W}\mathbf{r}_{\text{hid}}$$

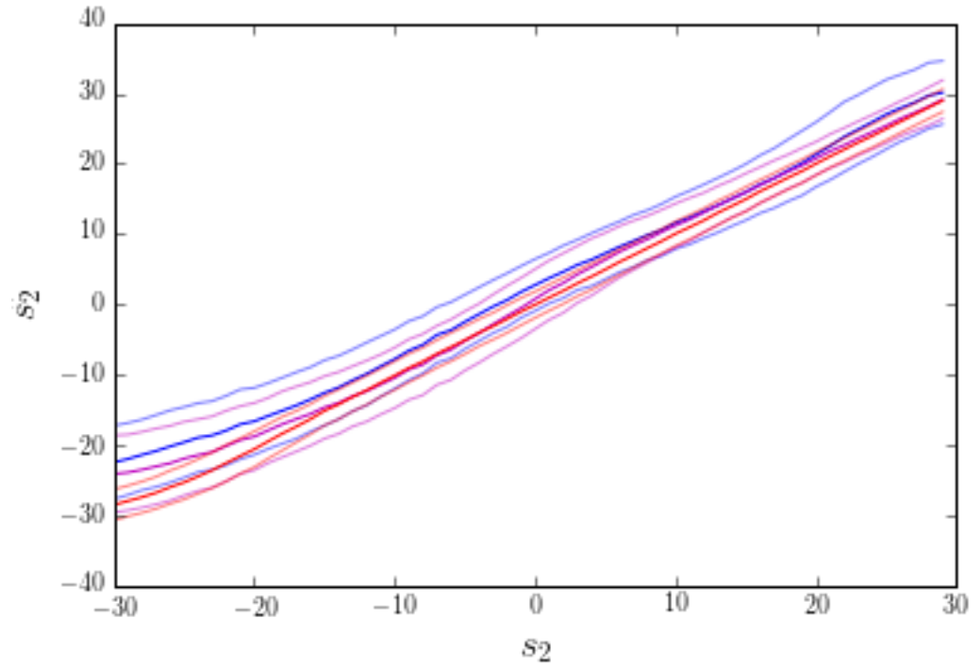
$$\mathbf{r}_{\text{hid}} = \phi(\mathbf{W}\mathbf{r}_{\text{hid}} + \mathbf{b})$$
$$\phi(h) = \max(0, h)$$

$$\mathbf{r}_{\text{in}} \sim \text{Poisson}(\mathbf{f}(c_1 s_1 + c_2 s_2))$$

20,000 training trials
100 epochs
50 hidden units
61 input units

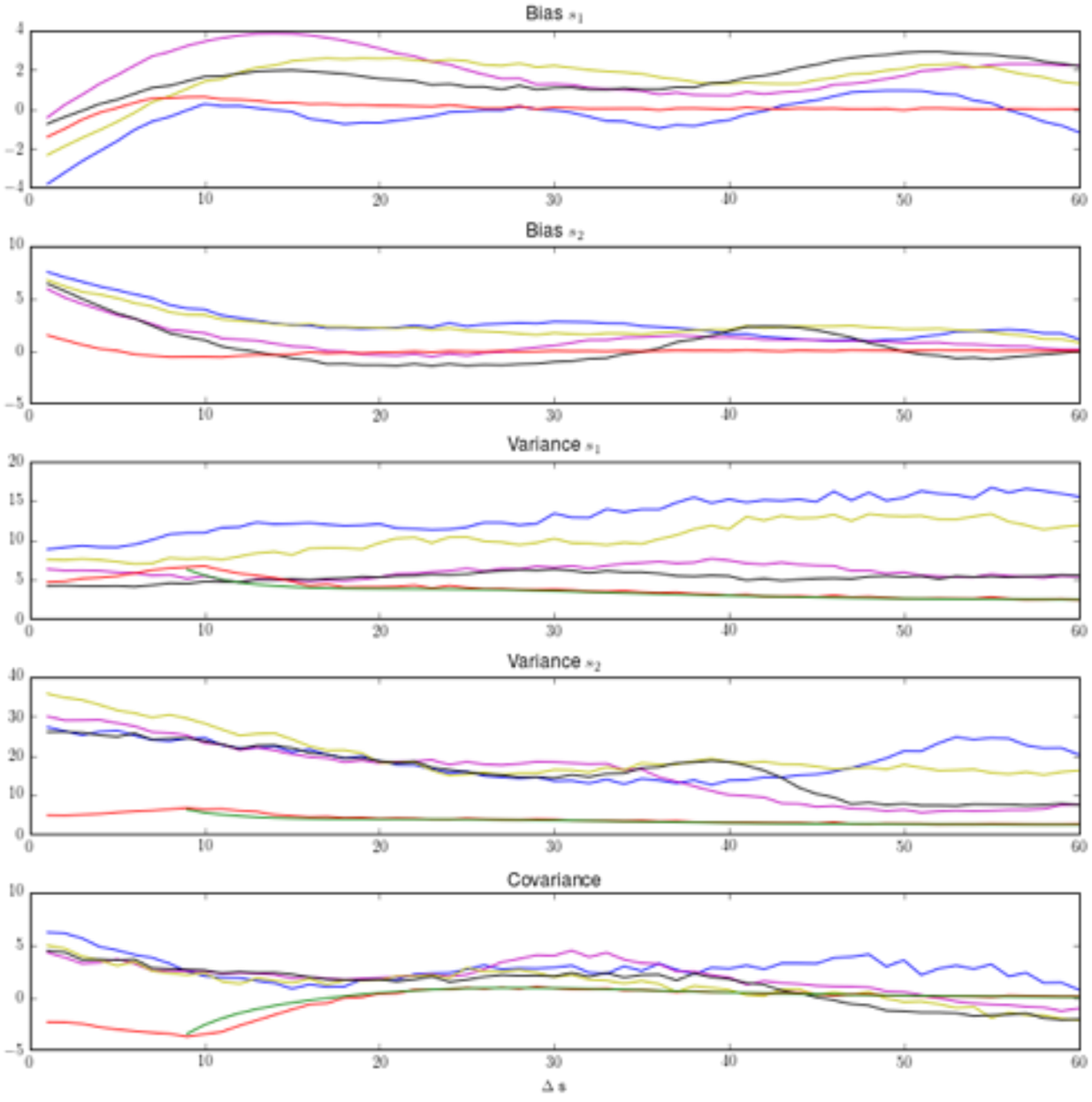
# Performance Plots

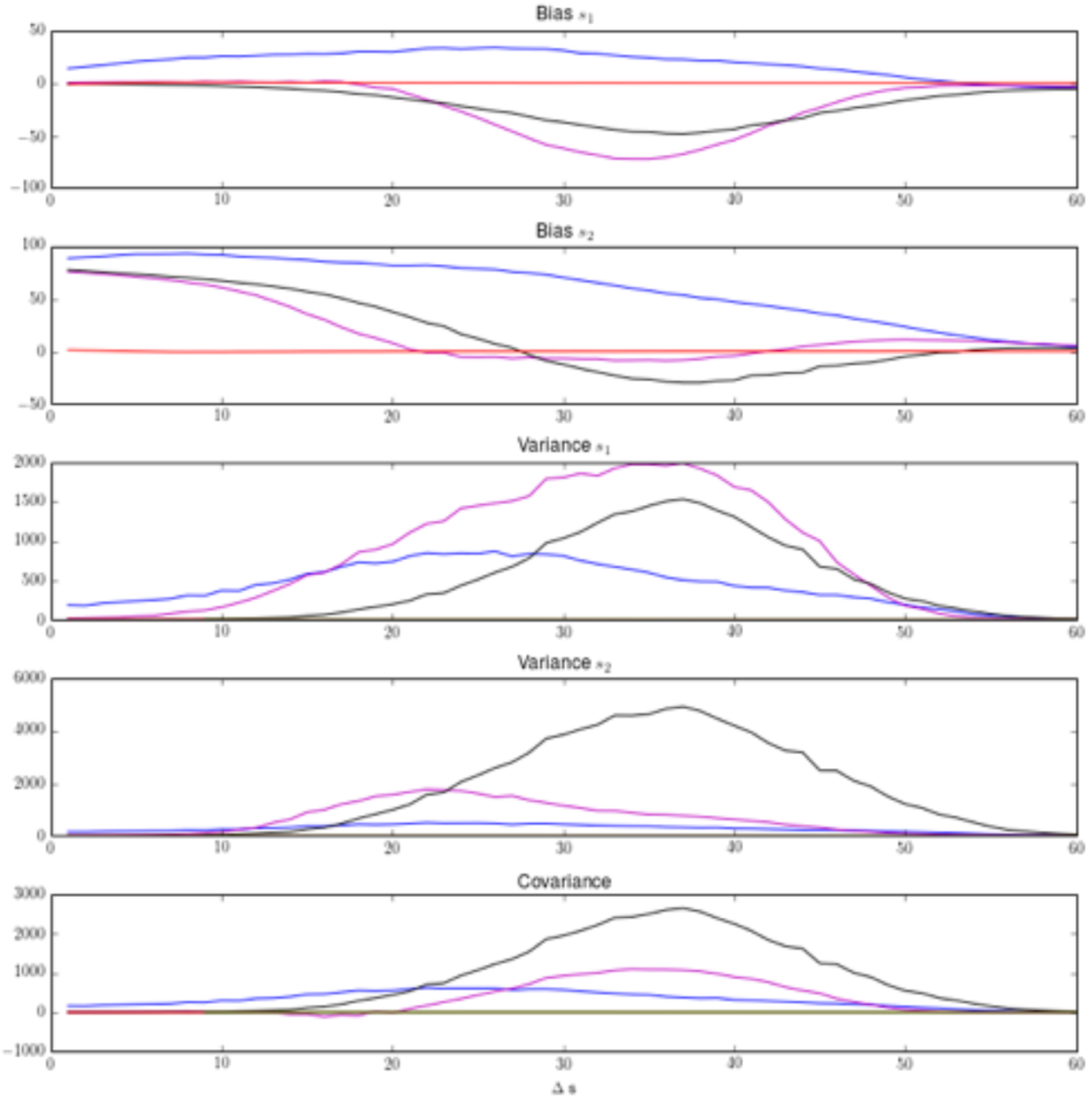



These are all placeholders!

# Performance Plots



# Conclusions