

Project 16: Hebbian plasticity as principal component analysis

- 1) Implement the learning rule described in Oja (1982) and illustrate how it extracts the first principal component for synaptic inputs sampled from a 2D Gaussian with an anisotropic covariance matrix.
- 2) What does the “forgetting” term imply about the relationship between postsynaptic activity and synaptic plasticity? Use this to explain why blocking activity reduces synaptic strength (Turrigiano et al., 1998). Show a simulation of this phenomenon.
- 3) Turrigiano observed that the data were consistent with multiplicative scaling of synaptic strength. Is Oja’s rule consistent with this? Show a simulation and compare it to the data.

References:

Oja, E. (1982). Simplified neuron model as a principal component analyzer. *Journal of Mathematical Biology*, 15, 267-273.

Turrigiano, G. G., Leslie, K. R., Desai, N. S., Rutherford, L. C., & Nelson, S. B. (1998). Activity-dependent scaling of quantal amplitude in neocortical neurons. *Nature*, 391, 892-896.