

636 Midterm Review

- **When and Where:** See course web page. If everyone arrives early, we can begin early.
- **Material:** Haykin chapters 1 through 4 (with focus on the material discussed in the lecture only).
- **Things to bring:**
 - 1 sheet of hand-written notes on US letter paper (you may fill both sides).
 - Scientific calculator (may not be necessary). You may use your phone's calculator.

Chapter 1: Introduction

- Benefits of neural networks
- Neural networks and brain organization
- Model neurons
- Neural network definition
- Similarity measures

Chapter 2: Learning

- Learning in general
- Five learning rules: err correction, Hebbian, memory-based, competitive, and Boltzman
- Learning paradigms: credit assignment problem, supervised and unsupervised learning.
- Memory: associative memory, correl. matrix memory, autoassociation
- Statistical nature of learning: bias/variance dilemma, VC dimension, PAC learning.

Chapter 3: Perceptrons and Linear Adaptive Filters

- Steepest descent
- Gauss-Newton method and linear least square fit (pseudoinverse)
- Perceptron: geometric interpretations (two ways)
- Perceptron: the role of the bias
- Linear separability and limitations of perceptron
- Perceptron learning rule
- Perceptron convergence theorem: geometric insight

Chapter 4: Multilayer Perceptrons

- Hidden unit representation, combination hidden units
- Error gradient and backpropagation
- Momentum
- Batch vs. sequential mode
- Representational power
- Training recurrent networks with backprop
- Function approximation with backprop
- Generalization and overfitting
- Curse of dimensionality
- Virtues and limitations of backprop

Chapter 4: Multilayer Perceptrons (supplemental)

- Heuristics for better backprop
- Weight normalization
- Backprop as optimization
- Conjugate direction method
- Conjugate gradient method