

# EE 774/874 Fall 2009 Exam 1 study guide

## ***Background math***

Be prepared to do the following:

- Show the validity of simple matrix calculus equalities discussed in class (see section A.3.4);
- Apply the chain rule in vector calculus equations.

## ***Chapter 2***

For the material in Chapter 2 you should be able to do the following:

- Reproduce and discuss Figure 2.1, equations (2.1)-(2.6);
- Derive and discuss equations (2.13), (2.15);
- Reproduce and discuss Figure 2.14;
- Derive and discuss the Wiener-Hopf solution, equation (2.27);
- Derive and discuss the LMS algorithm, equation (2.29);
- Discuss linear separability, nonlinearly transformed inputs;
- Sketch, and discuss (including equations governing the outputs) of the adaptive linear combiner, the Adaline, the Madaline;
- Discuss the  $\mu$ -LMS and  $\alpha$ -LMS algorithms;
- Derive and discuss equations (2.67)-(2.70) for the simple perceptron;
- Derive and discuss equation (2.82) for the generalized LMS learning rule and equation (2.84) for the leaky LMS learning rule;
- Discuss Hebbian learning.

## ***Chapter 3***

For the material in Chapter 3 you should be able to do the following:

- Derive and discuss equations (3.6)-(3.13);
- Reproduce and discuss Figure 3.4 showing a three-layer MLP NN;
- Derive and discuss backpropagation equations (3.40)-(3.57);
- Derive and discuss the vector-matrix form of backpropagation algorithm (section 3.3.7);
- Reproduce and discuss Figure 3.10 showing the RBF NN architecture, and be able to relate this figure to equation (3.146);
- Derive and discuss equations (3.147)-(3.154) for training an RBF NN with fixed centers;
- Derive and discuss equations given on page 146 for the stochastic gradient-based method for training an RBF NN;

## ***Recitation and homework proof material***

You should be able work through problems of the type you encountered in recitation and on proof homework assignments.