EE 500: NEURAL LEARNING AND COMPUTATIONAL INTELLIGENCE

Spring 2017

6:30 – 9:20 Wednesday

Professor Kosko
Office: EEB 438
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Hours: Wed 4:00 - 5:00
Fri 5:00 - 6:00
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Summary: The course presents modern neural learning and computational intelligence techniques. This includes neural systems, deep learning, adaptive pattern classification, fuzzy function approximation, and hybrid systems. Applications to financial engineering and other areas of signal processing. Students will work in pairs to prepare and present a final project that applies computational intelligence techniques to an approved problem.

Required: Kosko, B., *Fuzzy Engineering*, Prentice Hall, 1997
Kosko, B., *Neural Networks and Fuzzy Systems*, Prentice Hall, 1992
Note: Above two texts available as a bound copy in the bookstore.

Recommended: Ross, S. M., *An Elementary Introduction to Mathematical Finance*, 3rd edition, Prentice Hall, 2011
Bishop, C., *Pattern Recognition and Machine Learning*, Springer, 2006

COURSE OUTLINE

JAN 11: Introduction to computational intelligence. Nets and approximators.

JAN 18: BAM stability. Uncertainty types. Multilayer perceptrons.

JAN 25: Regression and classification. Uncertain inference. Rational asset pricing.

FEB 1: Two-stage RAP. Multivalued set theory. Mixtures.

FEB 8: IP overview. Approximate reasoning. Expectation-Maximization (EM).

FEB 15: MIDTERM I. Deep learning. EM-backpropagation. Pareto optimality.

FEB 22: Coase theorem. Capital asset pricing. Standard additive model.

MAR 1: Recurrent backpropagation. Expert fusion. SAM supervised learning.

MAR 8: Function approximation and representation. *Project proposals due*.

MAR 15: No class: Spring Break.

MAR 22: Mixture representations. Pricing derivatives with Black-Scholes.

MAR 29: MIDTERM II. Unsupervised and competitive learning. Clustering.

APR 5: Adaptive resonance. Neural vector quantization. MCMC and annealing.

APR 12: Gradient systems. Classical supervised learning. Feedback SAMs.

APR 19: Project presentations. Mandatory attendance.

APR 26: Project presentations. Mandatory attendance. Summative instructions.

EE 500: NEURAL AND FUZZY SYSTEMS

GRADING PROCEDURE

1. **Midterms**. Two midterms. Each worth 25 points.

2. **Homework**. Checked and recorded. Not graded. A perfect set of worked homework problems can earn 10 points. Lesser homework sets earn fewer points. Grade stays as is if only some homework turned in. How much homework counts for how many points lies at the discretion of the instructor and teaching assistant. Students may discuss the homework problems among themselves but each student must work his or her own problems. Cheating warrants a course grade of F.

3. **Project**. Well prepared and presented project worth 50 points. Exceptional projects can earn an automatic course grade of A. Hence: *Project excellence trumps all else*. Projects must have the instructor's written approval. Failure to present a project on schedule results in automatic course grade of F. Project evaluation at discretion of instructor and teaching assistant. View project as the final exam.

4. **Course Grade**. 100 points possible in course.

A	if	90 - 100
B	if	80 - 89
C	if	70 - 79
D	if	60 - 69
F	if	0 - 59

5. **Cheating**. Not tolerated. Common errors in homework and exams can count as written evidence of cheating. Penalty ranges from F on exam to F in course to recommended expulsion.