

**CS504/ECE504/ME578 Neural Networks Design**  
Spring 2007, Instructor: Dr. Milos Manic, <http://husky.if.uidaho.edu/ee578s07/>  
***Class policy***

- Course outline:**                   **Course title: ECE 578 Neural Network Design (3 cr)**  
**Topics:** Same as CS504 & ME 578. Introduction to neural networks and problems that can be solved by their application; introduction of basic neural network architectures; learning rules are developed for training these architectures to perform useful functions; various training techniques employing the learning rules discussed and applied; neural networks used to solve pattern recognition and control system problems. Prereq: perm.  
This course was offered in S06, S05, and F03 (see <http://husky.if.uidaho.edu>)  
**To be offered:** Spring 2007 in Idaho Falls (live), Moscow (compressed video), and on tapes/dvds. <http://husky.if.uidaho.edu/ee578s07/>  
**Credits:** 3 credit course
- Schedule (tentative):**           Mondays, 7:00pm - 9:45pm mdt (6:00pm - 8:45pm pdt)
- Office hours (tentative):**       Mondays, 6:00pm - 7:00pm mdt (5:00pm - 6:00pm mdt) (please make an appointment)
- Location:**                       Live in Idaho Falls (CHE 301), CV in Moscow (room JEB 026), and on tapes/dvds.
- Instructor:**                   Milos Manic, Ph.D.  
University of Idaho  
UIIF College of Engineering at IF, UIIF CS Dept  
1776 Science Center Drive, TAB Ste. 241,  
Idaho Falls, ID 83402;
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- ph. direct: 208.282.7845; fax: 208.282.7950;  
email: [misko@uidaho.edu](mailto:misko@uidaho.edu)  
url: <http://www.cs.uidaho.edu/~milosm>  
url: <http://husky.if.uidaho.edu>
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- Class web page:**               <http://husky.if.uidaho.edu/ee578s07/>
- Required textbooks:**       Required textbooks include:
- Simon Haykin, "Neural Networks: A Comprehensive Foundation", 2nd edition (July 6, 1998), Publisher: Prentice Hall; ISBN-10: 0132733501, ISBN-13: 978-0132733502
  - Christopher M. Bishop, "Neural Networks for Pattern Recognition", Publisher: Oxford University Press, USA (January 18, 1996), ISBN-10: 0198538642, ISBN-13: 978-0198538646
- Recommended text books related more towards applications:
- Robert J. Schalkoff, "Artificial Neural Networks" co-published by MIT Press and the McGraw-Hill Companies 1997, ISBN 0-07-057118-X.
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- J. M. Zurada, "Introduction to Artificial Neural Systems" - West Publishing Company 1992, ISBN: 0-314-93391-3.
- James A. Anderson, "An Introduction to Neural Networks" (Hardcover), Publisher: The MIT Press (March 16, 1995), ISBN-10: 0262011441, ISBN-13: 978-0262011440
- ed. by Ian Cloete & Jacek M. Zurada, "Knowledge-Based Neurocomputing", The MIT Press, 2000, ISBN: 0-262-03274-0.
- ed. by Emile Aarts, J.K.Lenstra, "Local Search In Combinatorial Optimization", John Wiley & Sons, 1998, ISBN: 0-471-948-225.
- ed. by D.B. Fogel, C.J. Robinson, "Computational Intelligence", John Wiley & Sons, IEEE Press, ISBN: 0-471-27454-2.
- Hagan, H. Demuth, M. Beale, "Neural Network Design", PWS Publishing Company 1995, ISBN: 0-534-94332-2

Required material will be provided through handouts and web based documentation.  
Also, there is a variety of recommended text books listed at course web page.

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<b>Tentative Semester Schedule</b>	Jan. 08            Spring 2007 semester begins March 5           Exam #1 <i>Single Neuron and Learning</i> (Ch. 23,4 Zurada's book + notes) March 12-16      Spring break April 09           Exam #2 <i>Advanced Learning Algorithms</i> (Ch 5,6,7, 8 + notes) April 30           Exam #3 <i>Special NN Architectures and Fuzzy Systems</i> Ch 9,10 11 + notes) Apr 30-May 04    No examination week May 07-11        Final examination week May 11            Close of spring semester
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Paper:  
 Paper first draft due: Feb 19  
 Paper second draft due: March 26  
 Paper final submission: April 23  
 Paper presentation: week of April 30

**Grading system:** Two exams, final exam, paper, and homework assignments.

<b>Grading policy &amp; tentative grades::</b>	Homework                      35% Exams #1, #2, #3                50% Paper                                15%
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- A (90 - 100) %
- B (80 - 89) %
- C (70 - 79) %
- D (50 - 69) %
- F (0 - 49)

**Homework assignments:** The homework will emphasize the important features of the text and lecture materials, such as: design, simulation and evaluation of specially assigned neural networks. **Homework will be picked up and graded.**

**Paper** Required paper can have more of a research (theoretical) or more of a project (applicative) flavor. The purpose of the project paper is to demonstrate the ability to apply learned algorithms on real world problems. Research paper is not required but is encouraged.

**Exams** The exams will be similar to the homework problems. All exams must be taken

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**Assigned projects:**  
(equipment used – PC  
computer with  
simulation software)

- ✚ Design and training of single layer discrete and continuous neural system using various learning rules such as: minimum distance classifier, annealing, perceptron, delta and regression.
- ✚ Design and training of feedforward neural systems with error back-propagation learning rule.
- ✚ Solving an optimization problems using continuous Hopfield recurrent network.
- ✚ Design of an analog to digital converter using feedforward and recurrent networks.
- ✚ Design autoassociative and bidirectional memories. Storage and retrieve patterns form memories. Investigation of memory capacity versus corruption.
- ✚ Extracting a statistical properties of data using Winner-Take-All (WTA) algorithm for unsupervised learning of clusters.
- ✚ Design counterpropagation networks for both: classification and nonlinear mapping purposes.
- ✚ Storing and retrieving data in Fuzzy Associative Memories (FAM) using correlation-product and correlation minimum encoding.
- ✚ Design of a fuzzy controller based on fuzzy rules and fuzzy centroid principle.
- ✚ Comparison of neural and fuzzy controllers for dynamic systems (inverted pendulum controllers)
- ✚ Implementation of genetic algorithms

**Plagiarism:**

Code reuse is encouraged - after all, there is no point in inventing the wheel :). However, if you reuse code, do not forget to properly include reference (& url, if applicable). *If you claim that code is yours and shows up it is not, submitted assignment will be considered as plagiarism, and will be graded with zero points.* Some examples are made or modified by course instructors and officially available on some University of Idaho pages. Such examples are copyrighted and not available for further use.

**Computer misuse:**

Computer misuse is a felony in the State of Idaho. We will cooperate fully with the FBI, campus IT staff, and local law enforcement if the need arises.

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