

CMSC 727: Neural Computation - Spring 2011

Time and Place: Tuesdays and Thursdays, 12:30 – 1:45 pm, CSIC 2118

Instructor: James Reggia, AVW Bldg., Rm. 3233, 405-2686, reggia@cs.umd.edu
Office Hours: Thursdays, 1:45 – 3:15 pm, or by appointment

Prerequisites: CMSC 421 or permission of instructor. Undergraduate calculus, linear algebra and elementary probability theory are assumed.

Half-Time TA: Thuan Huynh, thuan@cs.umd.edu, 405-2775
Office Hours: Tuesdays 9 – 10 am, or by appointment, AVW 1112

Class web page: <http://www.cs.umd.edu/class/spring2011/cmssc727/>

Content:

We survey the most important neural computation methods, illustrate their use for difficult computational applications and for cognitive/brain modeling, provide hands-on experience training neural models, and introduce active research areas. While this course includes multi-disciplinary information, the emphasis is on the role of neural computation in machine learning and AI.

1. Biological inspiration: neurons, synapses, neural networks, information processing mechanisms, learning, how the brain computes, neurobiological basis of cognition.
2. Basic concepts: architectures, activation and learning rules, self-organization, adaptive systems, emergent behavior, competition and cooperation in networks, local vs. distributed representations, dynamical systems, historical perspective, applications.
3. Supervised learning: logical neurons, perceptrons and perceptron convergence theorem, LMS learning rule with linear models of associative memory, error backpropagation, radial basis functions, etc.
4. Unsupervised learning: Hebb's rule, linear associative memories, competitive learning, self-organizing feature maps, adaptive resonance theory, energy-minimizing attractor nets, simulated annealing, etc.
5. Related topics at time permits: oscillatory neural nets, reinforcement learning, evolutionary computation and neural networks, learning of activation rules, applications, software packages, echo state networks, hardware implementations, large-scale networks, spiking neurons, strong AI, etc.

Workload and Grading: There will be regular reading and homework assignments. Some assignments will include conducting online experiments using the Matlab Neural Networks Toolbox. Grading will be based on homework assignments, quizzes and class participation (collectively 15%), midterm (35%), and final exam (50%).

Required Textbook: Mehrotra K, et al, *Elements of Artificial Neural Networks*, 1997, published by MIT Press (ISBN 0-262-13328-8). Additional readings will come from the literature.

Disabilities: Any student eligible for and requesting reasonable academic accommodations due to a disability needs to provide the instructor with a letter of accommodation from the Office of Disability Support Services within the first two weeks of the semester.

Academic Integrity: All homework assignments are to be done individually and independently; all submitted work must be your own. All students are expected to be familiar with and to uphold the Code of Academic Integrity administered by the Student Honor Council at UMCP (please see <http://www.shc.umd.edu>).