



蘇州大學
Soochow University

CS 450 Neural Computing

Winter 2024

Course Credits: 4

Contact Hours: 56 hours

Instructor: TBA

Email: TBA

COURSE OBJECTIVES

This course introduces the basic concepts and techniques of neural computation, and its relation to automated learning in computing machines more generally. It covers the main types of formal neuron and their relation to neurobiology, showing how to construct large neural networks and study their learning and generalization abilities in the context of practical applications.

Upon Completion of this Course, students will be able to:

1. Understand natural computation techniques in theory and in their broad applicability to a range of hard problems in search, optimisation and machine learning;
2. know when a natural computing technique is applicable, which one to choose and how to evaluate the results;
3. know how to apply a natural computing technique to a real problem and how to choose the parameters for optimal performance;
4. Match techniques with problems, evaluating results, tuning parameters, creating (memetic) algorithms by evolution.

PREREQUISITES

CS 246 Introduction to Data Structure

GRADING

Grades will be determined by accumulating points, with 100 points being the maximum, as follows:



ITEM	POINTS
Quizzes	20 Points
Assignments	20 Points
Midterm Exam	25 Points
Final Exam	35 Points
Total	100 Points

Late submissions will be graded at the end of the course. Grades will be assigned according to the following rule:

$$A \geq 90 > B \geq 80 > C \geq 70 > D \geq 60 > F.$$

We reserve the right to make adjustments to the overall grading policy.

COURSE MATERIALS

Required Texts:

James A. Freeman and David M. Skapura, “*Neural Networks Algorithms, Applications, and Programming Techniques*”, Pearson Edn.

Recommended (Optional) Texts or Other Materials:

None

COURSE TOPICS

MODULE	TASKS
Module 1	Topics: Topic 1: The Basic Architecture of Neural Networks Topic 2: Training a Neural Network with Backpropagation Topic 3: Common Neural Architectures Topic 4: Reinforcement Learning Assessments: Assignment #1
Module 2	Topics: Topic 5: Neural Architectures for Binary Classification Models Topic 6: Neural Architectures for Multiclass Models Topic 7: Backpropagation: The Gory Details . Topic 8: The Vanishing and Exploding Gradient Problems Assessments: Quiz #1



Module 3	Topics: Topic 9: The Bias-Variance Trade-Off Topic 10: Generalization Issues in Model Tuning and Evaluation Topic 11: Training an RBF Network Topic 12: Variations and Special Cases of RBF Networks Assessments: Assignment #2 Midterm Exam
Module 4	Topics: Topic 13: Hopfield Networks Topic 14: The Boltzmann Machine Topic 15: Recurrent Neural Networks Topic 16: Echo-State Networks Assessments: Quiz #2
Module 5	Topics: Topic 17: The Basic Structure of a Convolutional Network Topic 18: Visualization and Unsupervised Learning Topic 19: Deep Reinforcement Learning Topic 20: Generative Adversarial Networks Assessments: Final Exam

ATTENDANCE

1) Class attendance is required. Missing classes without permission will lead to decrease in overall grade.

Missing less than two classes: no penalty.

Missing more than two classes: 7% will be taken off from the overall grade.

If the instructor reports a student's frequent missing of class to the Soochow University Academic Administration Office, the student might get a written warning and might be prohibited from attending final exam.

2) Participants in this course are expected to arrive in class promptly and adequately prepared. The primary objective of this course is to critically engage with the readings and the subject matter. Therefore, course participants are expected to have completed the reading prior to class and prepare thoughtful reflections/commentaries to share with fellow colleagues.



LEARNING REQUIREMENTS

- 1) Late assignments are not acceptable and are subjected to grade deductions.
- 2) Assignments submitted in the wrong format will be counted as not submitted.
- 3) Failure to submit or fulfill any required course component results in failure of the class.
- 4) Make-up for midterm and final exams only with valid excuses, as defined by the University.
- 5) In order to earn a Certificate of Completion, participants must thoughtfully complete all assignments by stated deadlines and earn an average quiz score of 50% or greater.

TECHNOLOGY POLICY

The use of electronic devices in class is distracting, both for the user and for the rest of the class. Only non-programmable calculators can be used in the tests and exam. Any attempts to use cell phones and other electronic communication devices will be seemed as cheating. Laptops are discouraged, unless you use them for activities DIRECTLY related to the course (eg., note taking, reading course documents).

ACADEMIC INTEGRITY POLICY

Soochow University highly values the academic integrity and aims to promote the academic fairness, honesty and responsibility. Any academic dishonesty behaviors and any attempts to cheats and plagiarism will be reported to the university administration office. A written warning and the relevant penalties will be imposed. The record might be shown on the official university transcript.

DISABILITY ACCOMMODATION

Soochow University is committed to maintaining a barrier-free environment so that students with disabilities can fully access programs, courses, services, and activities at Soochow University. Students with disabilities who require accommodations for access to and/or participation in this course are welcome.

Note:

Please contact the University Administrative Office immediately if you have a



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learning disability, a medical issue, or any other type of problem that prevents professors from seeing you have learned the course material.