Neural Networks and Deep Learning (Fall 2026, DATA 442/610)

Schedule

Monday and Wednesday 2:00 PM to 3:20 PM, ISC 2280 (8/26 to 12/15)

Instructor

Jonathan Colen
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Office: ISC 3324
Office hours: Thursday 9:30-11:30 am, or by appointment

Course Description

This course teaches the foundation of Neural Networks and Deep Learning. Students entering into this course should have, at minimum, a background in data preprocessing, cleaning, manipulation, and dimensionality reduction within Python. Through an applied learning project, you will learn how to implement a machine learning project from design to implementation in the context of neural networks. Topics we will cover include the basic building blocks of neural networks, RNNs, convolutional networks and computer vision, backpropagation basics and strategies, and more. The course will utilize PyTorch.

This course is based on the book *Deep Learning* by Goodfellow, Bengio, and Courville, which is available at https://www.deeplearningbook.org/.

Prerequisite(s):

- **Proficiency in Python.** All in-class demos will use Python. All class assignments are provided and coded in Python.
- **Basic statistics.** You should understand distributions, standard deviations, means, and other basic principles. You should be comfortable with basic notation.
- **Basic knowledge of machine learning.** You should have a basic understanding of topics such as cost functions and optimization strategies.

To achieve the above, we recommend DATA 310 (Applied Machine Learning) **or** CSCI 241 and an appropriate statistics or quantitative course.

Credit Hours: 3

Course Grading Policy

Grade Distribution	
Problem Set 1	15%
Problem Set 2	15%
Problem Set 3	15%
Problem Set 4	15%
Final Project	40%
Total	100%

Letter Grade Distribution			
$\geq$ 93.00	A	73.00 - 76.99	C
90.00 - 92.99	A-	70.00 - 72.99	C-
87.00 - 89.99	B+	67.00 - 69.99	D+
83.00 - 86.99	B	63.00 - 66.99	D
80.00 - 82.99	B-	60.00 - 62.99	D-
77.00 - 77.99	C+	$\leq$ 59.99	F

Assignments

There are 4 problem sets, which will include programming and analysis questions. Each problem set contributes 15% towards your final grade, with bonus problems contributing additional points.

Final Project

The final project will be a research project, application, or analysis of neural networks / deep learning in a domain of your choice. This will involve a written report (3-5 pages) and potentially a presentation or poster session.

Attendance

This class does not have an attendance policy. However, regular attendance is encouraged as the majority of course content relevant to assignments will be covered in class. If you need to miss class, materials will be posted on the course website: https://colen-teaching.github.io/DATA442-Fall-2026.

Classroom Behavior

Please remain civil during discussions to promote the open exchange of ideas and foster a culture of open dialogue. Please bear in mind that all students are entitled to their own opinion.

Late / Poor Performance Policy

Assignments will not be accepted late, except in documented circumstances.

Collaboration

All assignments should be done individually. For the final project, you may work in groups of up to three. The expectations for the project scope will increase depending on the number of group members. Each group will submit a report, and for groups of more than one, a short paragraph should be included along with the report that explains the role of each group member.

Communication

We will use the Blackboard discussion forum for communication. Please post your questions about the course material here. You may post privately to the instructor if you wish. However, you are encouraged to post questions publicly, as others may have similar questions. For additional help, please attend office hours.

Materials, Resources, and Software

This course is based on the book *Deep Learning* by Goodfellow, Bengio, and Courville, which is available at https://www.deeplearningbook.org/.

This course will use Python and PyTorch. If you are using a personal machine, you can find installation instructions for PyTorch here: https://pytorch.org/get-started/locally/

This course is computationally intensive. A SciClone account is needed to access the William and Mary High Performance Computing (HPC) system. Registration can be started at https://hpc.wm.edu/acctreq/. If you intend to work on your own laptop, please ensure it has a dedicated NVIDIA graphics card with CUDA capabilities. If you do not have a laptop with an NVIDIA graphics card, you should consider online services such as Google Colab. Because online services regularly change, I will not be able to provide support specific to those options.

Academic Integrity

Academic dishonesty is taken very seriously. You are expected to adhere to the Honor Code, which can be read at https://wm.edu/honor. Make sure to cite all of your work and do not turn in work that is not yours. Cases of academic dishonesty will be evaluated and acted upon in accordance with William and Mary policies, found at https://www.wm.edu/offices/communityvalues/sarp/

Use of Artificial Intelligence

All work submitted in this course, whether in draft or in final form, must be your own and must be cited appropriately. **Unless otherwise stated**, you may use AI-generated content as a reference in assignments, but you must indicate your use of such tools by:

- including a formal citation, or
- including an acknowledgment, or
- providing the specific prompt(s) used to generate content, or
- providing a full log of prompts, outputs, and revisions.

Failure to adhere to this policy may result in grade deductions at the instructor's discretion. You remain responsible for the validity of all material you submit in this course. AI-generated content often contains falsehoods and fictional sources. I strongly recommend that you carefully check all AI-generated content.

Accessibility

William & Mary Student Accessibility Services offers a variety of services and reasonable accommodations upon request. They strive to foster student independence, encourage self-determination, emphasize empowerment and accommodation over limitation, and create a comprehensive, accessible environment to ensure that individuals are viewed on the basis of contribution, not deficit. For more information, please visit https://wm.edu/sas.

Other Resources

William & Mary offers many resources to help students in emotional or psychological distress and those with physical or medical concerns. These include

- William & Mary Counseling Center: (757)-221-3620. Services are free and confidential
- William & Mary Health Center: (757)-221-4386
- Academic Wellbeing can provide academic support including tutoring, academic coaching, and skills development: https://wm.edu/academicwellbeing
- Care Support Services can provide assistance for concerns about personal or interpersonal well-beings: https://wm.edu/care

Course outline

The course outline can be found below. The weekly content may change depending on the the pace and progress of classes throughout the semester. **Assignment due dates are tentative** and may change depending on the progress of the class. For the most up-to-date information, see the course website at https://colen-teaching.github.io/DATA442-Fall-2026

Week	Class Topics	Other
1	**Wed, Aug 26:** Course Introduction & History of Deep Learning	
2	**Mon, Aug 31:** Linear Classifiers & Perceptrons **Wed, Sep 2:** Logistic Regression, Nonlinear Classifiers and (stochastic) Gradient Descent	
3	**Mon, Sep 7:** No class **Wed, Sep 9:** Regularization & Optimization **Due Fri, Sep 11:** Bonus PS 0 - Getting Started	Labor Day Holiday
4	**Mon, Sep 14:** Optimization & Hyperparameter Tuning **Wed, Sep 16:** No class	
5	**Mon, Sep 21:** Deep Neural Networks & Backpropagation (from scratch) **Wed, Sep 23:** Deep Neural Networks & Backpropagation (in PyTorch)	
6	**Mon, Sep 28:** AutoGrad & Computational Graphs **Wed, Sep 30:** Image data & Convolutional Layers **Due Fri, Oct 2:** PS 1 - Building a NN from Scratch	
7	**Mon, Oct 5:** Convolutional Neural Networks **Wed, Oct 7:** Convolutional Neural Networks (continued)	
8	**Mon, Oct 12:** Time Series & Recurrent Neural Networks **Wed, Oct 14:** Recurrent Neural Networks (continued)	
9	**Mon, Oct 19:** Graph Neural Networks **Wed, Oct 21:** Graph Neural networks (continued) **Due Fri, Oct 23** PS 2 - CNNs and image data	
10	**Mon, Oct 26:** Transformers **Wed, Oct 28:** Transformers (continued)	
11	**Mon, Nov 2:** Unsupervised learning & Autoencoders **Wed, Nov 4:** Probabilistic models & Variational Autoencoders **Due Fri, Nov 6** PS 3 - NNs and time-series data	
12	**Mon, Nov 9:** Variational Autoencoders (continued) **Wed, Nov 11:** Generative Adversarial Networks	
13	**Mon, Nov 16:** Generative Adversarial Networks (continued) **Wed, Nov 18:** Contrastive Representation Learning	
14	**Mon, Nov 23:** TBD **Due Tue, Nov 24** PS 4 - Generative models & representations **Wed, Nov 25:** No class	 Thanksgiving Break
15	**Mon, Nov 30:** Interpretability & GradCAM (tentative) **Wed, Dec 2:** Physics-inspired deep learning (tentative)	
Finals	**Dec 7-15:** Final Project Report and Presentation	Exact Dates TBD