

Syllabus and Course Schedule



PennState
World Campus



AI 570 (F/K/A DAAN 570): DEEP LEARNING

COURSE DESCRIPTION

(3 credits) Deep Learning has become a prevalent area and is accomplished near-human level in image classification, speech recognition, and autonomous driving. This course will cover the foundations of Neural Networks and Deep Learning Networks and give students a practical understanding of the field of Deep Learning. It covers the core concepts of Deep Neural Networks, including Convolutional Neural Networks for image recognition, Recurrent Neural Networks for sequence generation, and Generative Adversarial Networks for image generation, and more!

***Prerequisites:**

- Students must be in the AI_MPS or DAAN_MPS majors. SWENG_MSE students may enroll with division approval.
- Recommended STAT 500 or equivalent.
- Students should have preliminary programming skills in Python.

FACULTY



Professor Wenlei Bai

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OVERVIEW

Throughout this course, you will learn to design neural network architectures and training procedures via hands-on assignments. You will also have the opportunity to prove your skills by building small projects in cutting-edge Deep Learning libraries. The course will also emphasize hands-on experience and assignments to implement algorithms.

OBJECTIVES

After successfully completing this course, you will be able to demonstrate:

- Knowledge of deep learning algorithms and techniques
- The ability to identify suitable learning tasks to which these techniques can be applied
- Understanding of some of the current limitations of deep learning techniques
- Formulation of deep learning problems, setting up and running computational experiments and evaluation of results, reuse of common deep learning libraries and packages.

COURSE MATERIALS


Recommended Textbooks

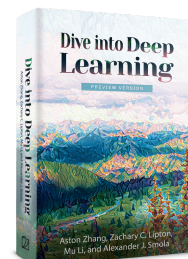
The textbooks for this course are:

- **[Dive into Deep Learning \(https://d2l.ai/\)](https://d2l.ai/)** (Recommended)


A digital version of this text is available on the web at <https://d2l.ai>.

- **Python for Data Analysis (Optional)**

Free E-Book: An online version *Python for Data Analysis* (2017) is available at no cost to you as a Penn State student. You can access the E-Book through [O'Reilly Learning](https://www.oreilly.com/library/view/python-for-data/9781491957653/)  (<https://www.oreilly.com/library/view/python-for-data/9781491957653/>). (Use your Penn State email to access the book.) (ISBN: 9781491957660)



Required Software


Anaconda (with Python and Jupyter Notebooks): <https://www.anaconda.com/>  (<https://www.anaconda.com/>). (If you need any assistance, please contact [Information Technology Support \(https://it.psu.edu/get-support\)](https://it.psu.edu/get-support) for assistance.)

You may be required to use Microsoft Word, Excel, or PowerPoint to complete assignments. MS Office 365 and Adobe Creative Cloud are free for Penn State students. These are powerful tools that allow you to create documents, spreadsheets, presentations, webpages, and more! If you need assistance using the software, you can access tutorials via LinkedIn Learning at no cost or contact [Information Technology Support \(https://it.psu.edu/get-support\)](https://it.psu.edu/get-support) for assistance.

TECHNICAL SUPPORT

Please remember that ALL questions about grades, course lesson content, and assignments should be directed to your course instructor.

Basic computer skills are required for this course. Computer and software tutorials are available for free via [LinkedIn Learning. \(https://linkedinlearning.psu.edu/\)](https://linkedinlearning.psu.edu/). If you have any technical difficulties using the tools within this course, please contact the Penn State Helpdesk.

- **HelpDesk Website:** <https://student.worldcampus.psu.edu/help-and-support/technical-support>  (<https://student.worldcampus.psu.edu/help-and-support/technical-support>)
- **HelpDesk Email:** techsupport@worldcampus.psu.edu
(<mailto:techsupport@worldcampus.psu.edu?subject=World%20Campus%20Tech%20Support%20Inquiry>)
- **HelpDesk Phone:** (800) 252-3592

CONTACT INFORMATION

All course-related e-mails should go through Canvas's course mail function (Canvas Inbox). Using Canvas to contact your instructor ensures that your message will be read and your instructor will respond to you in a timely manner, typically within 48 hours.

USING THE LIBRARY

Many of the University Libraries' resources can be utilized from a distance. Through the Library website, you can access magazines, journals, and articles; borrow materials and have them delivered to your doorstep; and get research help via email chat or phone from a librarian.

For more information, view the [Penn State University Library](https://libraries.psu.edu/)  (<https://libraries.psu.edu/>) website.

COURSE REQUIREMENTS AND GRADING

Navigating This Course:

1. **Read the lesson notes (Web pages):** These notes outline the key points and topics of the lesson and may include information not found in the textbook. The notes are designed to give you a general idea about the lesson and to supplement the assigned readings or assignments.
2. **Complete any assigned readings:** Readings may include selections from textbooks or other articles or websites. The specific reading assignments can be found within the lesson notes and in the course schedule.
3. **Complete all assignments and project deliverables:** You will have the opportunity to complete assignments, projects, and discussions to assess your understanding of the

material presented. Please submit all assignments by the due date noted in the course schedule.

A grade is given primarily on the basis of the instructor's judgment as to the student's scholarly attainment. You are encouraged to seek the instructor's input during the process of completing each course requirement. Students are expected to submit work by the due dates specified in the course. Instructors will provide grades and feedback in a timely manner, typically within a week of the submission deadline.

***Student work will be graded according to the following grading scheme:**

A = 94-100, A- = 90-93, B+ = 87-89, B = 84-86, B- = 80-83, C+ = 77-79, C = 70-76, D = 60-69, F = Below 60

Assignment Details

Assignment Category	Points	Weight (% of grade)
Individual Assignments (3)	100 points each	30%
Literature Review	100	10%
Project Proposal	100	10%
Project Presentation	100	10%
Project Deliverables	100	30%
Discussion Forums	100	10%
Total		100%

A Note about Netiquette

As part of this online course, you may be using discussion forums and email to interact with a diverse group of faculty and students. All communications should follow the rules of Netiquette that govern the Internet. Some basic guidelines include: Use subject lines; Proofread your communication before posting; Never use all CAPS; Be respectful, courteous, and professional; Avoid slang terminology, acronyms, and inappropriate language.



Assignments (30% of grade)

Homework assignments will be given periodically. Due dates are noted in the course schedule. Doing the homework promptly and carefully is necessary for learning the material. Collaboration with fellow students is allowed and encouraged on homework. However, each student must turn in their own written work which reflects their own understanding of the material. You will submit your work via **Turnitin**, which is an originality service detector, empowering you to do your best, original work.

Practice Exercises: There are also several ungraded practice exercises throughout the course. Although these are ungraded, it is important for you to complete these guided practice exercises. If you need additional support on any of these exercises, please contact your instructor.



Literature Review (10% of grade)

You will be assigned a scientific paper on various topics related to Deep Learning and you will write a review in your own words. You are expected to work independently on the paper and use whatever material that you have at your disposal. Scientific Reading & Review is worth 10% of your grade. You will submit your paper via Turnitin.



Group Project (50% of grade)

The project is worth 50% of your total grade. (10% for Project Proposal, 30% for deliverables, and 10% for presentation). This is a team project and each team should have at least two members. Your team will select a challenging and original problem to solve in your project. At the end of the semester, you will upload the final report (10+ pages excluding the title page). You will be provided with a template and instructions on what points need to be covered. A list of different data sources will also be shared with the class. You may download the data from this source or you are free to work on your own data set if you have any (related to your companies/workplace etc.). When completing group work, your team may choose any method of collaboration or communication that is most effective (Google Docs, Microsoft Teams, Zoom, etc.) If you need any assistance using these technologies, contact Penn State IT Support. You will present your group project by creating a video using Zoom.



Discussions (10% of grade)

Discussions are provided as an opportunity to connect with your peers about the lesson content, to share ideas, questions, and resources. You will be evaluated on the quality of your initial post as well as your replies and responses to the posts of your peers.

Grading

Within 3-5 days after you have submitted an assignment, you will be able to review your grade and any comments made by your instructors. This process is used for all homework assignments, exams, quizzes, projects, papers, or other graded submissions. Some instructors may also send a message to your inbox informing you that the assignment has been graded.

Some instructors for some assignments may choose to release all the grades to all students at once; other instructors may release grades per student one at a time.

Additional questions about grading procedures can be addressed by posting to the General Discussion Forum or by sending a message to the course instructor.

Course Policies

All course material is available to you through Canvas or in your textbook. Material is provided on a lesson-by-lesson basis and is presented to you as Web pages, Microsoft Word documents (.doc), or Portable Document Format (PDF) documents. Material that you submit for the course assignments must be submitted to the appropriate Lesson assignment and should be submitted as PDF files, .DOC, .DOCX files, and in appropriate cases, PowerPoint or Excel files. In most cases, I can read files from open-source equivalents. If I can't read a particular file, I will let you know and ask for you to convert it to one of the above formats. Thank you.

Policy on Late/Missing Assignments

Late Assignment Policy will be strictly applied in this course. If a personal emergency should arise that affects your ability to turn in an assignment in a timely fashion, you must contact me BEFORE the deadline to get a "Special Late Submission Approval".

Without the "Special Late Submission Approval"; Exercises and Assignments submissions will be still accepted up to 7 days late, **but with a 10% penalty per day.**

- **No "Special Late Submission Approval" will be granted after the deadline.**
- **No submission will be accepted after 7 days from the submission deadline.**

Specifications for Writing and Submitting Assignments

- Homework must be submitted in .doc, .docx, or PDF files.

Netiquette: Internet Etiquette Guidelines

A few basic reminders:

- It is generally bad form to type your messages IN ALL CAPITAL LETTERS. In addition to proper capitalization (first words of sentences, proper nouns, names, etc.), a majority of online students have reported that complete sentences and punctuation make online text communication easier to read.
- It is much better **not** to post inflammatory or accusational remarks than it is to "get it off of your chest." Profanity and personal attacks *will have no part* of this course. If you discover such remarks, please notify me immediately, and I will personally address the source of those remarks

UNIVERSITY POLICIES AND RESOURCES

All students are responsible for reading the [University Policies and Resources](https://sites.psu.edu/gvwc/course/penn-state-university-policies-and-resources/)  (<https://sites.psu.edu/gvwc/course/penn-state-university-policies-and-resources/>) which include important information regarding:

- **Academic integrity**
- **Student disability resources**
- **Educational equity**
- **Counseling services**
- **Technical requirements**

COURSE SCHEDULE

The schedule below outlines the topics we will be covering in this course, along with the associated time frames and assignments.

Please note: All submissions must be submitted to the proper assignment in Canvas prior to 11:59 PM EST on the final day of the lesson week.

- **Course begins:** Monday, January 13, 2025
- **Course ends:** Friday, May 2, 2025

Lesson 1: Intro to Deep Learning

Timeframe:	January 13 - January 19
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Readings:	<ul style="list-style-type: none"> • Read the Course Syllabus and Schedule • Read Online Content for Lesson 1 • Refer to The Roadmap of Mathematics for Deep Learning (https://towardsdatascience.com/the-roadmap-of-mathematics-for-deep-learning-357b3db8569b) by Danka, T. (2020) for additional details if you need more details. • Recommended: Access Dive Into Deep Learning (https://d2l.ai/index.html) and browse the contents. We will use examples from this book throughout the course. • Optional: Access Python for Data Analysis (https://www.oreilly.com/library/view/python-for-data/9781491957653/) via O'Reilly.com and browse the contents. This book provides supplementary content. <ul style="list-style-type: none"> ◦ To access free resources on O'Reilly be sure to sign in using your Penn State email address.
Assignments:	<ul style="list-style-type: none"> • Introduce yourself in the Welcome Activity • Participate in two Discussion Topics: <ul style="list-style-type: none"> ◦ Neural Network Discussion ◦ Math for Deep Learning Discussion • Download and Install Anaconda and practice using Jupyter Notebook • Complete Practice Exercise #1

Lesson 2: Neural Networks Basics

Timeframe:	January 20 - January 26
Readings:	<ul style="list-style-type: none"> • Read the Online Lesson Content • View Supplemental Resources provided in the lesson
Assignments:	<ul style="list-style-type: none"> • Participate in Discussion Topic L2 (Loss Functions)

Lesson 3: Shallow Neural Networks

Timeframe:	January 27 - February 2
Readings:	<ul style="list-style-type: none"> • Read the Online Lesson Content • View Supplemental Resources provided in the lesson
Assignments:	<ul style="list-style-type: none"> • Participate in Discussion Topic L3 (Activation Functions)

Lesson 4: Deep Neural Networks

Timeframe:	February 3 - February 9
Readings:	<ul style="list-style-type: none"> • Read the Online Lesson Content
Assignments:	<ul style="list-style-type: none"> • Participate in Discussion Topic L4 (Keras)

Lesson 5: Optimization

Timeframe:	February 10 - February 16
Readings:	<ul style="list-style-type: none"> • Read the Online Lesson Content • View supplemental resources
Assignments:	<ul style="list-style-type: none"> • Submit Project Proposal • Complete Discussion Topic L5 (Optimization)

Lesson 6: Improving Deep Neural Networks

Timeframe:	February 17 - February 23
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Readings:	<ul style="list-style-type: none"> • Read the Online Lesson Content • Read any supplemental readings provided
Assignments:	<ul style="list-style-type: none"> • Complete Assignment #1

Lesson 7: Convolutional Neural Networks (CNNs)

Timeframe:	February 24 - March 2
Readings:	<ul style="list-style-type: none"> • Read the Online Lesson Content • View any supplemental resources
Assignments:	<ul style="list-style-type: none"> • Submit Scientific Reading and Review Paper • Optional: Submit mid-course survey

Lesson 8: Advanced CNNs

Timeframe:	March 3 - March 9
Readings:	<ul style="list-style-type: none"> • Read the Online Lesson Content • View any supplemental resources
Assignments:	<ul style="list-style-type: none"> • Submit Assignment #2

****PSU OFFICIAL SPRING BREAK (NO CLASSES):
MARCH 9 - MARCH 15, 2025***

Lesson 9: Computer Vision & Advanced Computer Vision

Timeframe:	March 17 - March 23
Readings:	<ul style="list-style-type: none"> • Read the Online Lesson Content

Assignments:	<ul style="list-style-type: none"> • Continue working on your group project
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Lesson 10: Generative Adversarial Networks (GANs)

Timeframe:	March 24 - March 30
Readings:	<ul style="list-style-type: none"> • Read the Online Lesson Content • View any supplemental resources
Assignments:	<ul style="list-style-type: none"> • Continue working on the Group Project

Lesson 11: Recurrent Neural Networks (RNNs)


Timeframe:	March 31 - April 6
Readings:	<ul style="list-style-type: none"> • Read the Online Lesson Content
Assignments:	<ul style="list-style-type: none"> • Continue working on the Group Project

Lesson 12: Advanced RNNs

Timeframe:	April 7 - April 13
Readings:	<ul style="list-style-type: none"> • Read the Online Lesson Content
Assignments:	<ul style="list-style-type: none"> • Submit Assignment #3

Lesson 13: Transformers

Timeframe:	April 14 - April 20
Readings:	<ul style="list-style-type: none"> • Read the Online Lesson Content

Assignments:	<ul style="list-style-type: none"> • Continue working on the Group Project <hr/> <p>***Please remember to complete the online SEEQ evaluation  (https://rateteaching.psu.edu/) for your course instructor.</p>
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Lesson 14: Final Project

Timeframe:	April 21 - May 2
Readings:	<ul style="list-style-type: none"> • No Readings
Assignments:	<ul style="list-style-type: none"> • Post a link to your presentation in the Presentation Discussion by Sunday, April 27 • View all other teams' presentations and provide feedback by May 2nd • Submit your final Project Deliverables by May 2nd

Disclaimer: Please note that the specifics of this Course Syllabus are subject to change, and you will be responsible for abiding by any such changes. Your instructor will notify you of any changes.