CNIT 48300-003: Applied Machine Learning

This syllabus is subject to change with notice. For the most recent updates see https://purdue.brightspace.com

Catalog Description

In the past decade, we have observed the expeditious evolution and tremendous applications of machine learning, such as unmanned vehicle, autonomous language translation, and smart healthcare. This course will introduce the fundamental knowledge of machine learning techniques, including linear and logistic regression, various neural networks, and reinforcement learning, via a series of hands-on real-world examples in Python. The overall aim is to provide the students with a good understanding of machine learning technologies, building machine learning with Python, and applying machine-learning technologies to address real-world problems. In the projects, students will also have an opportunity to explore the cutting-edge machine learning technologies, such as deep learning, and develop their own machine learning-based solutions.

Organization and Schedule Credit 3

Semester	*Meeting Type*	*Days*	*Time*	*Location*	*CRN*
Spring 2023	Lecture	M/W	3:30pm – 4:20pm	Knoy B029	24807
	Lab	T	11:30pm – 1:20pm	Physics Building 026	

Requisites

Prerequisites: STAT 22500 - Introduction To Probability Models or STAT 30100 - Elementary Statistical Methods

CNIT 25501-Object-Oriented Programming Introduction

Course Description and/or Theme

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Keywords Applicable to Career Development and Job Hunting

- Data Scientist
- Software Engineer
- Principal Engineer

Information Technology Used In This Course

1. Data analytics
2. Data visulaization
3. Cyber security

Course Instructor

Name	***Office***	***Phone***	***Email Address***	***Office Hours***
Jin Wei-Kocsis	KNOY 289	765-496-0023	kocsiso@purdue.edu	12:30 to 2:30 pm on Wednesdays

Required Textbooks, Lab Manuals, and Supplies

Book References:

- C.M. Bishop, **Pattern Recognition and Machine Learning (Information Science and Statistics)**, Springer, April 2011.
- C. Chio and D. Freeman, **Machine Learning and Security: Protecting Systems with Data and Algorithms**, First edition, O'Reilly Media, February 2018.
- S. Dua and X. Du, **Data Mining and Machine Learning in Cybersecurity**, First edition, Auerbach Publications, April 2011.
- M. Collins, **Network Security Through Data Analysis: Building Situational Awareness**, First edition, O'Reilly Media, February 2014.
- M. Collins, **Network Security Through Data Analysis: From Data to Action**, Second edition, O'Reilly Media, October 2017.
- S. Halder and S. Ozdemir, **Hands-On Machine Learning for Cybersecurity: Safeguard your system by making your machines intelligent using the Python ecosystem**, Packt Publishing, December 2018.
- J. Saxe and H. Sanders, **Malware Data Science: Attack Detection and Attribution**, No Starch Press, September 2018.

- M.E. Williams, **Deep Learning with Python: The ultimate beginners guide to Learn Deep Learning with Python Step by Step**, Independently published, August 2019.

Article References will be provided.

Other useful resources

- Slides and other reading materials will be available on Brightspace.
- Purdue Library online journals access
- Purdue interlibrary loan

Course Learning Outcomes

- Python Tutorial and Environment Set-Up
- Introduction to Machine Learning and Its Applications
- Linear and Logistic Regression and Its Applications
- Introduction to Neural Network and Its Applications
- Fully-Connected Neural Network (FNN) and Its Applications
- Convolutional Neural Network (CNN) and Its Applications
- Recurrent Neural Network (RNN) and Its Applications
- Autoencoder and Its Applications
- Generative Adversarial Network (GAN) and Its Applications
- Reinforcement Learning and Its Applications

Instructor Objectives

- My objective in this class is to maximize the educational experience of those students who bring a sincere effort and serious interest in the subject matter into the classroom. I do not intend to waste their time, or mine, on those students less prepared or committed.
- This course is designed to be an effective and realistic introduction to the topic. It will be challenging. However, I will do whatever I can to help students who put forth a sincere effort in this course. To make this course "easier" would be a disservice to employers, alumni, the CIT program, Purdue University, and most importantly to you, the students.
- Remember, I am here to help you learn the material. Make me prove it.

Course Requirements and Learning Assessment

The aim of this course is to provide the undergraduate students with fundamental knowledge of machine learning techniques and introduce them to timely topics in the field of deep learning. The course will be organized via primarily lecture combined with lab projects. The learning assessment includes:

- Being able to explain the relationship of 8 machine learning models (Linear Regression, Logistic Regression, Fully-Connected Neural Network (FCNN), Convolutional Neural Network (CNN), Recurrent Neural Network (RNN), Autoencoder, Generative Adversarial Network (GAN), and Reinforcement Learning (RL)).
- Being able to program the basic realization of the eight machine learning models, stated above, in Python.
- Being able to apply the eight machine learning models stated above to solve real-world problems.

How Final Grades will be Determined (subject to change with notice)

Grading Policy

Assessment Mechanism	Percentage of Grade
Lab Project	20%
Homework	20%
Midterm Exam	20%
Final Project	30%
Participation	10%

Grading Scale

A	90 – 100	C+	76 – 79
B+	86 – 89	C	70 – 75
B	80 – 85	D+	66 – 69
D	60 – 65	F	0 - 59

Grading Notes and Comments

1. It is the student's responsibility to proofread the assignment before submission to avoid possible typos and misunderstanding that could affect the grade.
2. Late submission: (0, 24 hrs]~50%, 0 if >24 hrs.
3. Incompletes will only be given under extenuating circumstances.

4. In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances beyond the instructor's control.

Course Policies

Attendance, Preparation, and Courtesy Expectations and Policies

University Regulation - *Students are expected to be present for every meeting of the classes in which they are enrolled. Only the instructor can excuse a student from a course requirement or responsibility. When conflicts or absences can be anticipated, such as for many University sponsored activities and religious observations, the student should inform the instructor of the situation as far in advance as possible. For unanticipated or emergency absences when advance notification to an instructor is not possible, the student should contact the instructor as soon as possible by email, or by contacting the main office that offers the course. When the student is unable to make direct contact with the instructor and is unable to leave word with the instructor's department because of circumstances beyond the student's control, and in cases of bereavement, the student or the student's representative should contact the Office of the Dean of Students.*

- Class attendance is essential to success in this course. Therefore, you are expected to be in attendance for all class meetings. Only the course instructor may excuse you from any class meeting. Whenever possible this should be discussed with the instructor prior to the absence. The attendance will be checked by asking for your signature, answering in-class questions/quizzes, or any other necessary means.
- Any reasonable absence, due to bereavement, military leave, university-sponsored activities, illnesses, etc., is subject to validation and should notify the University in a timely fashion. Students are responsible for all required coursework and bear full responsibility for any academic consequences that may result due to absence (For more information or questions, look at the relevant regulations http://catalog.purdue.edu/content.php?catoid=8&navoid=8220 , https://www.purdue.edu/advocacy/students/absences.html and contact the Dean of Student Office at odos@purdue.edu or call 765-494-1747).
- If you don't attend class regularly, please don't expect individual help.
- All the students are expected during the class to be respectful to the instructor and your fellow students. Please arrive on time. If you are late to class, please enter quietly through the back of the classroom. Please avoid distracting behaviors and remain engaged in the discussion. You are only allowed to use electronics relating to course activities. Cellphones must be silenced or turn off all the time during the class. Only urgent calls may be answered outside the classroom.

Add/Drop Policies

- According to CIT educational policy, this course may not be added to any student's academic schedule after the first week of a Fall or Spring semester (or equivalent for a Summer semester) except under very extenuating circumstances to be approved by the unit head.
- According to CIT educational policy, no independent study course can be substituted for this course.

Course materials posting policy

- Please do NOT post course materials and derivative works (your notes and etc.) on the Internet. In general, notes are "considered to be 'derivative works' of the instructor's presentations and materials, and they are thus subject to the instructor's copyright in such presentations and materials." As such, they cannot be sold or bartered without the instructor's express written permission. (http://catalog.purdue.edu/content.php?catoid=8&navoid=8208#miscellaneous-conduct-regulations)

Academic Dishonesty ("Cheating") Policies

Academic integrity is one of the highest values that Purdue University holds. Individuals are encouraged to alert university officials to potential breaches of this value by either emailing integrity@purdue.edu or by calling 765-494-8778. While information may be submitted anonymously, the more information that is submitted provides the greatest opportunity for the university to investigate the concern.

- Any form of cheating will result in a penalty up to automatic "F" grade for the course. All instances of cheating will be forwarded to the Office of the Dean of Students for appropriate disciplinary action.
- Helping another student to cheat and cheating are considered equal cases of academic dishonesty and will be treated as outlined above.
- Giving another student an electronic copy of your homework, or access to your computer account constitutes cheating on your behalf if that other student copies or uses any files that become implicated in a cheating case.

Purdue Honors Pledge: "As a boilermaker pursuing academic excellence, I pledge to be honest and true in all that I do. Accountable together - we are Purdue."

Accessibility and Accommodation Policy Conditions

- Purdue University strives to make learning experiences as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, you are welcome to let me know so that we can discuss options. You are also encouraged to contact the Disability Resource Center at: drc@purdue.edu or by phone: 765-494-1247.
- Any student who, because of a disabling condition, may require special arrangements in order to meet course requirements should contact the instructor by the third week of class in order to make necessary accommodations. Students who do not contact the instructor by the third week of class, or as soon as they know they have a disabling condition, forfeit their rights to special accommodations. Students must work with the Dean of Students Office in order to receive special accommodations for this class.

Mental Health Support

- If you find yourself beginning to feel some stress, anxiety and/or feeling slightly overwhelmed, try WellTrack, https://purdue.welltrack.com. Sign in and find information and tools at your fingertips, available to you at any time.
- If you need support and information about options and resources, please see the Office of the Dean of Students, http://www.purdue.edu/odos, for drop-in hours (M-F, 8 am- 5 pm). If you're struggling and need mental health services: Purdue University is committed to advancing the mental health and well-being of its students.
- If you or someone you know is feeling overwhelmed, depressed, and/or in need of mental health support, services are available. For help, such individuals should contact Counseling and Psychological Services (CAPS) at (765)494-6995 and http://www.purdue.edu/caps/ during and after hours, on weekends and holidays, or by going to the CAPS office of the second floor of the Purdue University Student Health Center (PUSH) during business hours.

Campus Safety and Emergency Preparedness

In the event of a major campus emergency, course requirements, deadlines, and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances beyond the instructor's control. Here are ways to get information about changes in this course.

- Course Blackboard (https://mycourses.purdue.edu/)
- Instructor's email (kocsis0@prudue.edu)
- Instructor's phone (765-496-6883)

Non-Descrimintation Policies

- Purdue University is committed to maintaining a community which recognizes and values the inherent worth and dignity of every person; fosters tolerance, sensitivity, understanding, and mutual respect among its members; and encourages each individual to strive to reach his or her own potential. In pursuit of its goal of academic excellence, the University seeks to develop and nurture diversity. The University believes that diversity among its many members strengthens the institution, stimulates creativity, promotes the exchange of ideas, and enriches campus life. Purdue's nondiscrimination policy can be found at http://www.purdue.edu/purdue/ea_eou_statement.html

Violent Behavior

- Purdue University is committed to providing a safe and secure campus environment for members of the university community. Purdue strives to create an educational environment for students and a work environment for employees that promote educational and career goals. Violent Behavior impedes such goals. Therefore, Violent Behavior is prohibited in or on any University Facility or while participating in any university activity.
- See the University's full policy for more detail: https://www.purdue.edu/policies/facilities-safety/iva3.html.