



Idaho State University

Applied Neural Networks (3 credits)

Fall Semester 2023

CS 4433/5599

Tuesdays and Thursdays

11:00am – 12:15pm MT

ISU: TAB 286 (IF) / BA 304 (Pocatello)

Instructor: Dr. Leslie Kerby

Office: TAB 271

Office Hours: 11:00am-noon Wednesdays, <https://isu.zoom.us/j/93121774732>

Email: LeslieKerby@isu.edu

T/A: TBD

Email: ?@isu.edu

Syllabus

COURSE DESCRIPTION

This course will teach building and testing neural networks with TensorFlow and Keras, including artificial neural networks (ANNs), deep learning, convolutional neural networks (CNNs), recurrent neural networks (RNNs), image analysis, time series modeling, and introductory natural language processing. TensorFlow data pipelines, transfer learning, and data augmentation will be taught and utilized.

COURSE PREREQUISITES

CS 1181 and MATH 2240, or instructor permission.

TEXTBOOK

Optional:

Hands-on Machine Learning with Scikit-learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems, 3rd Edition, by Aurélien Géron

COURSE OBJECTIVES

- Build and train many neural network architectures for classification and regression using TensorFlow 2, including:
 - ANNs
 - CNNs
 - RNNs
- Explore the Keras API
- Explore TensorFlow's Data API
- Apply these models to various challenges in natural language processing, time series, and image analysis

ASSIGNMENTS

Homework assignments will be given regularly. Two projects will be given. Completion of the homework and projects is an essential aspect of the course.

Graduate students will create their own final project. They must submit a preliminary proposal, written report, and presentation. More information will be given later. Graduate students will also have extra work to do on several assignments and the mid-project.

Late homework will forfeit 10% of the grade if overdue less than one week, and 25% of the grade if overdue more than one week. If you will be more than two weeks late, contact me.

TUTORS

A tutor is available to help students gain any additionally needed understanding of course material to be able to complete assignments.

ACCOMMODATION

Students who are differently-abled are encouraged to discuss their needs with the instructor, preferably during the first week of class. All reasonable accommodations will be made to see that disabilities do not restrict a student's opportunity to learn. Students may also call the ADA and Disabilities Resource Center at 208-282-3599 or visit their website at <https://www.isu.edu/disabilityservices/>.

SUCCESS

Success in this course depends heavily on your personal health and wellbeing. Recognize that stress is an expected part of the college experience, and it often can be compounded by unexpected setbacks or life changes outside the classroom. I encourage you to reframe challenges as an

unavoidable pathway to success. Reflect on your role in taking care of yourself throughout the term, before the demands of exams and projects reach their peak. Please feel free to reach out to me about any difficulty you may be having that may impact your performance in this course. If you are experiencing stress in other areas of your campus life, I am happy to help you get in contact with other resources on campus that stand ready to assist you. In addition to your academic advisor, I strongly encourage you to contact the many other support services on campus that are available.

There are many resources ISU provides: [Student Resources](https://www.isu.edu/deanofstudents/student-care-and-assistance/)
(<https://www.isu.edu/deanofstudents/student-care-and-assistance/>)

SERVICES

ISU Counseling and Testing Services (CATS) would like to remind all students who are enrolled in the current semester (part-time or full-time) they are eligible for free, confidential counseling services. CATS offers individual, group, and couples counseling, as well as Biofeedback Training. They also offer crisis intervention services Monday through Friday from 8-5.

Locations:

Pocatello: Graveley Hall, 3rd floor of the south side. To schedule an appointment call 208-282-2130 or just stop by. Walk-ins are welcome Monday-Friday from 8am - 4pm.

Idaho Falls: Bennion Student Union, 2nd floor, Room 223. Please call 208-282-7750 to schedule an appointment.

Meridian: Counseling services are available to Meridian students through the ISU Counseling Department. Please call 208-373-1719 to schedule an appointment.

COMFORTABLE LEARNING ENVIRONMENT

We are all committed to maintaining an inoffensive, non-threatening learning environment for every student. Class members (including the instructor) are thus to treat each other respectfully—both in word and deed. Offensive humor and aggressive personal advances are specifically forbidden. If you feel uncomfortable with a personal interaction in class, see your instructor for help in solving the problem.

EXPECTATIONS ON PROFESSIONALISM AND ATTITUDE

- Be prepared for class.
- Get to class on time.
- Ask questions in class.
- Stay alert and attentive in class.
- Participate in class discussions in a courteous and positive manner.
- Do not carry on "sidebar" conversations during instructor, student or guest presentations.
- Laptops are encouraged. We will be coding live in class frequently.
- Spend enough time on assignments to ensure that you are actually learning the material and are able to turn in work of high quality. Assignments are an opportunity to learn, not something to just "get done."
- Turn in assignments on time. Grade reductions will be given for late assignments. The later the assignment, the more severe the reduction.

-Lecture availability on Moodle is not assured. Please attend class live if at all possible (whether in-person or remotely).

OFFICE HOURS

Dr. Kerby will hold virtual office hours every Wednesday from 11:00am to noon. The Zoom link is:

<https://isu.zoom.us/j/93121774732>

First come, first served. If there is more than one student in the chat, students will be placed in a waiting room until their turn.

CONDUCT

Academic dishonesty (cheating and plagiarism) is strictly prohibited. Students should refer to the ISU Policy on Academic Integrity and Dishonesty

(<http://www.isu.edu/policy/4000/AA-Academic-Integ-Dishonesty-4000-7-27-15.pdf>).

In carrying out its educational mission, Idaho State University is committed to adhering to the values articulated in Idaho State Board of Education Policy III.B. Membership in the academic community imposes on administrators, faculty members, other institutional employees, and students an obligation to respect the dignity of others, to acknowledge the right of others to express differing opinions, and to foster and defend intellectual honesty, freedom of inquiry and instruction, and free expression on and off the campus of an institution.

GRADING

Course grading will be determined using the following breakdown:

Topic	Value
Homework	60%
Mid-project	20%
Final project	20%

Grades will be earned based on a straight scale grading policy:

Percentage	Grade
$\geq 93.00\%$	A
90.00 - 92.99%	A-
87.00 - 89.99%	B+
83.00 - 86.99%	B
80.00 - 82.99%	B-
77.00 - 79.99%	C+
73.00 - 76.99%	C
70.00 - 72.99%	C-
67.00 - 69.99%	D+
63.00 - 66.99%	D
60.00 - 62.99%	D-
$\leq 59.99\%$	F

TENTATIVE COURSE SCHEDULE

Date	Topic
8/21 – 8/25	Artificial Neural Networks (ANNs) Sequential, Functional, and Subclassing APIs Callbacks and Hyperparameter Tuning
8/28 – 9/1	
9/4 – 9/8	
9/11 – 9/15	Deep Learning Transfer Learning Regularization and Data Augmentation
9/18 – 9/22	
9/25 – 9/29	
	Convolutional Neural Networks (CNNs) Deep Computer Vision Data API
10/2 – 10/6	
10/9 – 10/13	
10/16 – 10/20	
	Recurrent Neural Networks (RNNs) Processing Sequences
10/23 – 10/27	
10/30 – 11/3	
	FALL BREAK (no class)
11/6 – 11/10	
	Introduction to Natural Language Processing
11/13 – 11/17	
11/20 – 11/24	Finals Week
11/27 – 12/1	
12/4 – 12/8	
12/11 – 12/15	