Ira A. Fulton Schools of Engineering
Arizona State University

Course Syllabus - Fall A 2022

CSE 575: Statistical Machine Learning

Contact Information

Instructor:	Mohammad Reza Hosseinzadeh Taher
Teaching Assistants:	Karthik Uppalapati Aayush Sharma
Content Questions:	Weekly Discussion Forums
Project or Assignment Questions:	Designated Discussion Forums
Slack Channel:	Direct Link: https://asu-2227-cse575-81662.slack.com **Note**: You must join/access this workspace using your ASURITE credentials.
Content Issues:	Course “Report an Issue” tool (clickable link on every content page)
Technical Support:	Coursera Learner Help Center **Note**: Please make sure you are logged in so that support personnel recognize you as an ASU learner.
General Support:	mcsonline@asu.edu **Note**: When sending an email about this class, please include the prefix "CSE 575" in the subject line of your message. Please use this email address for questions that are private in nature. If it is a question that would benefit your classmates, and is not private in nature, please post in the Discussion Forums.

Course Description

Deriving generalizable models from some given training data is central to statistical machine learning. Statistical machine learning has found wide applications in many fields including artificial intelligence,

computer vision, natural language processing, finance, bioinformatics, and etc. This course provides a systematic introduction to common learning paradigms in statistical machine learning, accompanied by an exploration of a set of foundational algorithms. Main topics covered include supervised learning, unsupervised learning, and deep learning.

Specific topics covered include:

- Mathematical foundations for machine learning
- Maximum likelihood estimation
- Naive Bayes classification
- Logistic regression
- Support vector machines
- Probabilistic graphical models
- Mixture models
- K-means clustering
- Spectral clustering
- Dimensionality reduction
- Principal component analysis
- Neural networks and deep learning
- Convolutional neural networks

Technologies covered include:

- Python
- Matlab
- Jupyter Notebooks
- Google Colab
- PyTorch

Learning Outcomes

Learners completing this course will be able to:

- Distinguish between supervised learning and unsupervised learning
- Apply common probability distributions in machine learning applications
- Use cross validation to select parameters
- Use maximum likelihood estimate (MLE) for parameter estimation
- Implement fundamental learning algorithms such as logistic regression and K-means clustering

- Implement more advanced learning algorithms such as support vector machines and convolutional neural networks
- Design a deep network using an exemplar application to solve a specific problem
- Apply key techniques employed in building deep learning architectures

Estimated Workload/ Time Commitment Per Week

Average of 18 - 20 hours per week

Required Prior Knowledge and Skills

This course will be very challenging, and learners are expected to learn the necessary technologies on their own time.

Proficient Mathematical Skills and Theoretical Understanding

- Basics of linear algebra
- Basics of probability and statistics
- Basics of calculus and set theory
- Basics of algorithm design and analysis

Strong Application Skills

- Programming in Python
- Ability to effectively read Python code
- Confidence executing at least one programming language:
    - Python
    - Matlab
    - R

Note: It is highly recommended that learners use Python to complete the coursework to get more support from the course team.

Proficient Experience

- High level programming language:
    - Python or Matlab
- Ability to implement Machine Learning Algorithms using Python

- Familiarity with any one of the following frameworks:
    - Jupyter Notebook
    - Google Colab
    - Pytorch
- Familiarity with the following tools/libraries:
    - Numpy
    - Pandas
    - Tensorflow
    - Keras
    - Matplotlib
    - Scikit Learn

Technology Requirements

Hardware

- Standard personal computer with major operating system (OS) and 8 GB RAM or higher and an x86-64 CPU
- Reliable, strong Internet connection
- Webcam
- Microphone

Software/Other

- GPU environment like Google Colab or personal setup on your own
- Technology integrations will be provided through Coursera
- Jupyter Notebook
- Pytorch
- Matlab
- Anaconda
- ProctorU

Textbook and Readings

At the graduate level, inquiry, research, and critical reading are part of the learning experience; however, this course does not have a required textbook. Any required readings are provided within or are accessible through the course of the ASU Library.

Professor Christopher Bishop, PhD has given ASU permission to provide his textbook *Pattern Recognition and Machine Learning* to you in this course.

You may print portions of the book or the entire book, but you may **not** share the PDF, in whole or part, with any parties outside of this course.

Please note:

1. Material in *Pattern Recognition and Machine Learning* that corresponds with topics covered in the lecture videos is highlighted in the course's Recommended Readings, which can be found in the overview section at the beginning of each week.
2. PRMLT | Pattern Recognition and Machine Learning Toolbox is a companion to Professor Bishop's textbook. On it you will find a package that is a Matlab implementation of the algorithms described in the book, some of which are covered in this course.

For interested learners, Drs. He, Tong, and Li recommend:

- *The Elements of Statistical Learning: Data Mining, Inference, and Prediction, Second Edition*. Trevor Hastie, Robert Tibshirani, and Jerome Friedman. Springer, 2009.
- *Semi-Supervised Learning*. Olivier Chapelle, Bernhard Sch¨olkopf, and Alexander Zien. The MIT Press, 2006.
- *Kernel Methods for Pattern Analysis*. John Shawe-Taylor and Nello Cristianini. Cambridge University Press, 2004.
- *Pattern Classification, Second Edition*. Richard Duda, Peter Hart, and David Stork. Wiley, 2000.
- *Machine Learning*. Tom Mitchell. McGraw Hill, 1997.
- *Introduction to Data Mining*. Pang-Ning Tan, Michael Steinbach, and Vipin Kumar. Addison Wesley, 2005.
- *Data Mining: Theories, Algorithms, and Examples*. Nong Ye. CRC Press, 2013.

Course Schedule and Important Dates

Course teams will not be working on ASU's days off* and those are listed in the Course Schedule. Please review the ASU Days Off for more details.

Week/Title	Begins at 12:01 AM Arizona (AZ) Time	Ends at 11:59 PM Arizona (AZ) Time
Welcome and Start Here	August 15, 2022	August 21, 2022
Week 1: Introduction to Machine Learning	August 18, 2022	August 21, 2022
Week 2: Mathematical Foundations and Supervised Learning	August 22, 2022	August 28, 2022
Week 3: Supervised Learning, Linear Machines, and Support Vector Machines	August 29, 2022	September 4, 2022
Week 4: Linear Machines, SVM, and Graphical Models **ASU Day Off: Monday, September 5, 2022*	September 5, 2022	September 11, 2022
Exam 1	September 12, 2022	September 18, 2022
Week 5: Unsupervised Learning and Clustering	September 12, 2022	September 18, 2022
Week 6: Spectral Clustering and Dimensionality Reduction	September 19, 2022	September 25, 2022
Course Survey	Check in your course	Check in your course
Week 7: Dimensional Reduction, Neural Networks, Deep Learning, and Exemplar Applications	September 26, 2022	October 2, 2022
Exam 2	September 30, 2022	October 8, 2022
Request for Faculty Review: MCS Portfolio Project Report Inclusion Request Optional and only a degree-seeking learner degree requirement	September 26, 2022	October 22, 2022

Faculty Feedback for the Review: MCS Portfolio Project Report Inclusion Request Optional and only a degree-seeking learner degree requirement	September 26, 2022	November 5, 2022

Grades are due October 10, 2022 . Please see the ASU Academic Calendar for additional information.

Assignment Deadlines and Late Penalties

Unless otherwise noted, all graded work is due on **Sundays at 11:59 PM Arizona (AZ) time**. For learners with accommodations through SAILS, please work with your SAILS consultant, Connect, and your instructor.

Graded Discussion Prompts

- **Week 1 Graded Discussion Prompt** - due at the end of Week 1
- **Week 2 Graded Discussion Prompt** - due at the end of Week 2
- **Week 3 Graded Discussion Prompt** - due at the end of Week 3
- **Week 4 Graded Discussion Prompt** - due at the end of Week 4
- **Week 5 Graded Discussion Prompt** - due at the end of Week 5
- **Week 6 Graded Discussion Prompt** - due at the end of Week 6

Graded Quizzes

A single-automatic late penalty of 5% is applied after the scheduled due date and time.

- **Week 1 Graded Quiz** - due at the end of Week 1
- **Week 2 Graded Quiz** - due at the end of Week 2
- **Week 3 Graded Quiz** - due at the end of Week 3
- **Week 4 Graded Quiz** - due at the end of Week 4
- **Week 5 Graded Quiz** - due at the end of Week 5
- **Week 6 Graded Quiz** - due at the end of Week 6

- **Week 7 Graded Quiz - Part 1** - due at the end of Week 7
- **Week 7 Graded Quiz - Part 2** - due at the end of Week 7

Assignments

A single-automatic late penalty of 5% is applied after the scheduled due date and time.

- **Mini-Assignment: Mathematical Foundations** - due at the end of Week 2
- **Mini-Assignment: Estimators** - due at the end of Week 2
- **Mini-Assignment: SVMs - Part 1** - due at the end of Week 4
- **Mini-Assignment: SVMs - Part 2** - due at the end of Week 4
- **Mini-Assignment: Dimensionality Reduction - Part 1** - due at the end of Week 6
- **Mini-Assignment: Dimensionality Reduction - Part 2** - due at the end of Week 6
- **Mini-Assignment: Key Techniques for Deep Learning** - due at the end of Week 7

Projects

A single-automatic late penalty of 5% is applied after the scheduled due date and time.

- **Project 1: Density Estimation and Classification** - due at the end of Week 3
- **Project 2: K-means-Strategy, Part 1 and Part 2** - due at the end of Week 5
- **Project 3: Classification Using Neural Networks and Deep Learning** - due at the end of Week 7

Exams

A single-automatic late penalty of 100% is applied after the scheduled due date and time.

- **Exam 1** - available from Monday, September 12, 2022 at 12:01 AM MST until Sunday, September 18, 2022 at 11:59 PM MST.
- **Exam 2** - available from Friday, September 30, 2022 at 12:01 AM MST until Saturday, October 08, 2022 at 11:59 PM MST.

Course Content

Each course in the MCS program is uniquely designed by expert faculty, so learners can best master the learning outcomes. As a result, course features and experiences are not the same across all MCS courses. Learners are expected to plan accordingly to accommodate for these differences.

Feedback Descriptions

The feedback descriptions are specific to auto-graded or auto-feedback items in the course.

- **Limited**: you will be able to see your Total Score, which includes the overall total percent (%) and the number (#) of points.
- **Partial**: you will be able to see your Question Score, which includes the correct or incorrect status and the total points for each question.
- **Full**: you will be able to see your Options and Feedback, which includes any itemized additional feedback.

Details of the main instructional and assessment elements in this course:

If you have specific questions related to instructional and assessment items in this course that you would like to be considered to be addressed in the weekly Live Event hosted by the instructor, please clearly indicate your request in your discussion posts.

Lecture Videos

The concepts you need to know are presented through a collection of video lectures. You may stream these videos for playback within the browser by clicking on their titles or download the videos. Where available, you may download the individual slides that go along with the videos. To further support learning, all of the videos include transcripts and most include PDF lecture slides. Weekly overview videos, assignment videos, and project-related videos do not have PDF lecture slides because they are not lectures and have associated documents specific to them.

A media guide is included at the beginning of each week in the Overview section. These guides are designed to give you a snapshot description of each week's media components and to provide the week's PDF lecture slides or note-taking materials where available, so you can plan your learning and quickly go back and review material as you prepare for your coursework.

Recommended Resources

Please explore the recommended resources to deepen your knowledge and enhance your skills on the topics covered each week. Although the content in these resources will not be explicitly assessed, they may support your learning and successful completion of coursework.

General Discussion Forums

General discussion forums are present each week in the course. Although the course team is engaged in these discussions, the forums are spaces to clarify, support, and enrich learner-to-learner communication and learning.

There are no late penalties. General discussion forums are not counted toward your final grade in the class.

Discussion Prompts

There are discussion prompts alongside other items in the course. Each prompt provides a space for you to respond. After responding, you can see and comment on your peers' responses. Discussion prompts are designed to provide:

1. Clarification
2. Feedback
3. Enrichment and deeper learning
4. Connections between concepts or key ideas
5. Reflection opportunities of real-world experiences
6. Respectful debate and perspective building
7. Resource sharing

There are no late penalties. Responses to discussion prompts are not counted toward your final grade in the class.

Graded Discussion Prompts

Each week will have a graded discussion prompt that must be completed. Review each discussion prompt's instructions, which may include reading an article, before posting. Each discussion activity requires three contributions:

1. A 100-150-word original post answering the provided discussion question
2. At least a 50-word reply to a classmate’s post

3. At least a 50-word reply to a second classmate's post

All contributions must be completed by the due date to potentially earn full-credit.

- You may support your discussion contributions with brief references to outside works, provided you cite your source(s) and demonstrate direct relevance to the discussion prompt.
    - Citations may be in one of the following styles: APA, ACM, or IEEE.
    - Once you select a style, use only it throughout your posts.
- For every graded discussion activity, remember that clear, accurate, and relevant posts that demonstrate substantive analysis of the application presented in the article will lead to the most productive discussion.

Graded discussion prompts are counted toward your final grade in the class.

Knowledge Checks

Designed to support your learning, these are short, ungraded quizzes to test your knowledge of the concepts presented in the lecture videos. You may take your time, review your notes, and learn at your own pace because knowledge checks are untimed. With unlimited attempts, you may retake these as often as you would like at any point in the course. You are encouraged to read the full feedback, review your answer choices, and compare them to the correct answers. With the feedback as your guide, you may use these as opportunities to study for other assessments and tasks in the course.

There are no late penalties. Knowledge Checks are not counted toward your final grade in the class.

Mini-Assignments

Mini-Assignments are weekly graded opportunities for you to practice applying the week's content. These are in the form of quizzes, ranging from 1 - 6 questions and some may require you to enter code.

- You will be allowed three (3) attempts with unlimited time to complete each attempt.
- Mini-assignment questions provide limited feedback.

There is a late penalty of 5% for each day past the deadline. Mini-Assignments count toward 20% your final grade in the class.

Graded Quizzes

Weeks 1-6 each include one (1) graded quiz and Week 7 includes two (2) graded quizzes for a total of eight (8) graded quizzes in the course. Each graded quiz includes several single-select multiple choice questions. You will be allowed one (1) attempt for each of these quizzes. There is no time limit on how long you take to complete each quiz. Once you open a graded quiz or test, the timer will start and you are to complete the assessment in a single session. Graded quizzes in this course include limited feedback. Read the Graded Quiz and Exam Policy for your course for more information.

Seven (7) of the eight (8) quizzes count toward your final grade in the class. The lowest one (1) quiz is automatically dropped from your grade. Graded quizzes count toward your final grade in the class. There is a late penalty of 25% for each day past the deadline.

Individual Projects

This course includes three (3) individual projects. All projects are provided in the first week of the course in the *Welcome and Start Here* section, so you can preview what is expected and design your own learning schedules to complete these on time. Each project has a lab to work in, a submission space for results, and a submission space for the report at the end of the week it is due. As a set of three (3), the projects may be included in the Request for Faculty Review: MCS Portfolio Project Report Inclusion Request, which is optional and for degree-seeking learners only.

These projects count toward your final grade in the class.

- Project 1: Density Estimation and Classification
- Project 2: K-means-Strategy
- Project 3: Classification Using Neural Networks and Deep Learning

Request for Faculty Review: MCS Portfolio Project Report Inclusion Request

This is an optional task for degree students wanting to use this course's projects as part of their portfolio degree requirement/specialization requirements. Review your onboarding course and the Welcome and Start Here section of your course for more details. The submission space is towards the end of the course.

Although there are no late penalties, these requests must be submitted by the designated deadline. The Request for Faculty Review: MCS Portfolio Project Report Inclusion Request does not count toward your final grade in the class.

- Address these projects in your Request for Faculty Review: MCS Portfolio Project Report Inclusion Request:
    - Project 1: Density Estimation and Classification
    - Project 2: K-means-Strategy
    - Project 3: Classification Using Neural Networks and Deep Learning

Practice Exam Questions

In this rigorous course, there are practice exam questions to prepare you for your proctored exams. Please review the questions and their solutions to help you prepare for the proctored exam.

You may engage with your peers in the discussion forums to address questions, share resources and strategies, and provide feedback to help one another learn.

There are no late penalties. Practice exams are not counted toward your final grade in the class.

Proctored Exams:

You have two (2) proctored, timed exams. These consist of Exam 1 and Exam 2. Proctored exams include limited feedback. Read the Graded Quiz and Exam Policy for your course for more information.

No late exams will be permitted or accepted and will result in a score of zero points (0). This does not include established accommodations for learners with disabilities. Proctored exams count toward your final grade in the class.

Exam Details	Exam 1	Exam 2
Content Covered	Weeks 1, 2, 3, and 4	Weeks 5, 6, and 7
Question Type	single-answer multiple choice questions	single-answer multiple choice questions
Number of Questions	21 total questions (20 content questions pulled randomly from a question bank + 1 academic integrity question)	21 total questions (20 content questions pulled randomly from a question bank + 1 academic integrity question)

Availability Start	Monday, September 12, 2022 at 12:01 AM AZ Time	Friday, September 30, 2022 at 12:01 AM AZ Time
Availability End	Sunday, September 18, 2022 at 11:59 PM AZ time	Saturday, October 08, 2022 at 11:59 PM AZ time
Last Available ProctorU Appointment	Sunday, September 18, 2022 at 9:01 PM Phoenix time.	Saturday, October 08, 2022 at 9:01 PM Phoenix time.
Duration	120 minutes + plan for at least 15 minutes for proctoring set up	120 minutes + plan for at least 15 minutes for proctoring set up

Exam Allowances

- **Hardcopy and/or digital books and/or reference materials (all)**: None
- **Calculators (all)**: Computer calculator only
- **Notes in any format of any kind (all)**: One (1) sheet of hard copy front-and-back, handwritten, printed, or a combination of handwritten and printed notes on standard letter (8.5 inches x 11 inches)/A-4 paper as reference during the exam. No electronic/digital notes are allowed.
- **Web (all)**: None
- **Software (all)**: None
- **Other technologies, devices, and means of communication (all)**: None
- **Whiteboard, scratch paper, writing utensils, erasing resources**: Learners are *strongly* encouraged to use the whiteboard option instead of scratch paper.
    - If using a whiteboard, learners may have erasable whiteboard markers and what is needed to erase writing on the whiteboard; please have extra whiteboard markers and eraser resources in your testing area.
    - If using scratch paper, learners may have an unlimited amount of blank scratch paper of any size, writing utensils (e.g., pens, pencils, markers, and/or highlighters) and erasers; please have extra ones in your testing area should you run out of ink, the pencil breaks, etc.

    - Before the exam concludes and the proctoring session ends, all scratch paper must be destroyed and all whiteboard markings must be erased. The last question in the exam will be a confirmation of learners executing these ASU academic integrity actions.

- **Other**: Learners are to independently take the exam in a single session without leaving the testing space (e.g., no bathroom breaks) to ensure proctoring of the entire session. Once you open the exam, your testing session begins. You will be allowed one (1) attempt to take and complete each exam. Learners are to stay within a clear view of the proctor throughout the duration of the proctored exam session. You will be unable to open the exam until the exam proctor enters the password during the date and time you scheduled to take your exam with ProctorU.

- **Reminder**: All virtual machines must be closed *prior* to starting proctoring.

Proctoring

ProctorU is an online proctoring service that allows learners to take exams online while ensuring the integrity of the exam for the institution.

- You are expected to scan your testing space using your webcam for the proctor. Proctoring also requires you to have sound and a microphone. Please plan accordingly.

- You are strongly encouraged to schedule your exam(s) within the first two weeks of the course to ensure you find a day and time that works best for your schedule. Time slots can fill up quickly, especially during high volume time periods.

    - You *must* set up your proctoring at least 72 hours prior to the exam.

- **The exam proctor will input the exam password**.

- Additional information and instructions are provided in the *Welcome and Start Here* section of the course.

- **When you are going to schedule exams, you *must* pick "Coursera" as your institution.**

- Learners with exam accommodations through Student Accessibility and Inclusive Learning Services (SAILS) should not schedule exams until they receive an email invitation specifically for them from ProctorU.

- Your ID needs to be in English. See your MCS Onboarding Course for more information.

Course Grade Breakdown

Course Work	Quantity	Team or Individual	Percentage of Grade
Graded Discussion Prompts	6		5%
Graded Quizzes	8		5%
Mini-Assignments	7		20%
Project 1: Density Estimation and Classification	1		30%
Project 2: K-means-Strategy	1		
Project 3: Classification Using Neural Networks and Deep Learning	1		
Exam 1	1		20%
Exam 2	1		20%

*The project(s) count for 30% or more of the overall course grade, so this is a portfolio eligible course. See the MCS Graduate Handbook for more information about the portfolio requirement if you are a degree student.

Grade Scale

You must earn a cumulative grade of 70% to earn a “C” in this course. You must earn at least a “C” to receive graduate credit. This course has no grade curving. All graded coursework will be included to calculate grades (i.e., no graded items will be dropped) or add the drop rule. Grades will not be rounded. Grades in this course will **not** include pluses or minuses.

The instructor reserves the right to adjust individual grades based on, but not limited to: violations of academic integrity.

Letter Grade	Percentage

A	90% - 100%
B	80% - 89.99%
C	70% - 79.99%
D	60% - 69.99%
E	<60%

Live Events

This course has two types of live events: **Live Sessions** and **Virtual Office Hours**. Check the Live Events page in your course for your local time and access details. Although we try to be consistent for our learners' planning purposes, the Live Event schedule is subject to change throughout the course, so stay up-to-date on the event details by checking your Course Announcements and the Live Events page in your course.

You may join all live events from the course's Live Events page. The event's title will become active as a Zoom link 10 minutes before each event starts. You will also receive an email with a link to the Live Session or Virtual Office Hours the day before the event starts.

Read about the specific policies related to Live Events in the Policy section of this syllabus: Live Events, Policy Regarding Expected Classroom Behavior, and the Student Code of Conduct for more detailed information.

Live Sessions - Weekly

Live Sessions are a valuable part of the learning experience because learners can meet with the course instructor and fellow classmates to learn more about course topics, special topics within the field, and discuss coursework. If you are able to attend Live Sessions, you are strongly encouraged to do so. If you have specific questions or topics of interest to be discussed during Live Sessions, please indicate your request in a Discussion Forum post. Although it may not be possible to address all requests during the Live Session, the instructor is interested in tailoring this time to your questions and interests. The instructor will be following a set agenda, so please be mindful of that when engaging in the Live Sessions.

Live Sessions hosted by the faculty will be recorded and uploaded to the course.

- Instructor's live session is Mondays from 11:00 AM to 12:00 PM
  Zoom link: https://asu.zoom.us/j/9105371617

- Check the Live Events tab in your course and the course announcements for your faculty's Live Session information.

Virtual Office Hours - Weekly

Virtual Office Hours offer a chance for learners to get their questions answered from the course team. Although the course team is responsive to trends in the Discussion Forums and mcsonline@asu.edu emails, Virtual Office Hours focus on addressing learners' specific questions related to content: clarifications, reteaching, assessment review, etc. These sessions are not intended to address program or course design questions or feedback. Assistants do not have the authority to weigh in or make decisions regarding those items, so please do not include those at this time. These sessions are specific to helping learners learn materials and understand various course assessments. Feedback of that nature is best addressed in the communication channel: mcsonline@asu.edu and please include it in your course survey.

Virtual Office Hours are hosted by various team members and are recorded, but not uploaded into the course. This is up to the faculty's discretion.

- Karthik's Virtual Office Hours will be Fridays from 3:00 PM to 5:00 PM and Saturdays from 11:00 AM to 12:00 PM. Zoom link: https://asu.zoom.us/j/7360511149
- Aayush's Virtual Office Hours will be Wednesdays from 6:00 PM to 7:00 PM and Thursdays from 1:00 PM to 2:00 PM. Zoom link: https://asu.zoom.us/j/88133071617
- Check the Live Events tab in your course and the course announcements for virtual office hours with other course team members.

Slack Channel

This course will have a unique Slack workspace where you can communicate with your classmates.

You must join/access this workspace using your ASURITE credentials.

While your instructors have access to the Slack workspace, it is intended to provide a space to create community with your classmates. Please remember to follow the communication protocol pinned in your Slack channel to ensure that any questions or concerns you have are addressed in a timely manner. Also, please remember ASU's Academic Integrity policy, and refrain from sharing assessment questions, answers or solutions.

Course Outline with Assignments

Please review the ASU Days Off for more details. Course teams will not be working on ASU's days off.

Welcome and Start Here (8/15 - 8/21)

Topics

- ☐ Academic Integrity
- ☐ Course Syllabus
- ☐ Required Prior Knowledge and Skills and Technology Requirements
- ☐ Course Projects Overview
- ☐ Graded Coursework Instructions
- ☐ Exam Information and ProctorU

Other Tasks

- ☐ Required Checkpoint: Technology Access and Installation
- ☐ Activity: Zeemap
- ☐ Discussion: Get to Know Your Classmates
- ☐ Schedule your proctoring with ProctorU for your proctored exam(s)
- ☐ Required Checkpoint: Getting Started Quiz

Graded Coursework

- ☐ N/A

Week 1: Introduction to Machine Learning (8/18 - 8/21)

Topics

- ☐ Introduction to Machine Learning
- ☐ Machine Learning Examples

Other Tasks

- ☐ Schedule your proctoring with ProctorU for your proctored exam(s).
    - For learners needing accommodations, submit requests through Connect and review the ASU Student Accessibility and Inclusive Learning Services website.
    - Learners with exam accommodations through SAILS should not schedule exams until they receive an invitation specifically for them from ProctorU.
- ☐ Knowledge Checks

Graded Coursework

- ☐ Graded Discussion Prompt: Applications of Machine Learning: Energy Performance of Buildings
- ☐ Week 1: Quiz

Week 2: Mathematical Foundations and Supervised Learning (8/22 - 8/28)

Topics

- ☐ Mathematical Foundations
- ☐ Supervised Learning - Naive Bayes & Logistic Regression

Other Tasks

- ☐ Schedule your proctoring with ProctorU for your proctored exam(s), if you have not already done so.
    - Learners with exam accommodations through SAILS should not schedule exams until they receive an invitation specifically for them from ProctorU.
- ☐ Knowledge Checks

Graded Coursework

- ☐ Graded Discussion Prompt: Applications of Machine Learning: Motor Vehicle Crashes
- ☐ Mini-Assignment: Mathematical Foundations
- ☐ Mini-Assignment: Estimators
- ☐ Week 2: Quiz

Week 3: Supervised Learning, Linear Machines, and Support Vector Machines (8/29 - 9/04)

Topics

- ☐ Supervised Learning: Naive Bayes and Logistic Regression
- ☐ Linear Machines and SVM
- ☐ Naive Bayesian-example

Other Tasks

- ☐ Knowledge Checks

Graded Coursework

- ☐ Graded Discussion Prompt: Applications of Machine Learning: Regional Hazard Management
- ☐ Project 1: Density Estimation and Classification
  - ☐ Lab: Project 1: Naive Bayes Classifier
  - ☐ Quiz: Project 1: Density Estimation and Classification Result Submission
  - ☐ Graded Assignment: Project 1: Density Estimation and Classification Report Submission

Week 4: Linear Machines, SVM, and Graphical Models (9/05 - 9/11)

Topics

- ☐ Linear Machines and SVM
- ☐ Graphical Models

Other Tasks

- ☐ Knowledge Checks

- ☐ Practice Exam Questions
- ☐ Schedule your proctoring with ProctorU for your proctored exam(s), if you have not already done so.
    - Learners with exam accommodations through SAILS should not schedule exams until they receive an invitation specifically for them from ProctorU.

Graded Coursework

- ☐ Graded Discussion Prompt: Applications of Machine Learning: Energy Performance of Buildings
- ☐ Mini-Assignment: SVMs - Part 1
- ☐ Mini-Assignment: SVMs - Part 2
- ☐ Week 4: Quiz

Exam 1 (09/12 - 09/18)

Reminders

- ☐ Schedule your proctoring with ProctorU for your proctored exam(s), if you have not already done, at least 72 hours prior to your desired exam date and within the availability window.
- ☐ Covers content from weeks 1, 2, 3, and 4.
- ☐ Review the details and allowances information for this exam.
- ☐ Prepare for the exam and review the practice exam questions.

Week 5: Unsupervised Learning and Clustering (09/12 - 09/18)

Topics

- ☐ Unsupervised Learning and Data Clustering
- ☐ Spectral Clustering

Other Tasks

- ☐ Knowledge Checks

Graded Coursework

- ☐ Graded Discussion Prompt: Applications of Machine Learning: College Students' Academic Achievement

- ☐ Project 2: K-means-Strategy
  - ☐ Lab: Project 2: K-means-Strategy, Part 1
  - ☐ Quiz: Project 2: K-means-Strategy, Part 1 Result Submission
  - ☐ Lab: Project 2: K-means-Strategy, Part 2
  - ☐ Quiz: Project 2: K-means-Strategy, Part 2 Result Submission
  - ☐ Graded Assignment: Project 2: K-means-Strategy Report Submission
- ☐ Week 5: Quiz

Week 6: Spectral Clustering and Dimensional Reduction (09/19 - 09/25)

Topics

- ☐ Spectral Clustering
- ☐ Dimensionality Reduction

Other Tasks

- ☐ Knowledge Checks
- ☐ Complete the course survey before your final exam (strongly encouraged, appreciated, and used by the course team).

Graded Coursework

- ☐ Graded Discussion Prompt: Applications of Machine Learning: Early Medical Diagnosis
- ☐ Mini-Assignment: Dimensionality Reduction - Part 1
- ☐ Mini-Assignment: Dimensionality Reduction - Part 2
- ☐ Week 6: Quiz

Week 7: Dimensional Reduction, Neural Networks, Deep Learning, and Exemplar Applications (09/26 - 10/02)

Topics

- ☐ Dimensionality Reduction
- ☐ Neural Networks & Deep Learning
- ☐ Exemplar Deep Learning Applications
- ☐ Industry Perspective Wrap-Up

Other Tasks

- ☐ Knowledge Checks
- ☐ Practice Exam Questions
- ☐ Schedule your proctoring with ProctorU for your proctored exam(s), if you have not already done, at least 72 hours prior to your desired exam date and within the availability window.
- ☐ Request for Request for Faculty Review: MCS Portfolio Project Report Inclusion Request.
    - Optional for degree students wanting to use this course's projects as part of their portfolio degree requirement/specialization requirements.
- ☐ Complete the course survey before your final exam (strongly encouraged, appreciated, and used by the course team).

Graded Coursework

- ☐ Mini-Assignment: Key Techniques for Deep Learning
- ☐ Project 3: Classification Using Neural Networks and Deep Learning
    - ☐ Lab: Project 3: Classification Using Neural Networks and Deep Learning
    - ☐ Quiz: Project 3: Classification Using Neural Networks and Deep Learning Result Submission
    - ☐ Graded Assignment: Project 3: Classification Using Neural Networks and Deep Learning Report Submission
- ☐ Week 7: Quiz Part 1
- ☐ Week 7: Quiz Part 2

Exam 2 (09/30 - 10/08)

Reminders

- ☐ Complete the course survey before your final exam (strongly encouraged, appreciated, and used by the course team).
- ☐ Schedule your proctoring with ProctorU for your proctored exam(s), if you have not already done, at least 72 hours prior to your desired exam date and within the availability window.
- ☐ Covers content from weeks 5, 6, and 7.
- ☐ Review the details and allowances information for this exam.
- ☐ Prepare for the exam and review the practice exam questions.

Policies

All ASU and Coursera policies will be enforced during this course. For policy details, please consult the MCS Graduate Handbook and the MCS Onboarding Course.

Graded Quizzes and Exams

Each course in the MCS program is uniquely designed by expert faculty so that learners can best master the learning outcomes specific to each course. By design, course features and experiences are different across all MCS courses.

In the MCS program, we strive to provide learners with exercises and applied practice beyond quizzes and exams that align with the hands-on nature of the computer science industry. Ungraded practice opportunities *may* include, but are not limited to: in-video-questions (IVQs), knowledge check quizzes (KCs), weekly (i.e., unit) practice quizzes, practice exams, and other assignments or exercises. For all these learning activities, the questions and correct answers are provided to learners. When available, auto-generated typed feedback is built into the course to further help learners learn in real-time. Please thoroughly review your course to ensure that you are aware of the types of practice opportunities available to you.

If learners desire 1:1 feedback for their questions on graded assessments, please submit questions to mcsonline@asu.edu. Rather than receiving the exact questions learners had correct and incorrect and the answers to those questions, learners will likely receive the concepts that were covered in the assessment questions so they will know what they need to review prior to other assessments and how to apply this information in their professional environments.

Absence Policies

There are no required or mandatory attendance events in this online course. Live Events, both Live Sessions hosted by the instructor and Virtual Office Hours hosted by the course team do not take attendance.

Learners are to complete all graded coursework (e.g., projects and exams). If exceptions for graded coursework deadlines need to be made for excused absences, please reach out to the course team by the end of the second week of the course using the mcsonline@asu.edu email address. Review the exam availability windows and schedule accordingly. The exam availability windows allow for your own flexibility and you are expected to plan ahead. Personal travel does not qualify as an excused absence and does not guarantee an exception.

Review the resources for what qualifies as an excused absence and review the late penalties in the Assignment Deadlines and Late Penalties section of the syllabus and the course:

a. Excused absences related to religious observances/practices that are in accord with ACD 304–04, “Accommodation for Religious Practices” (please see Religious Holidays and Observances).

b. Excused absences related to university sanctioned events/activities that are in accord with ACD 304–02, “Missed Classes Due to University-Sanctioned Activities”.

c. Excused absences related to missed class due to military line-of-duty activities that are in accord with ACD 304–11, “Missed Class Due to Military Line-of-Duty Activities,” and SSM 201–18, “Accommodating Active Duty Military”.

Live Event Expectations

The environment should remain professional at all times. Inappropriate content/visuals, language, tone, feedback, etc. will not be tolerated, reported and subject to disciplinary action. Review the Policy Regarding Expected Classroom Behavior section of the syllabus and the Student Code of Conduct for more detailed information.

Policy Regarding Expected Classroom Behavior

The aim of education is the intellectual, personal, social, and ethical development of the individual. The educational process is ideally conducted in an environment that encourages reasoned discourse, intellectual honesty, openness to constructive change, and respect for the rights of all individuals. Self-discipline and a respect for the rights of others in the university community are necessary for the fulfillment of such goals. An instructor may withdraw a student from a course with a mark of “W” or “E” or employ other interventions when the student’s behavior disrupts the educational process. For more information, review SSM 201–10.

If you identify something as unacceptable classroom behavior on the class platform (e.g., Coursera Discussion Forum) or communication channels (e.g., Zoom, Virtual Live Session, Virtual Office Hours, Slack, etc.), please notify the course team using the mcsonline@asu.edu email. In the Discussion Forums, you can also flag the post for our attention. For more specifics on appropriate participation, please review our Netiquette infographic.

Our classroom community rules are to:

- Be professional
- Be positive

- Be polite
- Be proactive

Academic Integrity

Students in this class must adhere to ASU's academic integrity policy, which can be found at https://provost.asu.edu/academic-integrity/policy). Students are responsible for reviewing this policy and understanding each of the areas in which academic dishonesty can occur. In addition, all engineering students are expected to adhere to both the ASU Academic Integrity Honor Code and the Fulton Schools of Engineering Honor Code. All academic integrity violations will be reported to the Fulton Schools of Engineering Academic Integrity Office (AIO). The AIO maintains a record of all violations and has access to academic integrity violations committed in all other ASU colleges/schools.

Copyright

The contents of this course, including lectures (Zoom recorded lectures included) and other instructional materials, are copyrighted materials. Students may not share outside the class, including uploading, selling or distributing course content or notes taken during the conduct of the course. Any recording of class sessions is authorized only for the use of students enrolled in this course during their enrollment in this course. Recordings and excerpts of recordings may not be distributed to others. (see ACD 304–06, "Commercial Note Taking Services" and ABOR Policy 5-308 F.14 for more information).

You must refrain from uploading to any course shell, discussion board, or website used by the course instructor or other course forum, material that is not the student's/learner's original work, unless the student/learner first complies with all applicable copyright laws; faculty members reserve the right to delete materials on the grounds of suspected copyright infringement.

Policy Against Threatening Behavior, per the Student Services Manual, (SSM 104-02)

Students, faculty, staff, and other individuals do not have an unqualified right of access to university grounds, property, or services (see SSM 104-02). Interfering with the peaceful conduct of university-related business or activities or remaining on campus grounds after a request to leave may be considered a crime. All incidents and allegations of violent or threatening conduct by an ASU

student (whether on- or off-campus) must be reported to the ASU Police Department (ASU PD) and the Office of the Dean of Students.

Disability Accommodations

Suitable accommodations will be made for students having disabilities. Students needing accommodations must register with ASU Student Accessibility and Inclusive Learning Services. Students should communicate the need for an accommodation at the beginning of each course so there is sufficient time for it to be properly arranged. These requests should be submitted through the online portal. See ACD 304-08 Classroom and Testing Accommodations for Students with Disabilities. ASU Student Accessibility and Inclusive Learning Services will send the instructor of record a notification of approved accommodations and students are copied on these letters. It is recommended that students reply to the faculty notification letters, introduce themselves to their instructor, and share anything they might want to disclose.

Harassment and Sexual Discrimination

Arizona State University is committed to providing an environment free of discrimination, harassment, or retaliation for the entire university community, including all students, faculty members, staff employees, and guests. ASU expressly prohibits discrimination, harassment, and retaliation by employees, students, contractors, or agents of the university based on any protected status: race, color, religion, sex, national origin, age, disability, veteran status, sexual orientation, gender identity, and genetic information.

Title IX is a federal law that provides that no person be excluded on the basis of sex from participation in, be denied benefits of, or be subjected to discrimination under any education program or activity. Both Title IX and university policy make clear that sexual violence and harassment based on sex is prohibited. An individual who believes they have been subjected to sexual violence or harassed on the basis of sex can seek support, including counseling and academic support, from the university. If you or someone you know has been harassed on the basis of sex or sexually assaulted, you can find information and resources at https://sexualviolenceprevention.asu.edu/faqs.

Mandated sexual harassment reporter: As a mandated reporter, I am obligated to report any information I become aware of regarding alleged acts of sexual discrimination, including sexual violence and dating violence. ASU Counseling Services, https://eoss.asu.edu/counseling, is available if you wish to discuss any concerns confidentially and privately.

Disclaimer

The information in this syllabus may be subject to change without advance notice. Stay informed by checking course announcements and the syllabus section of your course.

Course Creator(s)

Jingrui He

Jingrui He, PhD is an associate professor in the School of Computing and Augmented Intelligence (SCAI) within the Fulton Schools of Engineering (FSE) at Arizona State University (ASU). She received her PhD from Carnegie Mellon University. She joined ASU in 2014 and directs the Statistical Learning Lab (STAR Lab). Her research focuses on rare category analysis, heterogeneous machine learning, active learning and semi-supervised learning, with applications in social media analysis, healthcare, manufacturing process, etc.

Baoxin Li

Baoxin Li, PhD is currently a professor and the chair of the Computer Science & Engineering Program and a Graduate Faculty Endorsed to Chair in the Electrical Engineering and Computer Engineering programs. From 2000 to 2004, he was a Senior Researcher with SHARP Laboratories of America, where he was the technical lead in developing SHARP's HiIMPACT Sports™ technologies. He was also an Adjunct Professor with the Portland State University from 2003 to 2004. His general research interests are on visual computing and machine learning, especially their application in the context of human-centered computing.

Hanghang Tong

Hanghang Tong, PhD is an associate professor at School of Computing and Augmented Intelligence (SCAI) within the Fulton Schools of Engineering (FSE) at Arizona State University (ASU) since August 2014. Before that, he was an assistant professor at the Computer Science Department, City College, City University of New York, a research staff member at IBM T.J. Watson Research Center and a Post-doctoral fellow in Carnegie Mellon University. His research interest is in large scale data mining for graphs and multimedia.