

SER 594

Topic: **Software Engineering for Machine Learning**

<http://javiergs.com/teaching/ser594/>

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1. Description

This course: (a) presents frameworks and tools for developing and incorporating machine-learning components into software systems; and (b) examines the application, adaptation, and extension of software engineering practices to develop and adopt machine-learning-enabled robust, secure, and scalable systems.

2. Credits

Three credits, lecture

3. Prerequisites or co-requisites

Graduate Computer Engineering or Computer Science or Software Engineering student.

Topics that you are expected to have learned before taking this class includes:

- Be familiar with data abstraction techniques, object-oriented design, and static and dynamic data structures, including Arrays, Strings, and Stacks.
- Understand programming techniques and control structures like branching, iteration, and recursion.
- **Been proficient in a high-level programming language like Java or C++** and the environment in which a program is developed (editor, compiler/interpreter, linker, source code, executable code, debugging tool, etc.)
- Previous knowledge of ML techniques is a plus but not mandatory.

4. Topics

This course will provide you with

- Overview of ML techniques and the type of problems they apply,
- Summary of frameworks, tools, and libraries available to include ML models in software applications,
- Practical examples of using these techniques and libraries to develop applications with ML capabilities, including text mining, image recognition, recommendation engines, and anomaly (fraud) detection.

Our course has a software engineering focus, and its core is the integration of ML into software systems applications. ML models are just one component, and we will review its creation and integration into the application considering good practices for performance, extensibility, modifiability, and reuse.

We will be covering the following main topics

1. Applied machine learning QuickStart
 - Data, data processing, data cleaning, and sampling
 - Fundamentals on supervised and unsupervised learning
 - Understanding classification, regression
 - Understanding clustering
 - Neural networks
2. Building ML applications
 - Software architecture for ML applications
 - ML Patterns
 - Public available Datasets and Repositories
 - Machine Learning Libraries – (I would assume Java knowledge), thus work with Java libraries:
 - Comparing Libraries
 - Working with Weka, DeepLearning4J, Mallet, Encog, and Apache Products
3. Assembling applications for:
 - Text Mining
 - Recommendation Engines
 - Pattern (Image) recognition
 - Anomaly (outliers) detection

5. References

- **Required:** Collection of papers posted on class' Canvas Site.

6. Use your ASU Email

ASU email is an official means of communication among students, faculty, and staff. Students are expected to read and act upon email in a timely fashion. Students bear the responsibility of missed messages and should check their ASU-assigned email regularly.

- **Always Use your ASU email to contact your Instructor, TAs, and Staff Members.**
- Use a clear subject line. And **include the course number as a prefix**. It would improve your chances of receiving a prompt reply.
- Did I mention "always Use your ASU email to contact your Instructor, TAs, and Staff Members"?

7. Evaluation and Grading Policies

Your course grade will be based on the distribution below:

- | | |
|-----------------------------|-----|
| ▪ Exams | 50% |
| ▪ Quizzes | 25% |
| ▪ Assignments (Programming) | 25% |

The following is the grading scale that will be used in the course:

- | | | |
|------|----|-----|
| ▪ A | >= | 95% |
| ▪ A- | >= | 90% |
| ▪ B+ | >= | 85% |
| ▪ B | >= | 80% |
| ▪ B- | >= | 75% |
| ▪ C+ | >= | 70% |
| ▪ C | >= | 65% |
| ▪ D | >= | 60% |
| ▪ E | < | 60% |

Grades reflect your performance on assignments and adherence to deadlines. Grades on assignments will be available within a week (or two) of the due date in the Gradebook.

Any **discrepancy or disagreement in grading must be presented within a week** of receiving your graded materials; otherwise, no grade change will be made.

The grade of "I" (incomplete) can be given ONLY when a student, who is doing otherwise acceptable work (passing grade), is unable to complete a part of work (e.g., the final exam) because of documented illness or other conditions beyond the student's control. In the latter case, the student must discuss with the instructor and complete an application form from the

department before the part of work is due or as soon as the circumstances are known. Please see ASU grading policies at: <https://students.asu.edu/grades>

7.1. Exams

- There will be **two exams** (a midterm and a final exam) given during the semester.
- **The exams will be comprehensive.** Exams may consist of multiple choice, fill-in-the-blank, short answer, programming problems, or any combination thereof.

7.2. Assignments and Quizzes

- Assignments and quizzes will be given throughout the semester. They are designed to help you practice the concepts you need to learn in this class. Finding the answer somewhere does not equal practice. Programming projects should take you anywhere from thirty minutes to ten hours to complete, depending on your skill level and study habits. They may include a written portion, a programming portion, or both. If you have trouble, please take advantages of office hours and other help resources, such as the discussion board and tutoring services. Assignments and projects **can never be made up** and **can never be turned in late**. The only exceptions are those mentioned in ASU policies including medical, family, and other unforeseen events.
- All assignments, unless otherwise announced, **MUST** be submitted to the designated area of Canvas. **Do not submit an assignment via email.**
- Assignment **due dates follow Arizona Standard time**. Click the following link to access the [Time Converter](#) to ensure you account for the difference in Time Zones. Note: Arizona does not observe daylight savings time.
- Quizzes may be announced during the class or they **may be unannounced**. There are **no make-ups for missed quizzes**.
- Notify the instructor **BEFORE an assignment is due** if an urgent situation arises (obviously, unless it is an unforeseen emergency) and you are unable to submit the assignment on time.
- Follow the appropriate **University policies to request an accommodations**. Accommodations can be made for religious observances provided that students notify the instructor at the **beginning of the semester** concerning those dates. Also, students who expect to miss class due to officially university-sanctioned activities should **inform the instructor early in the semester**. Alternative arrangements will generally be made for any examinations and other graded in-class work affected by such absences. The preceding policies are based on [ACD 304-04](#), "Accommodation for Religious Practices" and [ACD 304-02](#), "Missed Classes Due to University-Sanctioned Activities."

8. Classroom Behavior

Cell phones and pagers (must be/or state alternative rule) turned off during class to avoid causing distractions. **The use of recording devices is not permitted during class.** Any violent or threatening conduct by an ASU student in this class will be reported to the ASU Police Department and the Office of the Dean of Students.

How Long Students Should Wait for an Absent Instructor? In the event the instructor fails to indicate a time obligation, the time obligation will be 15 minutes for class sessions lasting 90 minutes or less, and 30 minutes for class sessions lasting more than 90 minutes. Students may be directed to wait longer by someone from the academic unit if they know the instructor will arrive shortly.

Due To COVID-19 Situation:

Until further notified, per ASU policy, faculty, staff, students and visitors, are required to wear face coverings in classrooms, labs, offices and community spaces.

9. Disability Accommodations.

Suitable accommodations will be made for students having disabilities and students should notify the instructor as early as possible if they will require same. Such students **must be registered with the Disability Resource Center** and provide documentation to that effect. See [ACD 304-08](#) Classroom and Testing Accommodations for Students with Disabilities.

10. Academic Integrity and Honor Code

You are encouraged to cooperate in study group on learning the course materials. However, you may not cooperate on preparing the individual assignments. Anything that you turn in must be your own work: You must write up your own solution with your own understanding. If you use an idea that is found in a book or from other sources, or that was developed by someone else or jointly with some group, make sure you acknowledge the source and/or the names of the persons in the write-up for each problem. When you help your peers, you should never show your work to them. All assignment questions must be asked in the course discussion board. Asking assignment questions or making your assignment available in the public websites before the assignment due will be considered cheating. All individual tests must be done independently. Working together during tests is not permitted.

The instructor and the TA will CAREFULLY check any possible proliferation or plagiarism by comparing among the student submissions, previous student submissions, and the publications in the public Web sites. We will use the document/program comparison tools like MOSS (Measure of Software Similarity: <http://moss.stanford.edu/>) to check all assignments and tests that you submitted for grading.

The Ira A. Fulton Schools of Engineering expect all students to adhere to ASU's policy on Academic Dishonesty. These policies can be found in the Code of Student Conduct:

<https://provost.asu.edu/academic-integrity>

ALL cases of cheating or plagiarism will be handed to the Dean's office. Penalties include a failing grade in the class, a note on your official transcript that shows you were punished for cheating, suspension, expulsion and revocation of already awarded degrees.

Fulton Schools of Engineering Honor Code

<https://engineering.asu.edu/integrity/>

- a) Seek out, acquaint myself with, and obey the instructor's rules concerning the materials I am allowed to use and the types of collaboration in which I am permitted to engage in each of my courses.
- b) Help my fellow engineering students to succeed both academically and professionally, while both following the instructor's guidelines on collaboration and encouraging my classmates to behave ethically.
- c) Ensure that all of my individual work products reflect my own abilities and not those of someone else. I will never copy the work of others or give others the opportunity to copy mine.
- d) Contribute a fair share of work to all teamwork in which I participate, and acknowledge the contributions of others. I will accept responsibility for the integrity of all work submitted by my team.
- e) Use only aids authorized by the instructor during all examinations, quizzes, projects, assignments and other evaluations.
- f) Provide aid to, or receive aid from other students only as permitted by the instructor.
- g) Give full credit to others for their words and ideas, whether directly quoted or paraphrased, using proper citation practices in all of my work, including text, figures and computer code, and all materials obtained from the Internet.
- h) Never act dishonestly including lying, cheating, stealing, or attempting to corrupt the academic enterprise in any way.
- i) Ensure that all data I record, or report are objective, true, accurate and properly documented.
- j) Treat all **students, faculty and staff with respect, courtesy and dignity**, the way I would like to be treated myself.

- k) Recognize that it is how I act when no one else is watching that defines my true character.
- l) Act at all times with integrity, as the true professional that I am to become.

11. 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>

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 discuss any concerns confidentially and privately.

12. Copyright

All course content and materials, including lectures (Zoom recorded lectures included), are copyrighted materials and students may not share outside the class, upload to online websites not approved by the instructor, sell, or distribute course content or notes taken during the conduct of the course (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 original work, unless the students first comply with all applicable copyright laws; faculty members reserve the right to delete materials on the grounds of suspected copyright infringement.

13. Syllabus Disclaimer

The syllabus is a statement of intent and serves as an implicit agreement between the instructor and the student. Every effort will be made to avoid changing the course schedule but the possibility exists that unforeseen events will make syllabus changes necessary. **Any information in this syllabus may be subject to change with reasonable advance notice.** Remember to check your ASU email and the course site often.