RMI 8450: Machine Learning Applications in Actuarial Science and Risk Management

Syllabus for Spring 2025*

Instructor: Xiangshi Yin†

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Contents

1 Description

This course explores the application of machine learning algorithms in actuarial science and risk management. Students will learn theoretical foundations, model selection, evaluation techniques, and practical applications through case studies, preparing them to address real-world challenges in these fields.

*The course syllabus provides a general plan for the course; deviations may be necessary.

†Email: xyin@gsu.edu

1.1 Instructor

Name	Xiangshi Yin
Email	xyin@gsu.edu

1.2 Teaching Assistant

Name	TBD
Email	N/A

1.3 Lectures

We meet on every Monday evening at 7:15 PM (Eastern Time).

Days	Monday
Time	7:15 PM - 9:45 PM (Eastern Time)
Room	(Online) Webex@iCollege

To attend the online class, you need to:

- Go to the class home page on iCollege at https://gastate.view.usg.edu/d2l/home/xxxxxxxtbd
- Click Webex tab→Click Virtual Meetings →Choose the corresponding class link and join.
- You could also click Content Course Schedule →Choose the corresponding class link and join

1.4 Office Hours

Days	Monday
Type	By Appointment
Time Slot 1	6:30 PM - 6:45 PM (Eastern Time)
Time Slot 2	6:50 PM - 7:05 PM (Eastern Time)
Room	(Online) Webex@iCollege

Please note that the office hours listed below are tentative and may be adjusted based on feasibility and student feedback. There are two 15-minute sessions available every Monday before our regular classes. To book a time slot, you need to:

- Go to the class home page on iCollege at https://gastate.view.usg.edu/d2l/home/xxxxxxxtbd

- Click Webex tab→Click Office Hours →Choose the available time slot and click Book .
- After the meeting is booked, you'll receive Webex online meeting instructions in your school email address, and you can also add the meeting to your calendar so that you don't miss it.

1.5 Contact the instructor

During the term, it is highly recommended that you contact the instructor either during scheduled office hours or via email. The instructor is available to help you gain access to resources, focus your projects, and answer any questions you may have. Additionally, your classmates can also be a valuable source of assistance.

1.6 Course Website

All class information will be posted on the iCollege site. This includes lecture notes, assignments, key announcements, and links to additional websites with course-related materials. Additionally, source code, data, and other resources used in the class can also be found on our GitHub repository.

2 Overview

In this course, we will explore the application of machine learning algorithms in actuarial science and risk management through common use cases such as:

- Time series modeling
- Marketing campaign predictions
- Insurance claim predictions
- Credit risk modeling
- Operational risk modeling and fraud detection
- Natural Language Processing (NLP) and information extraction

We will begin each topic with an overview of the theoretical foundations of relevant statistical and machine learning models. Discussions will cover the pros and cons of each model, best practices for model selection and evaluation, and case studies demonstrating their real-world applications. For some classical models, we will also

implement key algorithms from scratch to deepen our understanding. This approach aims to provide students with a comprehensive grasp of both the theoretical and practical aspects of these models.

2.1 Intended Audience

This course is designed for students who have a basic understanding of statistics and machine learning and are interested in applying these techniques to actuarial science and risk management. Basic knowledge of Python programming is required, and students should be comfortable with data manipulation and visualization using Python programming. We will do a quick survey of Python programming to ensure that everyone is on the same page but will not cover the basics in detail.

2.2 Learning Objectives