Department of Mathematics & Statistics
Concordia University

STAT 497 (MAST 397/MAST 679), Sec. N
Topics in Statistics & Probability
Topics in Math & Stats – Sports Analytics
Fall 2025

Instructor: Dr. Joshua W. Smith
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Lectures: Thursdays, 17:45-20:15, Room LB 915-4 (SGW).

Office Hours: Thursdays, 16:00 -17:30.

Course Description: Sports analytics is a continuously growing, fascinating area of research that covers a wide range of topics. In recent years, the type of data collected has grown enormously, allowing for more fine-grain analysis of many aspects of any game. From models allowing for a greater fan experience, injury risk assessment, and in-depth tactical analysis to name a few, sports analysts/data scientists have become standards for many competitive individuals and teams. This course follows a pragmatic approach aimed to give students an idea of all the different aspects that go into sports analytics. An emphasis will be placed on building a variety of mathematical models using available data, including "tracking data" where possible.

Course Objectives: By the end of the course, students will be able to:

- Understand the role a "sports analyst" is required to fulfil.
- Know what types of data are collected for different sports, as well as their limitations.
- Be exposed to the fundamental technical necessities required to be a sports analyst (frameworks, coding libraries etc.).
- Understand and apply statistical models to sports data.

Prerequisites: This course is aimed at students from all departments with a statistical background. MAST 333, STAT 360, or their equivalents are required. A heavy emphasis will be placed on coding, and it is highly recommended that you have some experience with a coding language. An introduction to python will be given, and any shared code examples will be in python. Should you wish to use a different language, you are welcome to do so. A refresher on the statistical methods and machine learning techniques most prevalent in sports analytics will also be given. You will be expected to code many of the models discussed in class.

Readings: Readings for respective weeks will be provided ahead of time. There is no assigned textbook for the course.

Resource Policy: All content on the internet is at your disposal. However, copying full solutions or blogs is not allowed. Please cite all sources that help you with the assignments and project. Ensure you read licences for the code and data that you use.

AI Policy: Use of external tools is allowed, but students are expected to demonstrate their own understanding. Assignments and projects will involve in-class graded discussions and presentations to ensure this.

Assignments: Weekly assignments will be assigned in the first part of the course.

Short Projects: Two short projects will be assigned, the second of which will help with the final project.

Final Project: The final project will consist of a short scientific paper and a presentation. More details will be provided during the course. There will be an element of peer review for the presentation. The due date for the paper will be the 4th of December.

Group Work: Some assignments/projects may be carried out in groups.

Late Submissions: Generally, late assignments will not be accepted. Please inform me of any extenuating circumstances that might arise.

Final Grade:
a) Weekly assignments (15%)
b) Short projects (35%: 17.5% x 2)
c) Final project 50% (15% presentation, 35% paper)

If the grading scheme for this course includes graded assignments, a reasonable and representative subset of each assignment may be graded. Students will not be told in advance which subset of the assigned problems will be marked and should therefore attempt all assigned problems.

Schedule (may be subject to change)

Weeks	Topics	Due before class
1: *(4 Sept)*	**Introduction to Sports Analytics**	
2: *(11 Sept)*	**Tools in Your Arsenal** • A sports analyst's development environment	Assignment 1
3: *(18 Sept)*	**Big Data and Sports Analytics** • Types of data • Collection methods and technologies • Lab work – working with the data	Assignment 2
4: *(25 Sept)*	**Guest Speaker - TBA** **Lab activities**	Assignment 3

5: *(2 Oct)*	**Model Building in Sports - Part 1** • Linear / Logistic regression • Clustering • Direct applications in soccer, tennis, athletics etc.	Project 1
6: *(9 Oct)*	**Model Building in Sports - Part 2** Using tracking data to model movement and space control of athletes	Assignment 4
(11 – 17 Oct)	• **Thanksgiving and Mid-Term Break – University Closed**	
7: *(23 Oct)*	**Model Building in Sports – Part 3** • Workload and Performance • Overview of advanced ML used in sports	Assignment 5
8: *(30 Oct)*	**Guest Speaker - TBA** **Lab activities**	Project 2
9: *(6 Nov)*	**Final Project Lab Work**	
10: *(13 Nov)*	**Guest Speaker - TBA** **Final Project Lab Work (or Presentations if needed)**	
11: *(20 Nov)*	**Final Project Presentations**	
12: *(27 Nov)*	**Final Project Presentations**	**Final paper due Dec 4th**

Student Services
You may wish to access the many services available to you as a Concordia student. An overview of these resources can be found here: https://www.concordia.ca/students/services.html

Academic Integrity and the Academic Code of Conduct
This course is governed by Concordia University's policies on Academic Integrity and the Academic Code of Conduct as set forth in the Undergraduate Calendar and the Graduate Calendar. Students are expected to familiarize themselves with these policies and conduct themselves accordingly. "Concordia University has several resources available to students to better understand and uphold academic integrity. Concordia's website on academic integrity can be found at the following address, which also includes links to each Faculty and the School of Graduate Studies: https://www.concordia.ca/conduct/academic-integrity.html" *[Undergraduate Calendar, Sec 17.10.2]*

Behaviour
All individuals participating in courses are expected to be professional and constructive throughout the course, including in their communications.

Concordia students are subject to the Code of Rights and Responsibilities which applies both when students are physically and virtually engaged in any University activity, including classes, seminars, meetings, etc. Students engaged in University activities must respect this Code when engaging with any members of the Concordia community, including faculty, staff, and students, whether such interactions are verbal or in writing, face to face or online/virtual. Failing to comply with the Code may result in charges and sanctions, as outlined in the Code.

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Extraordinary circumstances
In the event of extraordinary circumstances and pursuant to the Academic Regulations the University may modify the delivery, content, structure, forum, location and/or evaluation scheme. In the event of such extraordinary circumstances, students will be informed of the change.