

Kin 575: Principles of Applied Sports Analytics (replaced Kin 530A starting September 2021)

Date: September – December 2021

Time: Tuesdays 9am and Thursdays 5pm

Instructors:

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Course Description

This experiential course will enable students to develop interdisciplinary skills and gain an understanding of technical and applied knowledge in data science and analytics related to high performance sports. Students will develop techniques in data cleaning and processing, filtering, extraction of subject- / sport-specific metrics, and data interpretation with an emphasis on the application of technical skills and theoretical concepts on real-life competition, performance testing, and wellness monitoring data. Students will develop basic competencies in data manipulation using the programming language R and a basic conceptual understanding of statistical methods and data visualization methods.

Learning Objectives

Students will;

- Understand data collection protocols, their advantages/limitations, various data types, cleaning, privacy and storage considerations.
- Learn and use basic programming skills necessary for data collection and analysis.
- Understand different types of data, descriptive and inferential analysis, and their use or mis-use in High Performance sport related contexts.
- Apply data analysis techniques to establish evidence-based and data informed decisions related to high performance sport and or health outcomes
- Students have basic competency to do data processing and statistical analysis using R software.
- Learn how to visualize data and present key findings and analyses to synthesize critical decisions that are made in HP sport of health-related outcomes.

Expectations

Students will

- Be required to attend two (2) online sessions per week. Each session will be 1.5 hours in duration

- Be required to perform weekly data processing assignments which may require additional time (~60-90 minutes) outside of weekly sessions
- Complete individual projects that relate to their specific context and will be able to interpret results and deliver accurate recommendations from the analyses used.
- Do a final presentation on improving their current reporting templates using the knowledge learned in class.

Course Evaluation

- Weekly Assignment 30%
 - 10 assignments - due weekly before lecture starts
- Sport Data Processing project 30%
 - Data cleaning
 - Data processing (ie. filtering...)
 - Metrics extraction
 - Statistical analysis
 - Reporting (interpretation and visuals)
- Final Project 40%
 - Project proposal (5%)
 - Presentation (20%)
 - Peer evaluation (10% - done by 2 students, 5% each)
 - Instructor Evaluation (10%)
 - Identify areas for improvement
 - Describe processing steps
 - Demonstrate along with the analysis code
 - Integrate inferential statistics into reporting template
 - Interpretation of results
 - Report (15%)
 - Background
 - Gaps the report is addressing
 - Metrics used in report template
 - Methods
 - Technique used to improve template
 - Results and interpretation
 - Improvements made
 - Interpretation on results

Course Schedule

Lectures will be delivered as synchronous (ie virtual live) or asynchronous (ie pre-recording)

Lab sessions will be delivered as synchronous

Week	Dates	Class	Topics
1	Sept 9, 2021 Thurs 5pm	Lecture	Course introduction Adopting a Data Informed Approach <ul style="list-style-type: none"> - Course overview - Why data analytics? <ul style="list-style-type: none"> - Definition of data science - History of data science in sport - Importance of data driven culture - Data science framework - Fit into Canadian high performance system
2	Sept 14, 2021 Tues 9am	Lab	Introduction to software <ul style="list-style-type: none"> - Installation of R and RStudio - Installing libraries - Basic data structure Numbers, Strings, Variables <ul style="list-style-type: none"> - Data type concepts - Numeric operations - Character operations - Conversion of data type
2	Sept 16, 2021 Thurs 5pm	Lecture	Data Governance <ul style="list-style-type: none"> - Definition - Ownership - Research ethics and informed consent - Safeguarding information - Secondary uses of data Developing Research Plan <ul style="list-style-type: none"> - Identifying investigative question - Assessing metrics/equipment/tools used - Analysis to be used - Data Collection - Data structure/entry/formatting - Identify different types of sensors they could use.

			<ul style="list-style-type: none"> - Present the basis of data acquisition. Analog vs digital signals. Sampling frequency, dynamic range. <p>Specific utilization of different sensors.</p>
3	Sept 21, 2021 Tues 9am	Lab	<p>Comparison and logic</p> <ul style="list-style-type: none"> - Comparison operators - Logic operators - Filtering data frame with operators <p>Assignment #1 due (before class)</p>
3	Sept 23, 2021 Thurs 5pm	Lecture	<p>Validating Research Methods and Tools</p> <ul style="list-style-type: none"> - Sensitivity of methods and tools - Variance in data - Reliability of methods and tools <ul style="list-style-type: none"> - internal/external reliability - ICC - Bland-Altman plots - Validity of methods and tools - Accuracy <p>Precision</p>
4	Sept 28, 2021 Tues 9am	Lab	<p>Syncing data sources</p> <p>Descriptive statistics</p> <ul style="list-style-type: none"> - Mean - Standard deviation - Interquartile range - outliers <p>Assignment #2 due (before class)</p>
4	Sept 30, 2021 Thurs 5pm	NO CLASS	
5	Oct 5, 2021 Tues 9am	Lab	<p>If statements</p> <p>For loops</p> <p>Assignment #3 due (before class)</p>
5	Oct 7, 2021 Thurs 5pm	Lecture	<p>Formatting and structuring data</p> <ul style="list-style-type: none"> • Examples of proper data structure conventions <ul style="list-style-type: none"> ○ Date

			<ul style="list-style-type: none"> ○ Continuity of units ○ Naming conventions <p>Data Processing</p> <ul style="list-style-type: none"> • Why it's important • Data cleaning <ul style="list-style-type: none"> ○ Outliers ○ Formatting types • Working with outliers <ul style="list-style-type: none"> ○ Causes ○ Finding ○ Managing
6	Oct 12, 2021 Tues 9am	Lab	<p>Filtering</p> <p>Basic plotting</p> <ul style="list-style-type: none"> - Line - Bar <p>Assignment #4 due (before class)</p>
6	Oct 14, 2021 Thurs 5pm	Lecture	<p>Introduction to sources of data</p> <p>Descriptive statistics</p> <ul style="list-style-type: none"> - Distributions - mean - Standard deviation/variance/noise - Coefficient of variance - Effect size - Smallest worthwhile change
7	Oct 19, 2021 Tues 9am	Lab	<p>More descriptive metrics</p> <p>Assignment #5 due (before class)</p>
7	Oct 21, 2021 Thurs 5pm	Lecture	<p>Interpreting and reporting descriptive data</p> <ul style="list-style-type: none"> - Reporting requirements - Appropriate statement to communicate results <p>Filtering</p> <ul style="list-style-type: none"> - Moving averages
8	Oct 26, 2021 Tues 9am	Lab	<p>Rearranging data frame for analysis</p> <p>T-Test</p> <p>Assignment #6 due (before class)</p>

8	Oct 28, 2021 Thurs 5pm	Lecture	<p>Inferential Analysis</p> <ul style="list-style-type: none"> - Purpose of inferential analysis - Null hypothesis significance testing <ul style="list-style-type: none"> - Level of significance - Type 1 error - Type 2 error - Comparing means <ul style="list-style-type: none"> - T-test (one sample, independent, paired)
9	Nov 2, 2021 Tues 9am	Lab	<p>ANOVA</p> <p>Assignment #7 due (before class)</p>
9	Nov 4, 2021 Thurs 5pm	Lecture	ANOVA
10	Nov 9, 2021 Thurs 5pm	Lecture	<p>Investigating patterns/trends and relationships</p> <ul style="list-style-type: none"> - Simple Linear regression
10	Nov 11, 2021	NO CLASS	
11	Nov 16, 2021 Tues 9am	Lecture	<p>Investigating patterns/trends and relationships</p> <ul style="list-style-type: none"> - Multiple Linear regression
11	Nov 18, 2021 Thurs 5pm	Lab	<p>Linear Regression</p> <ul style="list-style-type: none"> - Simple - multiple <p>Assignment #8 due (before class)</p>
12	Nov 23, 2021 Tues 9am	Lecture	<p>Data Visualization</p> <ul style="list-style-type: none"> - Univariate - Bivariate <ul style="list-style-type: none"> - Categorical vs Categorical - Categorical vs Quantitative - Quantitative vs Quantitative - Multivariate <ul style="list-style-type: none"> - Grouping
12	Nov 25, 2021 Thurs 5pm	Lab	<p>Advanced plotting (GGPLOT2)</p> <p>Assignment #9 due (before class)</p>

13	Nov 30, 2021 Tues 9am	Lecture	Data Visualization <ul style="list-style-type: none"> - Time Series - Customizing graphs Axes, colors, points & lines, fonts. Legends, labels, annotations
13	Dec 2, 2021 Thurs 5pm	Lab	More advanced plotting (GGPLOT2) Reporting Assignment #10 due (before class)
14	Dec 7, 2021 Tues 9am	Lecture	Integrating Technology into your sporting environment