# Sports and Exercise Analytics, MS

***Program Director: Kristof Kipp Ph.D.***
Sports and Exercise Analytics website (https://www.marquette.edu/grad/programs-graduate-sports-exercise-data-analytics.php)

## Degree Offered

Master of Science

## Department of Physical Therapy Mission

The mission of the Department of Physical Therapy is to prepare future healthcare practitioners and researchers with an education rich in clinical experiences, community outreach, and research opportunities to develop leaders guided by the values of “Cura Personalis."

## Program Description

The sports and exercise analytics (SPRT) master’s degree is offered through the program in exercise science, within the Department of Physical Therapy. This degree provides a synergistic intersection between exercise physiology (EXPH) and computer science (COSC). Graduates of the sports and exercise analytics master of science program will have the analytic skills to develop new applications and interfaces for large and complex sport and human performance datasets combined with foundational knowledge in exercise/sport physiology by which to aid in the interpretation and translation of the results to consumers, end users and clients.

## Learning Outcomes

Upon completion of the master of science in sports and exercise analytics (SPRT), a student will be able to:

1. Articulate changes, trends and implications using analytics tools that can be ethically addressed across data platforms.
2. Design and implement strategies for analyzing data using appropriate methods, tools and datasets.
3. Analyze data to create actionable information, and use it to establish priorities, make decisions and solve problems aligning with the ethics, needs and values of individuals, communities and stakeholders.
4. Display and explain the results of analytics projects using effective written, graphic and verbal tools and techniques.
5. Use advanced data processing tools incorporating regulatory, data governance, master data management, data profiling, parallel and distributed processing best practices.
6. Manage data analytics projects and teams throughout the analytics lifecycle.
7. Interpret and translate sports and exercise performance data for targeted consumers (private, public).

## Academic Standards

A cumulative GPA of 3.000 is required in the sports and exercise analytics program. The Policies (https://bulletin.marquette.edu/policies/) tab describes the criteria and procedures for academic warnings, probation, removal of probation and dismissal. The sports and exercise analytics program strictly follows these policies and procedures.

The master of science in sports and exercise analytics requires a minimum of 33 credit hours. If a student is admitted with prerequisite deficiencies, completion of prerequisite courses does not apply toward master degree requirements. The program of course work and research is determined in consultation with the student's adviser.

## Thesis OPTION (Plan A)

The master's student in Plan A must complete the required courses in data science (15 credits), the required courses in human performance/exercise physiology (12 credits) and 6 credits of thesis, for a total of 33 credits.

## Non-Thesis OPTION (Plan B)

The master's student in Plan B must complete the required courses in data science (15 credits), the required courses in human performance/exercise physiology plus electives (15 credits) and 3 credits of project, for a total of 33 credits.

## Required Course Work for Plan A and Plan B

| Code | Title | Hours |
|---|---|---|
| Data Science Courses | | |
| COSC 5500 | Visual Analytics | 3 |
| COSC 6510 | Data Intelligence | 3 |
| COSC 6520 | Data Analytics | 3 |

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|---|---|---|
| COSC 6570 | Data at Scale | 3 |
| COSC 6820 | Data Ethics | 3 |
| Human Performance/Exercise Physiology Courses | | |
| EXPH 5192 | Advanced Exercise Physiology | 3 |
| SPRT 6110 | Advanced Applied Biomechanics in Injury Prevention and Performance | 3 |
| SPRT 6190 | Advanced Strength and Conditioning: Data Analytics | 3 |
| SPRT 6958 | Readings and Research in Sports and Exercise Analytics (taken once) | 0 |
| GRAD 9953 Seminar in the Responsible Conduct of Research | | 0 |
| Plan A (Thesis) or Plan B (Non-thesis) - refer to requirements below. | | 9 |
| **Total Credit Hours:** | | **33** |

## PLAN A: Thesis Option

| Code | Title | Hours |
|---|---|---|
| Elective (see Elective Options) | | 3 |
| SPRT 6999 | Master's Thesis | 6 |
| **Total Credit Hours:** | | **9** |

## Plan B: Non-Thesis Option

| Code | Title | Hours |
|---|---|---|
| Electives (see Elective Options below) | | 6 |
| SPRT 6600 | Project Design and Development in Sports and Exercise Analytics | 1 |
| SPRT 6998 | Professional Project in Sport and Exercise Analytics | 2 |
| **Total Credit Hours:** | | **9** |

## ELECTIVE OPTIONS

Suggested elective course options are listed below. Other graduate-level courses (5000 level or higher) across the university may be taken with approval of the director of graduate studies.

| Code | Title | Hours |
|---|---|---|
| BIEN 6450 | Musculoskeletal Biomechanics 1 | 3 |
| COSC 5600 | Fundamentals of Artificial Intelligence | 3 |
| COSC 5610 | Data Mining and Machine Learning | 3 |
| COSC 5800 | Principles of Database Systems | 3 |
| COSC 5931 | Topics in Computer Science | 1-3 |
| COSC 6390 | Professional Seminar in Computing (depending on topic) | 1 |
| COSC 6931 | Topics in Computer Science | 3 |
| COSC 6995 | Independent Study in Computer Science | 1-6 |
| EXPH 5195 | Advanced Exercise Physiology Laboratory | 1 |
| EXPH 7189 | Nutrition and Exercise Performance | 4 |
| EXRS 6931 | Topics in Exercise and Rehabilitation Science | 1-3 |
| MSSC 5730 | Introduction to R for Statistics and Data Science | 1 |
| MSSC 5740 | Biostatistical Methods and Models | 3 |
| SPRT 6931 | Topics in Sports and Exercise Analytics | 1-3 |
| SPRT 6995 | Independent Study in Sports and Exercise Analytics | 1-3 |

## MASTER'S DEGREE WITH THE DATA SCIENCE CERTIFICATE

The Department of Computer Science offers a data science certificate. If a sports and exercise analytics master's student chooses to also earn the certificate, admission to both programs may be concurrent. The same courses may be used to satisfy the requirements of the master’s program and certificate, as outlined in the university bulletin for each program. Students are expected to be admitted into all programs they intend to complete, although course work completed prior to admission may be allowed to apply toward program requirements.

Students who are dually enrolled in the master’s and the data science certificate may enroll in a secondary master’s that also accepts the data science certificate and complete the remaining requirements for that degree.

Details on the data science certificate can be found in this bulletin.

## University Policies

- Academic Censure - Graduate School (https://bulletin.marquette.edu/policies/academic-censure/graduate/)
- Academic Integrity (https://bulletin.marquette.edu/policies/academic-integrity/)
- Academic Misconduct (https://bulletin.marquette.edu/policies/academic-misconduct-policy/)
- Academic Program Definitions (https://bulletin.marquette.edu/policies/academic-programs-defined/)
- Accelerated Degree Programs (https://bulletin.marquette.edu/policies/accelerated-degree-programs/)
- Attendance - Graduate School (https://bulletin.marquette.edu/policies/attendance/graduate/)
- Awarding Diplomas and Certificates (https://bulletin.marquette.edu/policies/awarding-diplomas-certificates/)
- Background Checks, Drug Testing (https://bulletin.marquette.edu/policies/background-checks-drug-testing/)
- Class Rank (https://bulletin.marquette.edu/policies/class-rank/)
- Commencement (https://bulletin.marquette.edu/policies/commencement/)
- Course Levels (https://bulletin.marquette.edu/policies/course-levels/)
- Credit Hour (https://bulletin.marquette.edu/policies/credit/)
- Credit Load - Graduate School (https://bulletin.marquette.edu/policies/credit-load/graduate/)
- Faculty Grading (https://bulletin.marquette.edu/policies/faculty-grading/)
- Family Education Rights and Privacy Act-FERPA (https://bulletin.marquette.edu/policies/ferpa/)
- Grade Appeals (https://bulletin.marquette.edu/policies/grade-appeals/)
- Grading System - Graduate School and Graduate School of Management (https://bulletin.marquette.edu/policies/grading-system/graduate-management/)
- Graduation - Graduate School (https://bulletin.marquette.edu/policies/graduation/graduate/)
- Immunization and Tuberculosis Screening Requirements (https://bulletin.marquette.edu/policies/immunization-and-tuberculosis-screening/)
- Last Date of Attendance/Activity (https://bulletin.marquette.edu/policies/last-dateof-attendance-activity/)
- Military Call to Active Duty or Training (https://bulletin.marquette.edu/policies/militarycall-active-duty-training/)
- Registration - Graduate School (https://bulletin.marquette.edu/policies/registration/graduate/)
- Repeated Courses - Graduate School (https://bulletin.marquette.edu/policies/repeated-courses/graduate/)
- Student Consumer Complaints (https://bulletin.marquette.edu/policies/student-complaints/)
- Student Data Use and Privacy (https://bulletin.marquette.edu/policies/student-data-use-privacy/)
- Transcripts-Official (https://bulletin.marquette.edu/policies/transcripts-official/)
- Transfer Course Credit - Graduate School (https://bulletin.marquette.edu/policies/transfer-course-credit-policy/graduate/)
- Withdrawal - Graduate School (https://bulletin.marquette.edu/policies/withdrawals/graduate/)

## Graduate School Policies

- Academic Performance (https://bulletin.marquette.edu/graduate/policies/academic-performance/)
- Advising (https://bulletin.marquette.edu/graduate/policies/advising/)
- Certificate Concurrent Enrollment (https://bulletin.marquette.edu/graduate/policies/certificate-concurrent-enrollment/)
- Conduct (https://bulletin.marquette.edu/graduate/policies/conduct/)
- Confidentiality of Proprietary Information (https://bulletin.marquette.edu/graduate/policies/confidentiality-proprietary-information/)
- Continuous Enrollment (https://bulletin.marquette.edu/graduate/policies/continuous-enrollment/)
- Courses and Prerequisites (https://bulletin.marquette.edu/graduate/policies/courses-prerequisites/)
- Cross-listed Courses (https://bulletin.marquette.edu/graduate/policies/cross-listed-courses/)
- Deadlines (https://bulletin.marquette.edu/graduate/policies/deadlines/)
- Doctoral Degree Academic Program Overview (https://bulletin.marquette.edu/graduate/policies/doctoral-program-overview/)
- Dual/Joint Programs of Study (https://bulletin.marquette.edu/graduate/policies/dual-joint-programs/)
- Graduate Credit (https://bulletin.marquette.edu/graduate/policies/graduate-credit/)
- Graduate School Policies (https://bulletin.marquette.edu/graduate/policies/)
- Independent Study (https://bulletin.marquette.edu/graduate/policies/independent-study/)
- Intellectual Property (https://bulletin.marquette.edu/graduate/policies/intellectual-property/)
- Master's Degree Academic Program Overview (https://bulletin.marquette.edu/graduate/policies/masters-program-overview/)
- Merit-Based Aid Registration Requirements (https://bulletin.marquette.edu/graduate/policies/merit-based-aid-registration-requirements/)

- Research Involving Humans, Animals, Radioisotopes or Recombinant DNA/Transgenic Organisms (https://bulletin.marquette.edu/graduate/policies/research-involving-humans-animals-radioisotopes-recombinant-dnatransgenic-organisms/)
- Temporary Withdrawal from Graduate Program (https://bulletin.marquette.edu/graduate/policies/temporary-withdrawal-graduate-program/)
- Time Limitations (https://bulletin.marquette.edu/graduate/policies/time-limitations/)
- Working with Minors (https://bulletin.marquette.edu/graduate/policies/working-minors/)

**SPRT 6110 Advanced Applied Biomechanics in Injury Prevention and Performance (3 credits)**
In-depth study of advanced biomechanical applications that are used to prevent injuries and improve performance. Major emphases are the critical evaluation of scientific and evidence-based literature along with an in-depth understanding of current biomechanical laboratory techniques.
*Prerequisite:* Admitted to graduate EXRS or SPRT program.
*Level of Study:* Graduate
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=SPRT%206110)

**SPRT 6190 Advanced Strength and Conditioning: Data Analytics (3 credits)**
In-depth exposure into the role and use of data analytics in the field of strength and conditioning. Emphasis is placed on the analysis, interpretation and communication of data in ways that are meaningful and actionable by practitioners.
*Prerequisite:* Admitted to graduate EXRS or SPRT program.
*Level of Study:* Graduate
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=SPRT%206190)

**SPRT 6600 Project Design and Development in Sports and Exercise Analytics (1 credits)**
Provides mentorship in the design and development of the non-thesis master's project to include selecting the topic, population, community or site for project, design of methods and developing the agreements or contracts for the project. S/U grade assessment.
*Prerequisite:* SPRT 6958.
*Level of Study:* Graduate
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=SPRT%206600)

**SPRT 6931 Topics in Sports and Exercise Analytics (1-3 credits)**
Topics are presented that are not a part of the regular course work but are taught because of a special need, interest or opportunity. The number of hours is arranged according to specific circumstances and credits. Exposure to various topics, techniques and methods are presented by experts in the topic. May be taken more than once when topics vary.
*Prerequisite:* Cons. of grad. prog. dir. Consent required.
*Level of Study:* Graduate
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=SPRT%206931)

**SPRT 6958 Readings and Research in Sports and Exercise Analytics (0 credits)**
Introduces readings and ongoing research in individual laboratories of faculty within the SPRT program. The number of hours varies, but the rotation typically consists of two rotations. Involves laboratory work, attending laboratory meetings, individual meetings with laboratory PI and oral presentation of progress made in this rotation. Directs students toward potential laboratories with interest or expertise as identified by the student in areas related to sport and exercise analytics. Students select their research mentor and collaborators for their project by the end of the course. SNC/UNC grade assessment.
*Prerequisite:* Admitted to graduate SPRT program.
*Level of Study:* Graduate
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=SPRT%206958)

**SPRT 6989 Internship in Sports and Exercise Analytics (0 credits)**
Full-time experiences supervised by clinical faculty that immerse students in various practice settings. S/U grade assessment.
*Level of Study:* Graduate
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=SPRT%206989)

**SPRT 6995 Independent Study in Sports and Exercise Analytics (1-3 credits)**
Independent study under the direction of faculty.
*Prerequisite:* Cons. of instr. Consent required.
*Level of Study:* Graduate
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=SPRT%206995)

**SPRT 6998 Professional Project in Sport and Exercise Analytics (1-2 credits)**
Required course for the non-thesis option in Sport and Exercise Analytics. The final output of the course is a presentation of a completed project that meets project director's approval. S/U grade assessment.
*Prerequisite:* SPRT 6600.
*Level of Study:* Graduate
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=SPRT%206998)

**SPRT 6999 Master's Thesis (1-6 credits)**
S/U grade assessment. Consent required.
*Level of Study:* Graduate
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=SPRT%206999)

**SPRT 9970 Graduate Standing Continuation: Less than Half-Time (0 credits)**
Fee. S/U grade assessment. Designated as less than half-time status only, cannot be used in conjunction with other courses, and does not qualify students for financial aid or loan deferment.
*Prerequisite:* Consent required.
*Level of Study:* Graduate
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=SPRT%209970)

**SPRT 9974 Graduate Fellowship: Full-Time (0 credits)**
Fee. S/U grade assessment. Designated as full-time status. If a student is already registered in other courses full time, this continuation course is not needed.
*Prerequisite:* Consent required.
*Level of Study:* Graduate
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=SPRT%209974)

**SPRT 9975 Graduate Assistant Teaching: Full-Time (0 credits)**
Fee. S/U grade assessment. Designated as full-time status. If a student is already registered in other courses full time, this continuation course is not needed.
*Prerequisite:* Consent required.
*Level of Study:* Graduate
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=SPRT%209975)

**SPRT 9976 Graduate Assistant Research: Full-Time (0 credits)**
Fee. S/U grade assessment. Designated as full-time status. If a student is already registered in other courses full time, this continuation course is not needed.
*Prerequisite:* Consent required.
*Level of Study:* Graduate
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=SPRT%209976)

**SPRT 9991 Professional Project Continuation: Less than Half-Time (0 credits)**
Fee. S/U grade assessment. Allows a student to be considered the equivalent of less than half-time status. Requires that the student is working less than 12 hours per week on their professional project. Any professional project credits required for the degree should be completed before registering for non-credit Professional Project Continuation. Consent required.
*Level of Study:* Graduate
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=SPRT%209991)

**SPRT 9992 Professional Project Continuation: Half-Time (0 credits)**
Fee. S/U grade assessment. Allows a student to be considered the equivalent of half-time status. Requires that the student is working more than 12 to less than 20 hours per week on their professional project. Any project credits required for the degree should be completed before registering for non-credit Professional Project Continuation.
*Prerequisite:* Consent required.
*Level of Study:* Graduate
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=SPRT%209992)

**SPRT 9993 Professional Project Continuation: Full-Time (0 credits)**
Fee. S/U grade assessment. Allows a student to be considered the equivalent of full-time status. Requires that the student is working 20 hours or more per week on their professional project. Any professional project credits required for the degree should be completed before registering for non-credit Professional Project Continuation.
*Prerequisite:* Consent required.
*Level of Study:* Graduate
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=SPRT%209993)

**SPRT 9994 Master's Thesis Continuation: Less than Half-Time (0 credits)**
Fee. S/U grade assessment. Allows a student to be considered the equivalent of less than half-time status. Requires that the student is working less than 12 hours per week on their master's thesis. All six thesis credits required for the degree should be completed before registering for non-credit Master's Thesis Continuation.
*Prerequisite:* Consent required.
*Level of Study:* Graduate
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=SPRT%209994)

**SPRT 9995 Master's Thesis Continuation: Half-Time (0 credits)**
Fee. S/U grade assessment. Allows a student to be considered the equivalent of half-time status. Requires that the student is working more than 12 to less than 20 hours per week on their master's thesis. All six thesis credits required for the degree should be completed before registering for non-credit Master's Thesis Continuation.
*Prerequisite:* Consent required.
*Level of Study:* Graduate
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=SPRT%209995)

**SPRT 9996 Master's Thesis Continuation: Full-Time (0 credits)**
Fee. S/U grade assessment. Allows a student to be considered the equivalent of full-time status. Requires that the student is working 20 hours or more per week on their master's thesis. All six thesis credits required for the degree should be completed before registering for non-credit Master's Thesis Continuation. Consent required.
*Level of Study:* Graduate
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=SPRT%209996)