AI Capstone Project Course

MMAI 847

2024

COURSE OUTLINE

**Course Director: Alex Scott**

[avs@queensu.ca](mailto:avs@queensu.ca)

Office hours by appointment

**TA: Jen Jones**

[jennifer.jones@queensu.ca](mailto:jennifer.jones@queensu.ca)

# Introduction

This capstone project course provides students with the opportunity to customize their learning within the MMAI program. It is designed to let students choose a project focus and apply most, if not all, of the material covered during the program to either create a new AI-enabled business opportunity or use AI to help solve an existing issue. The project can be sourced from an organization within a student’s own contacts or proposed as a challenge from one of the industry partners. We will refer to projects focused on addressing existing issues and new opportunities as, respectively, AI Consulting Projects and AI Venture Projects. Reporting requirements for each type of project are described below.

Capstone projects will be generally be completed in teams of 2-4 students. There are two exceptions to this rule: you have self-sourced a project from your organization and cannot take on additional students, or you have an AI Venture startup idea you would like to keep confidential. In both cases, you may complete a project on your own. You will need approval from the course director. All students must have individual contributions to the project. Student teams will be assigned a Technical Advisor to provide them with guidance through the technical elements of the Project.

## AI Consulting Projects

An AI Consulting Project will require students to identify a managerial problem or opportunity within an organization, devise a plan to solve the problem or exploit the opportunity using analytic approaches, and present a proof-of-concept solution that illustrates an essential part of the plan.

## AI Venture Projects

A New AI Venture Projectwill require students to prepare a comprehensive business plan for an AI-enabled new business venture and present a proof-of-concept solution that illustrates an essential part of this plan.

It is important to note that all Capstone projects will **require** a technical deliverable to be considered successful. The solutions does not need to be production ready or meet an accuracy threshold to be considered successful. In the end, some teams will find an AI solution is not possible for a variety of reasons. These reasons should be included in the final report along with the best attempt at a technical solution.

## Project Expectations

The Capstone is an opportunity for you to hone both your technical and managerial skills. Both are equally important in terms of the success of your capstone project and your performance in the course. You should treat the engagement with your Capstone partners as if you are a consultant representing the Smith School of Business that has been hired to complete this work. Practically, this means that we expect high quality work and professionalism on par with any other professional role. To this end, your Capstone partner’s feedback will be solicited and may be incorporated into your final grade.

## Course Objectives

The objectives of the Project Course are:

* To create an opportunity for students to integrate the learnings from the Program by applying MMAI program concepts to a real business situation or opportunity;
* To assist students in gaining practical experience as an AI-enabled consultant (internal or external) or as an entrepreneur;
* To require students to think in cross-functional terms while using AI ideas;
* To develop student ability to think about the effect that the AI-based plan to exploit the new idea will have on the organization;
* To add value to an organization by using AI;
* To provide students with an opportunity to connect with potential employers.

# Project Selection Process

Students are encouraged to explore the opportunities for AI Consulting or New Venture Projects in their own professional networks where interested. The main requirements for the projects are (1) a clearly described problem or opportunity, possibly presented in business or other non-technical terms, (2) an essential AI component without which the project could not be completed, and (3) novelty to the extent that the problem addressed by the project has not yet been solved in a given organization, industry or business setting. At the same time, the projects should rely, to the extent possible, on the best-known industry and scientific practices with respect to the use of AI. This will require the students to conduct appropriate background research that should be discussed in the project deliverables as described below. Each student must have clearly identified contributions that are explicitly stated in the project deliverables.

The program will also source a number of AI projects through its network of industry partners. We suspect most students will take on an industry project instead of self-sourcing a project. These sourced project and students will be matched in the following process:

1. Partners will submit project descriptions by the end of January**.** These projects will be visible to all students on a special project portal (URL to be provided).
2. Students will choose and rank projects in February:
   * All choice and rank info will be private.
   * All students need to login and rank.
   * There will be an option to rank a self-sourced project at the top ranked spot. Ranking the self-sourced project option at the top communicates to the program that the student commits to the self-sourced project and does not participate in the assignment process.
   * **If the self-sourced project is not the top choice, a current resume needs to be uploaded for the partners to review.**
3. Partners are informed which students ranked them.
   * All info is private except partners see the list of students who chose them.
4. Partners rank students who chose them.
   * All info is private.
5. We assign students to projects by attempting to match each student and partner organization with their highest ranked choices and communicate this assignment to students in March.
   * All info is private.
   * Matches are final
   * Details around how to submit rankings will be communicated in advance.

# MMAI Capstone Project Deliverables

The MMAI 847 project course has the following deliverables (to be submitted for credit):

1. **Final Project Plan (45%)**,
2. **Interim Report (5%), and**
3. **Final Project Report (50%)**.

Given the current industry situation, the due dates below are *suggested* targets that can be adjusted in consultation with the course director or TA. When the dates below are infeasible for reasons beyond the student’s control, alternative due dates are chosen **by the student** and are considered **hard deadlines**. Please note that these extensions are meant to provide flexibility in working with your partner. Extensions will not be provided due to other course work, professional commitments, etc.

The draft project plan is due **April 12, 2024**. The course director will provide feedback and an opportunity to revise the plan for grading. The project plan should be written with an expectation to contribute at least 160 hours of time to the project over a period of 16 weeks. The target project completion date is **September 1, 2024**. The overall timeline is summarized as follows:

* Draft project plan due: April 12, 2024
* Feedback from the course director on the draft project plan: within 14 days of submission; draft plans are reviewed in the order of their submission time
* Final project plan due: May 1, 2024
* Interim project report: July 1, 2024
* Final Project Report: September 1, 2024

Students using human subjects or potentially sensitive data in their Project need to follow guidelines of the General Ethics Research Board under the supervision of the course instructor: <http://www.queensu.ca/urs/ethics/general-research-ethics-board-greb>

## Suggested Structure for the Project Plan

The main objective of the Project Plan is to detail the structure and timeline of the project, to present the project to all major stakeholders for their approval, and to set to the stage for formally launching it. The Project Plan should also detail the resources that will be required and the adoption of the Plan by stakeholders will signify their commitment to providing these resources. The charter must also speak to who is completing what tasks. Given these objectives, the appropriate section headings of the Project Plan may follow industry practices for “Project Charter”. Adapting the structure suggested [in the context of the PMI exam preparation](https://pmstudycircle.com/2012/05/project-charter-a-document-to-formally-authorize-the-project/), we recommend the following sections for the *AI Consulting Projects*:

* **The project manager** or reporting manager at the partner organization, if available
* A definition of the **project scope** in precise terms, including the potential business value (1/4 to 1 page)
* The **resources required,** e.g., budget, computing resources, database access, personnel (1/4 to 1 page)
* The **defined milestones**: what is delivered, when, are there any milestone dependencies? What team member is leading each milestone? (1/2 to 1 page)
* A list of the **important stakeholders** with explanations of the roles and expectations in relation to the project (up to ½ page)
* The **technical characteristics** of the deliverable: what models you will try, what you are going to attempt to predict/automate/etc. It should be clear to all readers what AI solution you are attempting to build (1 to 2 pages)

The final version of the charter must be explicitly approved by the project manager. Note that the project charter must be detailed enough that a 3rd party to the project can understand what you are attempting to accomplish and why. The first 5 proposed sections of the charter should have a heavy business focus and outline the problem statement, why it is important, and how your proposed solution will improve on that problem.

The structure outlined above is appropriate for an organizational setting. Alternatively, in the business-venturing context, i.e., for the *AI New Venture Projects*, we suggest the following structure of the plan:

* **Executive summary**: How does the solution work in concrete terms and what are the benefits? (1/2 to 1 page)
* **Product/solution positioning**: why do markets need this solution now? (1/4 to 1 page)
* **Product/solution description**: details of interactions, transactions, processing, integration with external systems, security, data, privacy, preliminary screen snapshots/wireframes, if available (1-2 pages)
* **Technology description**: product architecture, how the tech handles privacy and security from the technology standpoint (1/2 to 1 page)
* **Benefits**: economic benefits for all parties involved (1/2 to 1 page)
* **Timeline**: what happens and when? (1/2 to 1 page)
* **Revenue/business model**: how does the solution earn money? (1/2 to 1 page)
* **Resources required and budget**: what will be needed for development/deployment and when? (1/4 to 1 page)

The project plan submissions will be judged on the criteria of (1) completeness of the plan, (2) clarity of presentation, and (3) justification of the project/solution and its benefits. The overall expected length of the plan is 3-6 pages.

## Suggested Structure for the Interim Report

The interim project report is between 2-3 pages in length and must detail (1) the status of the project as of the date of the report, (2) milestones achieved, (3) difficulties encountered during the initial phase, and (4) the reasons for deviations from the project plan if any. The interim report provides an appropriate opportunity to discuss changes to the project scope should that be necessary.

## Suggested Structure for the Final Project Report

Below, I provide general guidelines on the recommended structure of the report. The only required section is the Executive Summary and you can deviate from this structure if that is warranted by the project’s subject matter or target audience. For example, if your project targets a submission of an academic paper for publication, I will accept a paper formatted according to the requirements of the publications outlet, such as conference proceedings or a journal. If your partner prefers a PowerPoint report out for the final presentation, you may include that as well.

The report must be a well-written and grammatically correct document. In addition to the Executive Summary, the *minimum* expected length of the body of the report is 10 pages, double-spaced. Only the most important figures and tables should be in the body of the report with the rest placed in the Appendix. If you anticipate significant deviations in the format of your report from the structure described below, please contact me with your proposed format and reasons for deviations as soon as possible. In the case of the Consulting Project form, the project manager at the partner organization must explicitly approve the final version of the report. While the structure of the report may change, the themes presented below must be present.

### Recommended Section Headings

**Executive Summary**: This one-page section is literally a summary of the key facts of the analysis and the conclusions you draw from them, and the value your project provides. It roughly corresponds to an Abstract of a paper in academic settings but should have a business audience in mind. The Executive Summary is perhaps the most important part of any written report. The Executive Summary is the “hook” that is used to pique enough interest to convince a busy executive that it is worth reading the entire document. It is, however, not simply an introduction to the report.

**Introduction**: This section should clearly describe the problem and its significance with the minimal use of technical language. The target audience is the decision-makers in the relevant business area. From reading this section, it should be clear that your solution captures the components of the problem that the decision-makers would view as critical. The introduction should also explain the main contributions of your project towards a solution.

**Background**: This section should describe the state-of-the-art in addressing the business problem including any sources that you need to cite and explain how your project contributes above and beyond the state-of-the-art. The style of presentation can follow an “academic” one, where the primary goal is to argue that your results constitute a new cutting-edge knowledge based on novel models and algorithms. Alternatively, the style can be an “industrial” one, where the primary goal is to “sell” the competitive advantage of your solution compared to the state-of-the-art while persuading the audience that the solution relies on proven and reliable technologies.

**Implementation**: This section describes in a moderately technical language what models and algorithms have been implemented. The terminology must be clear to a reader who has finished the Introduction and Background sections. The details have to be tied to the original problem in terms of data, features, model structure choice, etc. This section can refer the reader to an Appendix for further, more technical, detail.

**Results**: This section describes the results of your models and algorithms in the context of the original problem. The goal is to persuade the reader of the quality and value of your solution and explain any business insight that it generates. Ideally, the results should include benchmarks of the improvement relative to the state-of-the-art. For example, what is the marketing campaign response “lift” that can be achieved thanks to your model, what incremental NIAT is generated, or what are the anticipated improvements in the patient health outcomes?

**Conclusions**: This section should reiterate the change in the state-of-the-art achieved thanks to your project and explain further potential steps. For example, in a consulting context, it can present potential next phases in the project. This section is particularly important for those projects where your solution is a part of a bigger initiative. It should make it clear how your step contributes to the overall roadmap and how further work can build on it.

**Appendix**: The project report should also provide sufficient detail of your solution to ensure reproducibility. This detail, along with any necessary tables and figures, can be placed in the Appendix section. The language of the Appendix should be appropriate and sufficiently precise for any technical personnel that will potentially take over your project in the future.