Capstone Project Title

Project Group Reference (e.g., Project Group PG34)

1st Group Member Name, 2nd Group Member Name, 3rd Group Member Name,
4th Group Member Name, 5th Group Member Name, 6th Group Member Name

I. Introduction

Provide a brief yet comprehensive introduction to your project, highlighting its broader context and importance. Discuss the motivation behind selecting this particular topic or problem. Why does this matter, both in theory and practice? Frame the project in a way that aligns with current trends or challenges in data science or your chosen field.

Start by providing a broad overview of the field or industry related to your project. This could involve discussing larger trends, recent developments, or major challenges within this domain. The goal here is to introduce the reader to the relevant landscape, providing the necessary background to understand why this area is important.

After setting the broad context, emphasize the significance of this area. Why does it matter at this point in time? Explain how addressing issues in this field could lead to important advancements. Highlight any current trends or developments that make this area particularly relevant today, both in theory and practice.

Transition from the broad context to the specific use case your project will focus on. Describe the particular scenario, application, or real-world context that your project will address. This should not yet be the problem statement, but rather an explanation of the setting where your project will be applied. Explain why this use case is important within the broader field and why it deserves attention. Conclude by discussing your motivation for selecting this particular use case. Why is it compelling? How does it relate to your interests or to current challenges in the field? Articulate how this use case offers an opportunity to explore meaningful questions or solve practical issues, showing that it is both a timely and relevant choice for your capstone project.

A. Specific ST5188 Evaluation Criteria

- Has the context been set / use case been described adequately ($\longrightarrow$ clear and comprehensive)?
- Has a rationale for choosing / tackling the project been provided ($\longrightarrow$ significance and practical nature)?

II. Problem Statement or Hypothesis

This section should clearly define the problem your project seeks to solve or the hypothesis you intend to test. It lays the foundation for the rest of your proposal, including the objectives, methodology, and literature review. Here's how to structure it effectively:

1) Identify the Gap: Start by clearly identifying the gap that currently exists in the field or use case you've described. What is missing, unaddressed, or problematic in the current state of research or practice? Specify the area where your project can make a meaningful contribution, and ensure that this gap is both precise and well-defined. Avoid vague or broad statements—this should be a focused and identifiable issue.
2) Describe the Background: Provide context for when and where this gap or problem was first observed. Was it noticed in a particular industry, academic research, or a specific case study? What trends have emerged related to this gap? This background should tie into the broader context you've already set, but now focusing specifically on this unresolved issue. The goal is to show the progression or evolution of the problem.
3) Quantify the Gap: Next, quantify the gap as much as possible. What is the extent of the problem? How does it impact stakeholders, processes, or outcomes? Provide data or metrics that showcase the severity or significance of this gap. This may involve statistics, case examples, or other evidence that demonstrates why this issue needs to be addressed. By quantifying the gap, you emphasize its importance and provide a solid basis for your objectives.
4) Discuss Importance / Relevance: Explain why addressing this gap is crucial. What will be the impact of solving this problem or testing this hypothesis? Discuss the relevance of the problem to both the broader field and the specific use case you've chosen. Highlight the potential benefits of addressing the gap, both in theory (e.g., advancing knowledge) and in practice (e.g., improving systems, processes, or outcomes).

A. Specific ST5188 Evaluation Criteria

- Is there a clearly identifiable problem statement or hypothesis ($\longrightarrow$ distinct and explicit)?
- Has a gap been identified and explored in depth?
- Has the gap been quantitatively assessed?
- Has the importance or relevance of addressing the gap been discussed?

III. Literature Review

The literature review serves as a critical foundation for your project, positioning your work within the broader research landscape. This section is more than a summary; it is a

comprehensive and analytical review of existing research that informs your project.

A. Purpose 1: Inform Readers of Established Knowledge and Ideas

Review of Significant Literature: Begin by identifying and summarizing the most significant research relevant to your project. Focus particularly on studies from the last five years to ensure that your review is current. Highlight key theories, methodologies, and findings that have shaped the field. Aim for both breadth (covering a wide range of studies) and depth (delving into the most relevant and influential research). Focus on the Problem Statement: Connect the literature back to your problem statement. Show how existing research addresses (or fails to address) the gap you've identified. This helps ground your project in the context of what is already known.

B. Purpose 2: Compare, Contrast, and Connect Findings

Comparative Analysis: Go beyond summarizing individual studies—compare and contrast the findings. Are there areas of agreement or disagreement among researchers? Discuss how different studies approach similar problems and what their results indicate about trends or inconsistencies in the field. Nuanced Understanding: Demonstrate a deep understanding of the nuances in the literature. What do the differences in methodology, results, or theoretical approaches reveal about the problem? Highlight gaps, shortcomings, or unresolved questions that remain in the current research. This analysis is crucial for showing that you are not just summarizing, but critically engaging with the literature.

C. Purpose 3: Establish a Research Context for Your Project

Identify Gaps and Opportunities: Use the literature review to identify the gaps, shortcomings, or failures in existing research. How does your project address these gaps? Make it clear how your work builds on or diverges from the studies you've reviewed, and explain why this makes your project significant. Position Your Project: Establish the educational or research context for your project. Show how your project contributes to the field—whether by addressing an underexplored area, proposing a new methodology, or filling a specific gap identified in the literature. Your review should clearly establish the foundation on which your project is built.

D. Specific ST5188 Evaluation Criteria

- Purpose 1 (Breadth and Depth): Has the review covered a wide range of relevant literature, and does the review delve into the most significant and recent studies (i.e., past 5 years)?
- Purpose 2 (Nuanced Understanding): Does the review go beyond summaries to demonstrate a deep understanding of the nuances and contrasts in the literature? Have any gaps, inconsistencies, or areas of debate been identified?
- Purpose 3 (Critical Connections): Has there been a concerted effort to establish connections of the reviewed literature to the project's intentions? Is it clear how the proposed work fits into or challenges the existing research landscape?

IV. Project Objectives

Project objectives are critical as they define the specific goals you aim to achieve through your research. They should be directly linked to your problem statement and literature review, providing a clear path toward solving the identified problem. Here's how to effectively articulate your project objectives:

1) Clear Identification of Objectives: Begin by clearly identifying the objectives of your project. These should be concise statements that outline what you intend to achieve. Remember, objectives are about what you aim to accomplish, not the activities or tasks you will perform to get there. For example, an objective might be to "develop an algorithm that improves accuracy in speech recognition systems," rather than "analyse data from speech recordings."
2) Alignment with Problem Statement and Literature Review: Ensure that your objectives are directly aligned with the problem statement you've articulated and the gaps identified in your literature review. Each objective should contribute to addressing the gap or problem you've defined. This alignment ensures that your project is focused and coherent, with each objective serving as a stepping stone toward resolving the identified issue.
3) SMAR(T) Objectives:

   Specific: Your objectives should be clear and precise, detailing exactly what you plan to achieve. Specificity here will help in defining the requirements and success measures later on. Avoid vague statements; be explicit about the outcomes you expect.

   Measurable: Define how you will measure the success of each objective. This could involve specific metrics, benchmarks, or qualitative assessments. Measurable objectives make it easier to evaluate whether you have achieved your goals.

   Achievable: Ensure that your objectives are realistic given the resources, time, and scope of your project. They should be challenging but feasible, reflecting what can be accomplished within the constraints of your project plan.

   Realistic: Your objectives should take into account any practical limitations, such as time, resources, or expertise. This ensures that your goals are not only achievable but also sensible within the context of your project.

   Timebound: You may ignore this aspect as it is generally beyond the scope of a 9-weeks effort.

Specific objectives will naturally lead to the identification of project requirements and success measures. For instance, if your objective is to "reduce error rates in data classification by 20%," this will guide your project's requirements in terms of data, tools, and success metrics. Achievable and realistic objectives should be reflected in your project plan. Ensure

that your objectives align with the milestones and timelines you set in your plan.

A. Specific ST5188 Evaluation Criteria

- Are the objectives (goals or aims, not activities!) clearly identified?
- Do the objectives align with the problem statement?
- Are the objectives SMAR(T)?

V. Project Requirements

The project requirements section outlines everything needed to successfully complete your project. This includes data, tools, technical resources, and access to domain knowledge.

First, identify all required resources:

- Data Needs: Even if the exact data set is not known yet or has to be generated/assembled, articulate the type of data you need. Describe the characteristics, volume, and format of the data that will be relevant to your project. Discuss where you might source the data or what steps will be involved in generating or assembling it.
- Tools and Compute Resources: List the tools, software, and computational resources you'll need. This might include specific programming languages, libraries, platforms, cloud services, or hardware such as GPUs. Clearly state why these resources are necessary for your project.
- Domain Knowledge or Expertise: If your project requires specialized domain knowledge (e.g., expertise in healthcare data, finance, etc.), identify the need for access to such expertise.

Next, ensure that your identified requirements align with your problem statement and objectives. The resources should be both reasonable and sufficient in scope for addressing the problem you are investigating. Finally, make sure your requirements are realistic within the scope of the project timeline and budget (if applicable). Avoid overcommitting to tools or data that may be difficult to obtain or use.

A. Specific ST5188 Evaluation Criteria

- Are data and technical (or skills / domain) requirements clearly identified?
- Do they seem reasonable with respect to the identified problem statement and objectives?

VI. Success Measures

Success measures are critical for evaluating the outcomes of your project. These measures ensure that your objectives are met and that the project progresses as planned. Here's how to define success measures effectively:

1) Link to Objectives: Your success measures must directly reflect the objectives outlined in your project. For each objective, there should be a corresponding way to measure success. Ensure that there is a clear relationship between what you aim to achieve and how you plan to evaluate whether that achievement has been met.
2) Define Success Measures: Success measures should be formally defined whenever possible. This could involve using specific metrics, formulas, or measurable outcomes (e.g., reducing error rates by a certain percentage). If exact metrics are challenging to define, you may use pseudocode to outline how success will be evaluated. The goal is to provide a clear, logical method for tracking progress and assessing outcomes.
3) Business Context Consideration: When defining success measures, take into account the business or practical context of your project. Think about how your project's success will translate into real-world benefits, such as improving efficiency, reducing costs, or increasing accuracy. Your success measures should be relevant to stakeholders and applicable to the broader business context in which the project operates.
4) Evaluation and Tracking: Success measures should enable you to track progress throughout the project lifecycle. They provide benchmarks for decision-making and allow you to identify issues early, preventing project failure. Clear success measures help guide decisions during the project by indicating whether adjustments or improvements are needed.

A. Specific ST5188 Evaluation Criteria

- Are the success measures consistent with the objective?
- Have the success measures been defined formally or given in pseudocode?

VII. Project Plan

The project plan outlines how you intend to accomplish your project objectives within the given timeline and the responsibilities of each group member. It serves as a roadmap for the entire project and helps you stay on track. Here's how to structure it effectively:

1) Main Data Science Tasks: Clearly identify the key data science tasks involved in your project. These might include data acquisition, preprocessing, modelling, analysis, validation, and reporting. Ensure that the descriptions are brief but specific enough to convey what needs to be done. Next, break each major task into smaller, manageable activities. Any activity requiring more than five days of effort should be divided into smaller subtasks. This ensures that each part of the project is well-defined and progress can be monitored effectively.
2) Assigning Responsibilities: Assign tasks to each group member based on their skills and expertise. Be clear about who is responsible for which parts of the project, ensuring a fair distribution of work. This helps in tracking accountability and progress.
3) Timeline (9 Weeks): Lay out a timeline for completing the project over the course of nine weeks (i.e., week 5 to week 13). Highlight key milestones, such as data collection, model development, validation, and final reporting. Be realistic about how long each task will take and ensure that the timeline is feasible. Ensure to account for potential delays or setbacks by building some buffer

time into your plan. This ensures that you remain on track even if challenges arise.

4) Potential Difficulties and Contingencies: Consider the potential difficulties you might encounter during the project. This could include data availability issues, computational challenges, or unexpected roadblocks in analysis. For each potential difficulty, propose a contingency plan. What will you do if things don't go as expected? Consider alternative approaches or backup plans that can still lead to successful outcomes.

The project plan should serve as a 'contract' for your group work. Seek agreement from all group members on the division of labour and the timeline. Use this plan to track progress and make adjustments as needed throughout the project.

A. Specific ST5188 Evaluation Criteria

- Primary: Have the key data science tasks been clearly identified?
- Secondary:
  - Major and minor tasks have been identified and logically sequenced;
  - Timeline (weekly) or time estimates (for minor tasks) are reasonable;
  - Tasks are assigned to group member(s);
  - Flexibility (e.g., time set aside) for adjustments based on challenges or new findings; and
  - The cyclic nature of data science activities is evident.

NOTES ON REFERENCES

References are an essential part of your project, providing credibility and grounding your work in existing literature. Here's how to structure and manage your references effectively:

- Consistency in Citation Style: Select a consistent citation style (e.g., APA, IEEE, Chicago) and ensure that all references follow the same format. Stick to this style throughout your proposal, report, and any other deliverables.
- Referencing Within the Text: For instance, when using the IEEE citation style, number citations consecutively within brackets [1], ensuring the sentence punctuation follows the bracket [2]. Avoid using "Ref. [3]" or "reference [3]" unless at the beginning of a sentence (e.g., "Reference [3] was the first . . .").
- Footnotes: Use footnotes sparingly and number them separately in superscripts. Footnotes should only appear in the column where they are cited and not in the abstract or reference list.
- Author Names and Titles: Include all authors' names unless there are six or more, in which case you may use "et al." Ensure proper capitalization in titles, where only the first word and proper nouns are capitalized.
- Handling Unpublished or In-Press Works: If a paper has not been published but is cited, indicate it as "unpublished" [4]. For papers accepted for publication but not yet published, mark them as "in press" [5].
- Foreign-Language Publications: If citing papers from translation journals, provide the English citation first, followed by the original foreign-language citation [6].
- Relevance and Usage: Ensure that only sources directly referenced or used in your project are included in the reference list. Avoid padding the references with unrelated works to ensure clarity and focus.

REFERENCES

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[3] I. S. Jacobs and C. P. Bean, "Fine particles, thin films and exchange anisotropy," in Magnetism, vol. III, G. T. Rado and H. Suhl, Eds. New York: Academic, 1963, pp. 271–350.

[4] K. Elissa, "Title of paper if known," unpublished.

[5] R. Nicole, "Title of paper with only first word capitalized," J. Name Stand. Abbrev., in press.

[6] Y. Yorozu, M. Hirano, K. Oka, and Y. Tagawa, "Electron spectroscopy studies on magneto-optical media and plastic substrate interface," IEEE Transl. J. Magn. Japan, vol. 2, pp. 740–741, August 1987 [Digests 9th Annual Conf. Magnetics Japan, p. 301, 1982].