

CS 791 Topics: Mass Detection in Mammograms

Project Guidelines

Each student is required to complete a semester-long project. You can either choose one of the suggested topics provided by the instructor or propose your own project idea. If you decide to pursue your own topic, you must discuss it with the instructor first to receive feedback and approval.

Project Requirements

The focus of the project must be to investigate a scientific question. A simple literature review or a direct reimplementing of an existing method, without any modification or exploration, will not be sufficient. A typical research project generally follows one of two paths:

Option A: Improving an Existing Solution: This is the most common approach. It begins by testing state-of-the-art methods on a given problem using different datasets. The aim is to uncover potential **weaknesses or limitations** of existing methods, that is, cases where they fail to produce strong results. Once identified, the next step is to **improve or extend these methods** to achieve better performance. Even modest improvements can represent a meaningful research contribution.

Option B: Identifying and Solving a New Problem: This approach requires greater creativity and independent thinking. Rather than improving existing solutions, the goal here is to identify a **novel research problem** that has not been sufficiently explored in the scientific community and to propose a method for addressing it. Though more challenging, this path often leads to **greater advances** in the field.

Regardless of which option you pursue, your project idea should be well-defined and include a clear research problem, a goal to solve that problem, and a proposed approach. In this context, you should: (i) **identify a research gap** (i.e., either a method that fails to work well in some cases or a problem that has not been sufficiently addressed in the research community), (ii) **frame a solution/goal that addresses this gap**, and (iii) **propose an approach for solving the problem**. Providing some **initial experimental results** to demonstrate feasibility will make your proposal more credible.

Obtaining promising results from either option can form the basis of a **Master's thesis, PhD dissertation, or a publishable paper** in a conference or journal.

Key Considerations

To complete your project successfully:

- You must have, or be willing to gain, a solid understanding of the **problem and**

relevant methods.

- Ensure that **code is available** (especially if methods are complex). Reliable sources include GitHub (preferably from published papers), PapersWithCode, Google Scholar, or by contacting authors directly.
- Ensure that **data is available** for experimentation.

Project Deliverables

There will be **three** project deliverables as detailed below.

First Deliverable: Project Proposal (due on TBD at 11:59PM)

Your proposal should address the following questions:

1. **What is the problem/question that you will be investigating?**
 - Clearly state your main research problem.
 - Be specific, not overly broad.
2. **Why is the problem interesting/important?**
 - Explain the significance: societal, scientific, or practical relevance.
3. **What are the most relevant readings (2-4 papers)?**
 - Briefly summarize what each paper contributes.
 - Discuss how your project builds on or differs from these works.
4. **What data will you use?**
 - Specify datasets (public benchmarks, proprietary data, or self-collected data).
5. **What are the existing methods? Are their implementations available?**
 - Review prior approaches (algorithms, models, or frameworks).
 - Note if open-source code exists (e.g., on GitHub or PapersWithCode).
6. **What method or algorithm will you use, and why? What motivates your choice of this approach?**
 - Describe your chosen approach.
 - Explain why it is suitable compared to alternatives.
7. **What computing resources will you use to train and run your model(s)?**
 - Detail hardware (e.g., GPUs, cloud services, university clusters).
8. **How will you evaluate your results?**
 - State your evaluation strategy.
 - Compare results to baselines or prior work.
9. **What kind of results do you expect?**
 - Describe the kind of output you anticipate (e.g., figures, confusion matrices).
10. **What kind of analysis will you use to evaluate and/or compare your results?**
 - Define metrics (accuracy, F1, precision/recall, BLEU, etc.).
 - Specify statistical tests if relevant (e.g., t-tests, bootstrapping for significance).
11. **If your approach is successful, what difference will this contribution make?**

- Explain how your project fills the identified research gap.

The **formatting** of the proposal is flexible. You may organize it into sections with headings, with each section addressing one or more of the required questions. Alternatively, you may use a narrative format (without section headings). Whichever option you choose, use full sentences and paragraphs, rather than bullet lists. This not only ensures readability but also helps prepare you for the style of writing expected in the interim and final reports. Keep your proposal to a maximum of 2 pages (single-spaced).

Each student will be required to give a short presentation (**10 minutes**) to discuss their project proposal.

Second Deliverable: Interim Project Report (due on TBD at 11:59PM)

The **interim report** should clearly explain:

- What has been accomplished so far.
- Whether any goals or objectives have changed since the proposal.
- What milestones remain to be achieved.

The interim (as well as the final) report should be structured like a research paper; the following structure is suggested:

1. **Abstract:** A concise summary of the project and progress achieved so far.
2. **Introduction:** Background, motivation, and a clear statement of the research problem.
3. **Review of Related Work:** A concise review of prior studies relevant to your project.
4. **Methods:** Description of your chosen approach, methodology, and rationale.
5. **Datasets and Experiments:** Details on the data used and experimental setup.
6. **Results, Comparisons, and Discussion:** Presentation of findings to date, including comparisons with baseline or prior methods.
7. **Conclusion:** Summary of major achievements so far and the next steps in your project.
8. **References:** A complete list of cited works (not counted toward page limit).

It is recommended that you write your report using the [ICCV2025-Author-KIT](#). Keep the interim report to a maximum of **5 pages**, excluding references. Points might be deducted for reports that are excessively long or wordy; a well-written, focused, and concise report is always preferable to a lengthy one.

Each student must also give a **15-minute presentation** outlining their interim progress.

Third Deliverable: Final Project Report (due on TBD at 11:59PM)

The **final report** should be based on the interim report and include additional details, experiments, and results. You should describe and evaluate what you did in your project, which may not necessarily be what you hoped to do originally. A small result described and evaluated well will earn **more credit** than an ambitious result where no aspect was done well. Specifically, the final report must:

- Address the same sections as the interim report.
- Clearly state what was accomplished relative to your **original goals and objectives**.
- If some goals were not met, explain why and provide context.
- Present and discuss your **experimental results thoroughly**, with emphasis on interpretation and analysis.
- Include a **conclusions and future research** section, outlining potential directions for extending the project.

Keep the final report to a maximum of **10 pages**, excluding references, using the same formatting guidelines as for the interim report.

Each student must deliver a **20-minute** presentation, covering:

- Overall project accomplishments
- Results and insights
- Future work