Final Project

BMI/CS 567 Medical Image Analysis

April 11, 2025

Abstract

Goal: Analyze and compare methods for medical image analysis in the context of a project. To develop the project, you need a dataset, metrics to quantify performance, and strategies to perform the analysis. The deliverable of the project has two components: 1) code to reproduce the project results, and 2) a report describing the findings and conclusions of the analysis.

***Note**: The code can be organized in multiple modules or notebooks. Please, create a folder with your name and zip it with the suffix `-code.zip`. If you use multiple files, make sure you include a README file with a brief description of what your files are and what they contain. Alternatively, instead of a zip file, you can include a link to a Github repository in your report, pointing to where your code is posted publicly with the solution to your project. Posting your code in Github is optional. The rest of this document describes the requirements for the final report.*

1 Format

The report will follow the Lecture Notes in Computer Science (LNCS) manuscript format. LNCS is used in the Medical Imaging Computing and Computer Assisted Intervention (MICCAAI) conference, which is an important venue to advance the field of medical imaging. You can find the details of the format, along with templates in Word and LaTeX in the following URL: https://www.springer.com/gp/computer-science/lncs/conference-proceedings-guidelines

- Export your report as a PDF file and upload it to Canvas together with the `zip` file of your code.
- Do not include the PDF file in the `zip` package.
- Number of pages: minimum 4 and the maximum 8.
- The report must have 4 main sections: Introduction, Methods, Results, and Conclusions. The details for these are described below.
- Give a title to your report. Also, make sure you put your name and institution in the space dedicated to the author.

Write an abstract to summarize your project. The abstract must have exactly 4 sentences describing the following aspects:

- Sentence 1: Clinical problem and imaging type.
- Sentence 2: Dataset and computational problem.
- Sentence 3: Methods evaluated.
- Sentence 4: Main result or conclusion.

Example abstract:

Abstract*: This project aims to diagnose skin cancer using histopathology images. A dataset of 5,000 microscopy images was obtained from the University Hospital with the goal of classifying them in 4 cancer stages. We evaluate a KNN classifier, and a linear classifier using edge and texture features, and also implement a deep CNN. The results indicate that the CNN improves performance by 30% with respect to the linear classifier, reaching 90% precision, and making it a feasible alternative for automated diagnosis.*

2 Introduction

- Write one paragraph describing the clinical problem and the dataset.
- Write one paragraph describing at a high-level the techniques you use to solve the clinical problem.
- Write one paragraph summarizing the results and conclusions.

3 Methods

- Start with a paragraph describing your dataset: image types, image sizes, classes and /or mask types. Also, describe what your data splits are, and if you used any subsampling or rescaling of the original images.
- Create a subsection to describe each method that you evaluate in your project.
- For each method, write a brief summary of how it works (in your own words).
- In addition, describe the parameters and decisions that you made to implement and optimize the method.
- Add a final subsection with one paragraph describing the metrics used to determine whether the methods perform well or not.

4 Results

- Include one plot of your choice for each method showing how the method was optimized independently of the others.
- Include one plot of your choice comparing the best result of each method against each other.
- Add figure legends describing what the axes are, what the points / bars / or other elements mean
- Write one paragraph for each plot explaining what you observe and what your interpretation of the results is.

5 Conclusions

Write one or two paragraphs describing your overall conclusions of the analysis. The conclusions section should answer the following questions:

- What was the best method?
- Why was this the best method in your opinion?
- What other experiments you would run with more time or more computing capacity?

Close the document with one paragraph disclosing the following:

- Limitations of the study. This may include computing power, lack of sufficient data, and other aspects out of your control that may limit the results or conclusions of your project.
- Disclosures: whether you used Generative AI and for what part of the project, or whether you used someone's help or someone else's code.

Add any citations and links at the end as necessary.

***Final Note**: Make the best effort to optimize your models to reach the maximum possible performance. We understand that there are limitations in terms of computing power, amount of data, complexity of models, and others. Feel free to change strategies if necessary to deliver a full report. Focus on completing a project with all the elements described above, and enjoy the intellectual challenge of putting all the pieces together. Good luck with your final project!*