Project Instructions

BIOE/CS/CME/BIOPHYS/BIOMEDIN 279

Due: December 6, 2024 at 11:59 PM

1 Description

The goal of this project is to allow you to explore a topic from the class in more detail. **The project should involve 3D structures of biomolecules and/or spatial organization of molecules within a cell.** It should also involve computation. Subject to these requirements, any topic is acceptable. If you are unsure whether your project idea meets these requirements, or if you need help scoping your project, please feel free discuss with a TA.

You can work **individually** or in groups of **up to three students. The project is meant to involve about as much work *per person* as assignments 2 or 3, regardless of whether you work individually or in a group.** You are of course welcome to do novel, publishable research for your project, but this is by no means expected or required, as it would typically take more time than students can allot to the project.

Each project will likely involve at least one of the following:

- Using existing software to perform computational experiments and analyze the results. You could apply this software to study a biomolecular or cellular system of interest (for example, a particular protein), or you could examine the accuracy/performance of the software.
- Implementing an algorithm or method (for example, one of those discussed in class, or a related method)

The Project Topics lecture, which will be posted to the course website around November 12th, includes a number of project ideas, along with pointers to a number of software packages, servers, and datasets you may find useful. You are welcome to work on other topics as well.

We've also posted several example projects from past years on the course website. Of course, you may not copy these projects (or anyone else's work), but they may provide inspiration. Likewise, the optional readings on the course website may serve as starting points, along with other published papers.

If you try out a computational method and it doesn't "work" in the sense of producing accurate results, that's fine! In that case, please explain what you did, how you evaluated the results, why the methodology you applied may have failed, and what you other approaches you might try if you were to continue working on the project.

2 Deliverables

You are to turn in a written report summarizing the results of your project and your code. The report should be:

- 2–4 pages for individual projects
- 3–5 pages for groups of two
- 4–6 pages for groups of three

with 12-point font, double spaced, 1-inch margins, not including figures, charts, tables, references, and contributions.

No text may be copied from any source (including chatbots or large language models) without explicit, clear attribution.

Report Structure

The report should consist of the following sections:

- **Introduction:** Identify the problem you wish to solve and the scope of your project.
- **Background:** Include a brief section on the background of the problem: why is it important and what techniques have people used to solve it?
- **Methods:** Describe how you went about solving (or trying to solve) the problem.
- **Results and Analysis:** Present any results and conduct an analysis of your experiments or implementation. Requirements for this section will vary depending on whether you worked on an implementation project or used existing software. Please see the "Results and Analysis" section below for details.
- **Contributions:** If you worked in a group, describe each team member's contribution.

Results and Analysis

This section will vary slightly between projects that involve significant implementation and projects that use existing software.

In either case, please also make sure to give some explanation of how your project fits into the larger context of the class and computational/structural biology.

Projects Using Existing Software

In the Results and Analysis section, you should include the results of your experiments, as well as an analysis of these results.

- What do the software packages you used do, and how do they do it? Are there other approaches that might work? What are the tradeoffs between these approaches, and why did you choose the one you used?
- What were the results of your experiments?
- Do these results seem reasonable?
  (Are they physically realistic? Do they match your intuition?)
- What did you learn by running the experiments?
- What are the "next steps" in the project? That is, if you were to continue working on it, what would you want to do next?

Implementation Projects

In the Results and Analysis section, you should discuss the following.

- Describe the major design decisions in your implementation.
- What challenges did you encounter?
- How well does your implementation work?
- What did you learn through implementing the project? Any major takeaways?
- What are the "next steps" in the project? That is, if you were to continue working on it, what would you want to do next?

You will also be expected to submit your code and a description of how to build/run it. You **must** clearly cite all starter code, including code that you wrote for another class.

3 Sharing a Project Between Classes

If you are simultaneously enrolled in another class that requires a final project, you can do one combined project for both classes (contingent on the agreement of the other course's staff). However, this should not reduce the total amount of work you do for the two class projects. If you choose this option, please specify clearly in your submission which sections of the work were done for each class; the amount of work done for this class should be as much as if you were doing a project only for this class. Please also include your writeup for the other class with your submission.

4 Grading

When grading your project, we will evaluate how well you have met the project expectations as outlined in this handout. We will consider the amount of work per person, clarity as a piece of scientific writing, and relevance to the course (i.e., that the work involves 3D structures of biomolecules and/or spatial organization of molecules within a cell). Rather than using a strict rubric for each of these categories, we will grade holistically based on quality of work and level of effort involved. If you set out to "solve" a problem but are unable to do so, you can still earn an excellent grade on the project, provided you give a thoughtful description of what you did and what went wrong.

5 Submission Instructions

Your submission will include the following two parts:

- `writeup.pdf`: A written report following the format outlined above. If you worked in a group, please make sure to list all members of your group at the top of your report.
- `code.zip`:
  If you wrote code for your project, please zip your code, together with any data that you used. You should also include instructions outlining how to build/run your code, either as detailed comments inside your code or as a separate document zipped together inside `code.zip`.
  If you did not write any code, please create a text file (`readme.txt`) describing the software packages that you used along with the commands that you ran for the project. Please zip your readme file(s), together with any data that you used.

To submit, go to Gradescope and upload `writeup.pdf` under "Final Project Writeup" and `code.zip` under "Final Project Code and Data".

Only one submission is required per group. If you worked in a group, please add all of your group members to the Gradescope submission.

Lastly, please note that, per the course policies, you **may not** use late days for the project submission.