School of Chemical and Biomolecular Engineering

Cornell University

ChemE 7770: Advanced Principles of Biomolecular Engineering

Project Guidelines

General Objectives:

- Provide a setting where physical and engineering principles can be applied intelligently to a biological phenomenon.
- Provide concrete, "hands-on" experience on open-ended problems.
- Develop skills for critical reading and analysis of technical literature.
- Give students the opportunity to be active participants in the learning process by teaching themselves a particular subject of interest.

Specific Objectives:

- Demonstrate ability for critical interpretation and analysis of current literature.
- Demonstrate ability to *apply* concepts, methods, and lessons learned throughout the course to specific problems (beyond what may be given in a selected publication).

The second specific objective entails the pursuit of some aspect of a problem that is new, even if incrementally so. The novelty of the project may be due to features of the system of interest, which are different from those treated in the literature, or due to distinctive features of the method of analysis. The project should emphasize computational modeling or theoretical treatments of a problem. Projects should not involve actual experimental work.

Overall, a typical project entails identifying a published paper (or set of papers) that describes a computational model or theoretical treatment of a problem and extending the model or theory in some new way(s) to enable additional questioning and analyses. In more ambitious cases, a de novo model of a biomolecular/biological system can be constructed and analyzed.

Individual or Teams:
You can work on the final project as an individual or as a team of 2 people maximum.

Output:

Deliverable I – Project abstract (**Due on March 17th by 5 PM**): You should prepare an abstract that communicates your preliminary plans for your project and proposed analyses. Your abstract should include the biomolecular/biological system under investigation, the computational models and theoretical treatments that will be

developed, and the questions that you propose to answer. If you propose an extension of a published model, include a reference to the publication(s) and specifically outline your plans for extending the published work in some incremental (or major) way. The project should be of your **own design,** but it can be ***related to your MS or PHD thesis work***. However, the model should not be theoretical/computational work already in progress under direct supervision of a research mentor. By March 17th, an abstract summarizing your proposed project (approximately 25 lines of text or less) should be sent to the 5440/7770 submission email.

Deliverable II – Oral progress report (**April 19th; during Tuesday lecture)**: A 10 minute oral presentation that describes project background (what is the current state of understanding in the literature; what is known and unknown), overall hypothesis (what you think is the answer to the unknown), significance/innovation (what is new about what you are doing/thinking and why is it important), approach (your proposed model and treatments), and preliminary results (what you accomplished so far).

Deliverable III – Written final report (**The final project deadline – day and time – will be assigned by the University; this is a hard deadline**): You should prepare a final written report on the project. The final written paper should contain the typical sections of peer-reviewed papers, e.g., title, abstract, introduction, methodology, results-discussion, conclusions, acknowledgements, references, and appendix. The paper should be concise, making sure to stress the most important points and results. Any additional materials, including extended modeling details and equations, can be included in appendices. Slides from the April 19th presentation should be included as one appendix. Any model source code should be released on GitHub with a README document. Formatting guidelines:

a. The main text (title, abstract, introduction, methodology, results, figures, conclusions, and acknowledgements) should not exceed 8 pages, 12-point font, single spaced, 1-inch margins. The bibliography and appendices do not count toward the page limit.
b. References should be provided throughout the text with a bibliography included at the end of the document. Free reference managers, such as Zotero, can be used to insert references directly into Microsoft Word documents (cite-and-write feature) and automatically compile a bibliography. American Chemical Society would be one recommended citation style for formatting the bibliography.
c. A LaTeX template will be provided if you would like to explore a professional typesetting program as an alternative to word processing programs, like Word (this is optional).
d. Appendices should be numbered and referenced in the main text. Appendices can include source code, detailed calculations/derivations, supplemental figures and results, extended methodology.
e. Figures should be numbered and referenced in order in the main text.
f. If applicable, model source code should be released on GitHub (with a README document) as part of the deliverable.

Grading:

Course staff will conduct ***a simulated peer review*** of your report and assign marks for rigor (e.g. appropriate statistical analysis of stochastic simulations), reproducibility (i.e. has enough information been provided in the methodology and submitted code for course staff to reproduce your results), technical merit (e.g. are calculations and/or simulations accurate; are key results obtained and explained), innovation (e.g. does the project advance current understanding at least in some incremental way), and scientific communication (e.g. clarity and effectiveness of writing, visual aids, plots).