

CARNEGIE MELLON UNIVERSITY

24658/42640: Image-Based Computational Modeling and Analysis

Due Date: 2:30pm on December 4, 2019

Project 2

2-3 students form a team. From the given list (see the 2nd page), each team picks one topic and finds at least 6 technical papers on this topic from conference proceedings and technical journals. If you are interested in other research topics related to this class, please discuss with me. You can choose one from the following two options to work on your topic.

❖ Option 1: Survey Project

Read these papers, summarize problems, categorize previously proposed approaches, discuss the pros and cons of each approach, give discussion and observation, and wrap up with future directions that you think might be promising. Each team gives a presentation and submits the project proposal and final report together.

❖ Option 2: Programming Project

From the 6 papers, you can choose one algorithm, implement it, and design some examples to test your code. Finally, summarize your results into one report and submit along with your codes.

Schedule:

➤ Nov 11 (Mon) One-page project proposal due (10 points)

Write and hand in a one-page project proposal. This is to give me a chance to provide you feedback on your topic. (You can later change the description of the proposal with my permission.) Include the following items in your proposal.

1. Your Names and Project Title
2. Mission Statement: Describe the goal and coverage of your project.
3. Background information: Explain why you are interested in this problem. Also indicate if this is part of your senior project, MS project, or Ph.D. project.

➤ Dec 4 (Wed) Project final report due (10 points)

The format of the report is open, but your report should include the following information: problem summary, classification of previous approaches, discussion of pros and cons of each approach, discussion and observation, and a list of the references. Also submit one copy of all the reference papers.

➤ Dec 2 (Mon) and Dec 4 (Wed) Presentation (10 points)

Each team has 10min to present the project and 2min to answer questions. The order of the presentations will be decided by Nov 18. Every team should submit the presentation materials 30min before the presentation class starts.

Some example topics you can choose from:

1. Medical imaging filtering
2. Medical image segmentation
3. Medical image registration
4. Geometric modeling from imaging data (or isocontouring)
5. Delaunay triangulation and Voronoi diagram
6. Octree-based mesh generation
7. Tetrahedral mesh generation
8. Hexahedral mesh generation
9. Mesh quality improvement
10. NURBS and T-Spline modeling
11. Isogeometric analysis with engineering applications
12. Combining machine learning with image processing, mesh generation or physics-based simulations
13. Implicit solvation model construction from atomic resolution data of protein data bank
14. Biomolecular electrostatic potential analysis by solving Poisson-Boltzman equations
15. Computational mechanics and its applications in biomedical engineering
16. Patient-specific cardiovascular blood flow simulation
17. Dynamic lung modeling and image registration
18. Bioheat transfer analysis for laser therapy of cancer treatment planning