CSCI 5563: 3D Computer Vision

Spring 2021, 3 credits

Instructor

Prof. Hyun Soo Park (hspark@umn.edu)
- Office hour: Wed 2-3pm @ Zoom

Teaching Assistant

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- Office hour: Mon/Tue/Thr 2-3pm @ Zoom

Suggested Textbook (not mandatory)

Hartley and Zisseman, "Multiple View Geometry in Computer Vision", 2nd Edition

Prerequisites

Note: **I will assume that all students are fluent on the following subjects** (we don't have time to cover in the lectures):
+ Math: linear algebra, calculus (optimization), machine learning, and basic computer vision knowledge.
+ Python programming: numpy, matplotlib, pytorch

Evaluation

Your overall grade in the course will be determined by the following:
- 5 programming assignment (15% each)
  - Late submission: 20% off from each extra late day
- Final project (25%)
  - Project proposal presentation 5%
  - Project proposal 5%
  - Project final presentation 10%
  - Project final report 5%

Note: no make-up assignment

Note on collaboration: in general, you are welcome to discuss the assignment problems in general with others, but **you must work out and write your own solutions: any in-person or online discussion should stop before you start discussing or designing a solution.** Note this means not only writing the final program, but also key preliminary and intermediate steps such as problem analysis, solution design,

debugging, etc. Copying others' solutions or letting another person copy your solutions is a serious situation, which will result in course failure and we will report to University according to the plagiarism policy (https://communitystandards.umn.edu/content/plagiarism). If you have any questions about what is and is not allowable in this class, please ask the professor.

Course Project

A team (up to four students) will find a challenging computer vision problem and propose a novel solution. The requirements are:
- Project proposal (3 pages)
  - Introduction/motivation
  - Related work
  - Baseline method
  - Proposed method
- Final report (6 pages)
  - Introduction/motivation
  - Related work
  - Baseline method
  - Proposed method
  - Result
    - Quantitative comparison
    - Qualitative result
  - Conclusion

Submission format: CVPR submission format will be used (**cvpr2019AuthorKit.zip**).
http://cvpr2019.thecvf.com/submission/main_conference/author_guidelines

Incompletes

An incomplete grade will be given only in very rare instances when an unforeseeable event causes a student who has completed all the coursework to date to be unable to complete a small portion of the work (typically the final assignment or exam). Incompletes will not be awarded for foreseeable events including a heavy course load or a poorer-than-expected performance. Verifiable documentations must be provided for the incomplete to be granted, and arrangements for the incomplete should be made as soon as such the unforeseeable event is apparent.

Withdrawals

You are free to withdraw from the class up to the end of the tenth week of classes. Withdrawing thereafter is up to the college, and is not automatic. If you are not doing as well as you had hoped and are considering withdrawing, please do so by that date.

Content

This course will walk through the fundamentals of 3D geometry in computer vision.

- + Single view geometry
    - + Camera model
    - + Projective transform and single view metrology
    - + Image warping
    - + Camera calibration
    - + Learning based 3D reconstruction
- + Math
    - + Rotation and representation
    - + Linear, nonlinear, robust estimation
    - + Optimization
- + Multiview geometry
    - + Epipolar geometry
    - + Camera pose estimation
    - + Triangulation
    - + Bundle adjustment
    - + Implicit scene representation

Important Dates

Homework due:
- + HW #1: Feb 5 midnight
- + HW #2: Feb 19 midnight
- + HW #3: Mar 12 midnight
- + HW #4: Apr 9 midnight
- + HW #5: May 7 midnight

Project due:
- + Registration: Feb 19 midnight
- + Proposal presentation: Mar 2 / Mar 4 @ 4pm-5:30pm
- + Proposal paper: Mar 5 midnight
- + Final presentation: Apr 27 / Apr 29 @ 4pm-5:30pm
- + Final report: Apr 30 midnight

Spring break: Week of Apr 5

Additional Information

Standard University of Minnesota policies apply to this course on matters of
- the student conduct code,
- use of personal electronic devices in the classroom,
- scholastic dishonesty,
- makeup work for legitimate absences,
- appropriate student use of class notes and course materials,

- grading and transcripts,
- sexual harassment,
- equity, diversity, equal opportunity, and affirmative action,
- disability accommodations,
- mental health and stress management, and
- academic freedom and responsibility.

For detailed information about these policies, please see https://policy.umn.edu/education/syllabusrequirements-appa.