CSCI 5561: Computer Vision

Fall 2019, 3 credits

Instructor

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- Office hour: MW 2-3pm @ Shepherd Laboratory 261

Teaching Assistant

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- Office hour: Tu/Th 1-2pm @ Shepherd Laboratory 234

Suggested Textbook (not mandatory)

"Computer Vision: Algorithms and Applications", Richard Szeliski

"Computer Vision: A Modern Approach", David A. Forsyth and Jean Ponce

Supplemental material

In this course we will often use Matlab and Python to write programs. Matlab has extensive online documentation and there are many resources available on the web. However, if you would like a hardcopy book, here are a couple you can consider:

- *Matlab: A Practical Introduction to Programming and Problem Solving* by Stormy Attaway
- *Mastering Matlab* by Duane Hanselman and Bruce Littlefield

Prerequisites

CSCI 5511: Artificial Intelligence I

Note: **I will assume that all students are fluent on the following subjects** (we don't have time to cover in the lectures):

+ MATLAB/Python usage for image handling
+ Linear algebra
+ Calculus
+ Machine learning

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
- 1 final written exam (10%)
- Final project (15%)
    - Project proposal 5%
    - Poster presentation 5%
    - Project final report 5%

Note: no make-up assignment and exam

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 two 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.

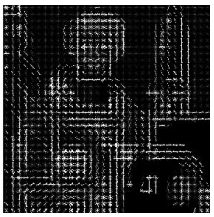
Withdrawals

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.

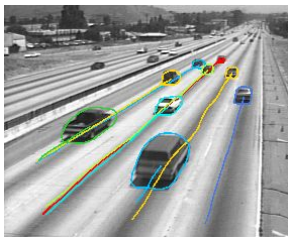
Content

This course will walk through the fundamentals of computer vision from low level vision to 4Rs (registration, recognition, reorganization, and reconstruction).

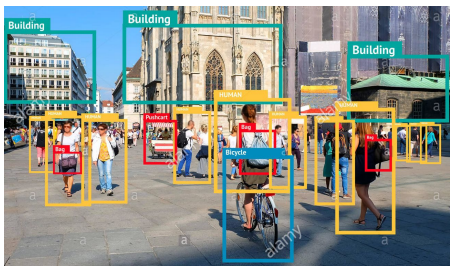
+ Low level computer vision: image formation, image convolution/filtering, feature representation

+ Registration: optical flow, image alignment, tracking



+ Recognition: bag of feature, template matching, object proposal, convolutional neural network



+ Reorganization: graph cuts, superpixel, semantic segmentation

+ Reconstruction: camera geometry, epipolar geometry, stereo

Tentative Schedule

Week 1-3: Low level computer vision
Week 4-5: Registration
Week 6-8: Recognition
Week 9-10: Reorganization
Week 11-12: Reconstruction
Final exam: Tuesday Dec 10 (regular class hour)

Important Dates

HW #1 due: Sep 20 midnight
HW #2 due: Oct 11 midnight
HW #3 due: Nov 1 midnight
Project proposal due: Nov 4 midnight
HW #4 due: Nov 22 midnight
Final exam: Dec 10 in-class
Project poster presentation: Dec 12 in-class
HW #5 due: Dec 13 midnight
Project report due: Dec 18 midnight

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.