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Computer Vision 319968

Syllabus (tentative)

Prerequisite: AP CS A Plus Data Structures; Recommended math co-requisite: AP Calc BC

Text: Machine Vision: Theory, Algorithms, Practicalities by E.R. Davies

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Course Description:

Computer Vision algorithms are at the heart of self-driving cars, modern medical imaging devices for diagnosis of disease, asteroid detection mechanisms, robotics, and myriad other applications. This course will introduce students to the foundations as well as to open problems in the field and build on their knowledge from earlier computer science and mathematics coursework. Topics covered in the course include image filtering; boundary detection and object segmentation, recognition and detection; motion estimation and structure from motion. Students will gain experience using MatLab, Open CV and Point Cloud Libraries and will have the opportunity to explore implementation of the algorithms on parallel architecture.

The problem of computer vision is traditionally separated into three conceptual levels of analysis -- low-level, intermediate-level and high-level --, and this course will develop tools beginning with those useful at the lowest level and building toward the most sophisticated tools applicable to high-level vision processing. The course is project-based with each important set of tools used by students in a substantial programing project.

PROJECT	**TOOLS EMPLOYED**
Image file manipulation, filtering	Convolutions with Gaussian kernels, grayscale
Morphology	Figure erosion, dilation, closing, opening
Edge detection	Canny & Harris algorithms
Line and circle detection	Hough transform
Segmentation and connectivity	Watershed algorithm, Nd –trees, union-find data structure
3-D Representations	Homogeneous coordinates, 2½-D representation
Shadow recognition and inference	Ray tracing, RANSAC
Particle tracking	Kalman filtering
Feature detection	SIFT features
Object recognition and nearest neighbor	FLANN library, and best-bin-first algorithm
Motion detection	Hidden-markov models, image pyramids and optical flow

Grading: Two quarter grades will be weighted evenly in calculating the final grade for each semester. Each quarter's assignments will be weighted 50% lab work, 25% lab reports, and 25% quizzes.

Student Advocacy: Students should consult the TJHSST Student Advocacy Brochure to be found at www.tjhsst.edu/abouttj/integrity to understand their rights and options concerning requests for extensions under exceptional circumstances. Students are encouraged and invited to discuss these issues with their instructor at least one week in advance of the scheduled due date or testing date.

Plagiarism: Honesty and academic integrity are important values of the TJ community. No person should feel the need to take ethical shortcuts. This class strongly encourages collaboration, meaning a discussion among students about problem solving approaches. It is not acceptable to work together to generate identical code. A student who is helping may look at another student's code to aid in debugging, but a student who is being helped should not read code written by other students. Plagiarism, which means copying code in whole or in part, from a student or from the Internet, is an academic offense with consequences. Students' code will be checked with plagiarism detection software. The teacher is required to report plagiarism to the student's grade level administrator, counselor, and parents.