

MARIST SCHOOL

COURSE NUMBER: BT 410

TERMS: 1, 2, 3

TEACHER: Mr. Christopher Michaud

COURSE NAME: Computational Perception and Artificial Intelligence

A. COURSE DESCRIPTION

This class teaches the computational techniques for perception and analysis of computer vision and sound. Algorithms for artificial intelligence will also be explored. Topics include the Open Computer Vision toolset, Image Sonification, and Music Information Retrieval. Course will feature modules in computer vision and sound followed by a culminating project. Open to 10th-12th graders who have completed Computational Media and one of: Introduction to Programming in JAVA, Mobile App Design, Robotics and Engineering, Electronics I, Foundations of Computer Graphics, or AP Computer Science.

B. REQUIRED MATERIALS

Marist Lenovo Laptop
Marist Lenovo Laptop Power Supply (Charger)
Headphones or Ear buds
Software as assigned by Instructor
Webcam: Logitech C270 (Available at Amazon)

C. STUDENT EVALUATION

Participation and Daily Materials	10%
Final Exam	10%
Homework, Daily Work, and Quizzes	20%
Lab Projects	60%

Late Work: Class Projects turned 1 to 3 days late will receive a 10 point deduction. Projects more than 4 days late will not be accepted.

D. OTHER PERTINENT INFORMATION:

TUTORIAL

Students may come in for extra help/work each day, Monday through Friday, from 3:00 to 3:30 in room W162. This lab is also open from 7:30-8:00 a.m. Monday through Friday and by appointment with Mr. Michaud.

CLASSROOM RULES SUMMARY

Classroom rules exist to provide a safe, secure, and supportive environment so we may be productive and engage in learning. We will abide by these rules:

EQUIPMENT

Students will bring their Marist Laptop, webcam, and headphones or ear buds to class every day. It is expected that the student laptop be well maintained and functional for class software needs. Students without laptops will lose 3 points off their Participation Grade for each day without laptop.

PASSWORD: Students should not give out their password to anyone.

END OF CLASS: Students secure equipment clean their workstations.

PAPER: Please recycle paper whenever possible.

TARDIES: If you are not in your seat when the final bell rings, you are late. On the FIRST (and subsequent) unexcused tardy, you will be given detention or demerits.

UNIFORM: You must follow the uniform guidelines as described in the Marist Handbook.

FOOD/DRINK & GUM: Absolutely prohibited! We have several thousand dollars worth of equipment in this room and we will be good stewards of our equipment. Keep your water bottles, snacks, and gum in your backpacks.

STREAMING: Absolutely NO streaming of videos, music, or water allowed in the classroom.

INTERNET: Marist School strictly prohibits the visitation of web sites that are not school-related (see Conditions, Rules and Acceptable Use Agreement).

BE ON TASK: Only use the technology equipment to accomplish the assigned tasks related to course objectives or projects. Students are to stay directly involved with class assignments and activities. Only software and tools required for class assignments are to be employed during class.

PRAYER, ANNOUNCEMENTS, & NATIONAL ANTHEM: Each day, one student will be asked to lead a brief prayer at the beginning of class. During the prayer (as well as during announcements and the national anthem), all students should refrain from talking.

PLAGIARISM: Marist School strictly prohibits any and all acts of plagiarism. The *Marist Handbook* defines plagiarism as follows: *to represent as one's own the words or ideas of another person or source, through either verbatim copying or paraphrasing, without using an appropriate citation.* Students guilty of plagiarism in this class will be subject to disciplinary action.

LUNCH: Will be discussed the first day of class.

SAFETY: We will use and build mechanical and electrical devices using various tools during this course. Students will follow all safety guidelines pertaining to proper safety attire/equipment and procedures for using tools and machinery. Students not following safety rules will be removed from the current project and receive zero credit for the assignment.

E. SCHEDULE AND COURSE CONTENT

UNIT 1: Software Setup and Definition of Perception

1. Install Python, OpenCV, Numpy, and Scipy
2. Python language syntax
3. Setup Class File system
4. Definition of Artificial Intelligence and Perception

UNIT 2: Matrix Operations, Linear Algebra, Python / Numpy

1. Matrix Properties and Operations in Python
2. Linear Algebra operations in Python

UNIT 3: Image Manipulation with Python and OpenCV

1. Image Manipulation with OpenCV
2. Images as Functions
3. Matrix Operations with Image Data
4. Color and Grayscale representations
5. OpenCV drawing primitives
6. Blending and Averaging Images

UNIT 4: Algorithms for Template Matching

1. Template Matching
2. SSD and Normalized Correlation Algorithms: 1D and 2D applications
3. Filtering and Blurring with Gaussians
4. Image Derivatives and Gradients

UNIT 5: Edge Detection Algorithms

1. Edge Detection Algorithms in Images and Sound
2. Applications of Derivatives and Vectors with Edge Detection
3. Canny Edge Detector

UNIT 6: Parametric Space and Line / Circle Detection

1. Image Processing Versus Vision
2. Parametric Models and Line / Circle Detection
3. Hough Parameter Space

UNIT 7: Stereo Vision and Depth

1. Stereo Geometry
2. Algorithms for Stereo Vision
3. Disparity (Depth) Images: Window Based Stereo Matching

UNIT 8: Feature Detection

1. Feature Detection: Harris Corners

UNIT 9: Motion Classification

1. Motion and Movement Detection and Classification
2. Motion History Images

UNIT 10: Applications to 1D Array and Sound

1. Applications of Image Perception to Sound and Music

UNIT 11: Machine Learning and Artificial Intelligence

1. A* Pathfinding Algorithm
2. Supervised Learning: Regression Technique

UNIT 12: Final Project

1. Final Project

UNIT 13: Final Exam

1. Final Exam

I have read and agree to the items listed on the syllabus above.

_____ Initials

Your Full Name: _____