IE 690: Gestures & Body Interaction Systems
FALL 2025 SEMESTER

INSTRUCTOR: Dr. Juan P. Wachs Grissom Hall 134. ph-67380 jpwachs@purdue.edu
CLASSES: T-Th 9:00am – 10:15am Grissom Hall 118

OFFICE HOURS: Th 3:20-4:20 PM, Grissom 262.

COURSE TEXTBOOK (OPTIONAL):

- *Brave NUI World: Designing Natural User Interfaces for Touch and Gesture*; by Daniel Wigdor and Dennis Wixon.
- *Designing Gestural Interfaces: Touchscreens and Interactive Devices*. By Dan Saffer. Ed. O'Reilly.
- *Kinect for Windows Human Interface Guidelines v1.8.0* *http://go.microsoft.com/fwlink/?LinkID=247735*

ADDITIONAL TEXTBOOKS:
Image Processing, Analysis and Machine Vision. Milan Sonka, Vaclav Hlavac, Roger Boyle, Publisher: Thomson, Third Edition, 2008.
Digital Image Processing. Rafael Gonzalez, Richard Woods. Publisher: Pearson. Third Edition 2008
Learning OpenCV Computer Vision with the OpenCV Library. Gary Bradski, Adrian Kaehler. Publisher O'Reilly Media, 2008.
The Image Processing Handbook. John C. Russ. Publisher CRC Press. Fifth Edition

PREREQUISITE:
Linear Algebra, Introduction to Programming (Python)

COURSE DESCRIPTION:
IE 690 introduces students to methods for gesture detection and recognition using interface design principles computer vision and heuristics based techniques; the main objective is to develop usable systems that can recognize gestural behavior for human-machine interaction. The final goal of the course is understand how to address an activity recognition challenge called Trauma Thompson (https://thompson-challenge.grand-challenge.org/) through lectures, readings, hands-on-tools, discussions, and team projects.

In addition to the basic principles of gesture recognition and relevant literature, the course will explore different ways in which it has been applied to human-computer interaction, and the involved challenges and opportunities that this presents. The students will learn the practical details of how these methods can be used effectively in assistive technologies, gaming and communications.

COURSE OBJECTIVES:
1. Overview of general approaches in computer vision to tackle recognition problems.
2. Teach students how to apply computer vision techniques for gesture recognition.
3. Develop the critical thinking elements to participate in a real-world scientific challenge.

COURSE ASSIGNMENTS:

Readings: Some lecture topic will be linked to a reading assignment. Students should complete the reading assignment before the lecture and be prepared to discuss and participate in the class about the readings.

Individual Assignments: Three individual home-works are assigned during the semester. The problems will be focus on creativity and reflection. Realistic challenges in the area of gesture recognition will be presented, and students are expected to come up with original conceptual solutions. The focus of these assignments are not programming, though sometimes pseudo-codes can be integrated in the assignments.

Project Assignments: The project assignment will consist of two parts. First, each individual student will select a research paper, from a pool of papers offered by the lecturer. The papers are related to the solution of the gesture recognition challenge. Each group will have to make a presentation discussing in details each algorithm, why is works, results, and further insights.
The second part of the project assignment is in small groups and requires implementing one of the papers assigned to one of the members of the group and implement that method using a programming language (Matlab or Python) Each team must implement a working prototype of a gesture recognition approach and validate it with the Trauma Thompson database. The project design includes four milestones: an initial written project proposal, the design and implementation, and a final presentation with a written report.

GENERAL INFORMATION
Since the projects may require special software and hardware, they can be done at the intelligent systems and assistive technologies lab, DUDL 3465. The lab spaces are limited to 6 stations, and therefore, time slots need to be agreed with the instructor beforehand.

The project will be conducted in teams of two students per project group. The purpose of the project is to design and implement working gesture recognition algorithms. Students can decide to which group they want to be assigned, otherwise those students without a group will need to address the instructor to be assigned to a new group. Each group will select one of the papers discussed in their team and implement the prototype during the semester. The result of this work will be reflected in a written report, an oral presentation and optionally a conference paper. **Successful completion of a conference paper to a major computer vision or human computer interfaces conference will result in a significant bonus to the final score**.

COURSE POLICIES

GRADING: The final grade will be based on the total number of points earned during the semester. The general policy will be approximately 90% for an A, 80% for a B, etc. However, the final scores might be adjusted at the prerogative of the course instructor. Each homework assignment and final project will be graded on the basis of 100 points but will be assigned different weights in terms of the final grade. The specific range of scores for the assignment of letter grades will not be designated at the onset of the course. The conventional A through F grading scale will be used without the plus and minus option. Class evaluation is part of the class participation.

The weighting procedure for determining final letter grades will be as follows:

Homework (3)	20%
Project (report, code, present.)	35%
Participation	5%
Submission to conference	5% (bonus)
TOTAL	105%

CLASS CONDUCT: Class conduct is expected to conform to the Student Code of Honor. The commitment of the acts of cheating, stealing, and deceit in any of their diverse forms will not be tolerated. Plagiarism, copying during examinations, the use of substitutes for taking examinations, illegal cribs, and ghost-written papers are considered serious acts of dishonesty. Knowingly to aid and abet, directly or indirectly, other parties in committing dishonest acts is in itself dishonest

GRADE CORRECTIONS: A given paper (homework or project), can be submitted for re-grading if it appears that insufficient credit was received. In order to request a re-grade:

1) On the back of the paper, indicate which items should be reviewed and briefly state why additional credit should be given. (For example: Problem 9, page 3 – According to the text…). The final grade of the paper can be higher, equal or even lower than the original grade.
2) The paper must be submitted to the laboratory instructor ***within one week*** of the date that the paper was returned. Papers will not be re-graded after the one-week deadline.

LATE ASSIGNMENTS: Students are expected to complete all assignments and turn them in on the due date. Late assignments will not be accepted unless accompanied by a valid excuse and some points might be deducted depending upon the circumstances.

Week	Class #	Day	Date	Class Chapter	Lecture Topic
1	1	T	26-Aug	**Introduction**	Course Information, Goals, Schedule, etc
	2	TH	28-Aug	**Image Classification**	Image Processing
2	4	T	2-Sep	**Fundamentals of Vision**	Linear Classifiers II, image features and latent representation
	5	TH	4-Sep	**Object Classification**	The ABC of object classification
3	6	T	9-Sep	**Homework 1 out**	Virtual and Augmented Reality
	7	TH	11-Sep		Telementoring
4	8	T	16-Sep	**Design by Agreement**	The STAR telementoring system
	9	TH	18-Sep	**Submit paper choice**	Field Applications
5	10	T	23-Sep	**Posture Recognition**	The DAISI dataset and captioning
	11	TH	25-Sep	**Homework 1 due**	The AI Mentor
6	12	T	30-Sep	**Challenges**	The Trauma Thompson Project
	13	TH	2-Oct		The Trauma Thompson Dataset
7	14	T	7-Oct	**Paper phase 1 due**	The Trauma Thompson Challenge
	15	TH	9-Oct	**Homework 2 out**	Results of the Challenge in 2023
8		T	14-Oct		**OCTOBER BREAK**
	16	TH	16-Oct		Paper presentation 1
9	17	T	21-Oct		Guest Talk 1
	18	TH	23-Oct		Individual team meetings
10	19	T	28-Oct		Paper presentation 2
	20	TH	30-Oct		Application Brainstorming
11	21	T	4-Nov	**Homework 2 out**	Guest Talk 2
	22	TH	6-Nov	**Homework 3 out**	Individual team meetings
12	23	T	11-Nov		Paper presentation 3
	24	T	13-Nov		Application Brainstorming
13	26	T	18-Nov		Guest Talk 3
	27	TH	20-Nov		Individual team meetings
14	28	T	25-Nov		Paper presentation 4
		T	27-Nov		**THANKSGIVING VACATION**
15	29	T	2-Dec		Guest Talk 4
	30	TH	4-Dec	**Assignment #3 due date**	Individual team meetings
16	31	T	9-Dec		Paper presentation 5
	32	TH	11-Dec	**Paper report + code**	Conclusion of the Class