Instructor Information

Instructor(s)
Vassilis Athitsos

Office Number
All office hours are conducted online, via Microsoft Teams

Office Telephone Number
All conversations are conducted via Microsoft Teams

Email Address
athitsos@uta.edu

Faculty Profile
https://mentis.uta.edu/explore/profile/vassilis-athitsos

Office Hours
MW 11:00am-12:30pm

Course Information

Section Information
CSE 4310, section 001.

Time and Place of Class Meetings

Time: MWF 10:00am-10:50am.

Course Website: https://athitsos.utasites.cloud/courses/cse4310_spring2021/

Modality: The course is offered fully online. Students can follow this course both synchronously and asynchronously, and they can switch back and forth between the two options at will. There will be no exams, and 100% of the semester score will be based on homework assignments.

Synchronous mode: Class lectures will be conducted on Microsoft Teams during the scheduled times (MWF 10:00am-10:50am). Live attendance is optional. Students attending live can ask questions and participate in class discussions.

Asynchronous mode: Class lectures will be recorded, and the videos will be posted on Microsoft Stream. Students can view or download those videos at any time. The lecture slides are also available on the class website so students can study that material at any time.

Description of Course Content
This course introduces students to basic concepts and techniques in computer vision. The topics covered include morphological operations, connected component analysis, image filters, edge detection, feature extraction, object detection, object recognition, tracking, gesture recognition, image formation and camera models, calibration, and stereo vision. A strong programming background is assumed, as well as familiarity with linear algebra (vector and matrix operations), and knowledge of basic probability theory.
Student Learning Outcomes
After successfully taking this course, a student should be familiar with basic techniques for addressing standard computer vision problems such as object detection, object recognition, tracking, calibration, and stereo vision. Students should be able to discuss pros and cons of these approaches, be able to implement these basic computer vision methods, and be able to apply such basic computer vision methods to real world problems.

Required Textbooks and Other Course Materials

There will be no textbook for this class. The only reading material consists of the slide presentations that will be used during the lectures. All those presentations are available on the course website, at https://athitsos.utasites.cloud/courses/cse4310_spring2021/lectures/

Two textbooks that we will NOT refer to in class, but that students may find useful, are:

Linda G. Shapiro and George C. Stockman, "Computer Vision", first edition (paperback), Prentice Hall, 2001. This is an easier read, more accessible to computer vision novices.

David A. Forsyth and Jean Ponce, "Computer Vision: A Modern Approach", first edition, Prentice Hall, 2002. This is a more math-heavy reference, provides good theoretical coverage of several topics.

The course will not follow either textbook. There will not be a close correspondence between class lectures and textbook chapters, and thus these textbooks are entirely optional. Students are expected to heavily refer to class lectures and the class slides that will be posted online.

Descriptions of major assignments and examinations

All assignments must be submitted via Canvas.

Any assignment that includes the word "tentative" in its title is not finalized. When the contents of an assignment are finalized, the word "tentative" is removed from the title. When an assignment is posted on Canvas, it can be considered as finalized. However, even if an assignment is "finalized", the instructor reserves the right to make changes, so as to fix errors, add clarifications, etc. Such late changes will be announced via e-mail and posted on the course website.

- **Tentative Assignment 1**. Due date: Thu 01/28, 5:00pm. 
  Topics: review of prerequisite material on algorithms, algebra, calculus, probabilities.
- **Tentative Assignment 2**. Due date: Thu 02/04, 5:00pm. 
  Topics: frame differencing, connecting components, thresholding, bounding boxes.
- **Tentative Assignment 3**. Due date: Thu 02/18, 5:00pm. 
  Topics: morphological operations, colors, directional derivatives, gradients.
- **Tentative Assignment 4**. Due date: Thu 03/04, 5:00pm. 
  Topics: Hough Transform, template search.
- **Tentative Assignment 5**. Due date: Thu 03/25, 5:00pm. 
  Topics: Nearest neighbor classification using Euclidean and chamfer distance.
- **Tentative Assignment 6**. Due date: Thu 04/08, 5:00pm. 
  Topics: Face detector evaluation, camera calibration, stereo estimation.
- **Tentative Assignment 7**. Due date: Thu 04/22, 5:00pm. 
  Topics: PCA, shape context, HOG features.
• **Tentative Assignment 8.** Due date: Thu 05/06, 5:00pm. 
Topics: Gesture recognition, motion energy images, dynamic time warping, gesture spotting.

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**Assignment Policies**

There are several assignments in this course. Each assignment may include both programming and written components. No assignment scores will be dropped. The following class policies regarding assignments will be followed:

- **Programming language:** Programming assignments have to be done in Matlab or Python. Matlab is strongly recommended and will be supported. Students who opt to do assignments in Python assume full responsibility for porting provided Matlab code to Python and for figuring out how to use existing Python libraries. No programming support for Python will be provided. The Matlab version should be compatible with version 2018b or later. Python code needs to run on Anaconda (Python version 3.8.3, numpy version 1.18.5). Any exceptions to these requirements must be provided via e-mail from the instructor or the teaching assistant.

- **On using existing libraries and tools:** The instructor recommends that students do not use existing libraries (except numpy) or existing tools in the programming assignments. The course slides provide sufficient information for students to complete their programming assignments without using special libraries. At the same time, if students want to use such special libraries or other built-in tools, they are allowed to. However, if these libraries or built-in tools do not provide results that match the assignment specifications, then the solutions will be counted as wrong. The instructor will not help the student before the deadline in determining whether any specific libraries/tools are compliant with the assignment specifications, since the recommended approach is to not use such libraries and tools. Oftentimes, existing libraries and tools implement variations of the methods and formulas that are specified in the assignment requirements, and any such variations will not be acceptable.

- **Submissions:** All assignments must be submitted via Canvas.

- **Deadline extensions:** No deadline extensions for the entire class will be provided. The syllabus describes the policy on extensions for individuals. Please note that such extensions can only be granted for emergencies documented in writing, and only when the student has clearly made efforts to inform the instructor as early as possible.

- **Extra credit:** Little extra credit will be provided. Any extra credit opportunities that are provided will be available for all students.

- **Multiple submissions:** If you make multiple online submissions for the same assignment, only the latest submission will be graded.

- **Verifying your submission:** After you submit your solutions, you should download them and make sure that you submitted the correct files. Every semester, several students ask for leniency, claiming that they did the assignment, but accidentally submitted the wrong files. These claims are often legitimate, but, unfortunately, no grade leniency will be accorded to such claims. **It is each student's responsibility to doublecheck their submissions.**

- **In case of Canvas problems:** If, for whatever reason, you cannot submit on Canvas, e-mail your solution to the instructor and the teaching assistant, from your UTA account, BEFORE the submission deadline. The time stamp on your e-mail message will serve as proof that you did the work on time. You still have to offer a convincing explanation as to why you were not able to submit online.

- **Student conduct:** Each student is expected to work on each assignment INDIVIDUALLY and submit his or her own work. The instructor will report to the Office of Student Conduct all violations of this policy, and all cases that are suspicious of such violations.

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**Late submission policy:**

- All assignments are graded out of 100 points. Assignments submitted late will be penalized, at a rate of 1 penalty point per hour. The submission time will be the time shown on Canvas.
• Exceptions to late submission penalties will only be made for emergencies documented in writing, in strict adherence to UTA policy. For all such exception requests, the student must demonstrate that he or she made all efforts to notify the instructor as early as possible.
• Computer crashes, network crashes, software or hardware failure, Canvas failure, e-mail failure, will NOT be accepted as justification for late submissions. If you want to minimize chances of a late submission, aim to submit early. You can always revise your submission till the deadline.
• Sometimes students submit the wrong files online. Unfortunately, no credit or waiver of late penalties can be provided in such cases.
• If you find yourself in an emergency situation and can not deliver a homework on time, immediately inform the instructor and teaching assistant, via e-mail. Even if you have a valid reason for delivering late an assignment, you must make a convincing case that you have notified the instructor and teaching assistant as early as possible.

If you want to minimize chances of a late submission, aim to submit early. You can always revise your submission till the deadline.

Technology Requirements
• Lectures and office hours will be conducted on Microsoft Teams.
• Lecture videos will be available on Microsoft Stream.
• Homework assignments need to be submitted on Canvas. There are significant penalties for late submissions (1 out 100 points deducted per hour past the deadline).

Live attendance of lectures is NOT required. However, students taking this class assume full responsibility for having adequate Internet connectivity to view lectures (live or recorded), to download slides, to install the required Python version, and to submit assignments on time. Students also assume full responsibility for having access to a computer that is adequate for implementing and running the programming assignments. No accommodations will be provided for students who cannot meet these requirements.

Grading Information
The semester score will simply be the average of all assignment scores. All assignments will have equal weight.

The final semester score, calculated based on the percentages listed above, will be converted to letter grades based on the following scale:

• A: 90%
• B: 80%
• C: 70%
• D: 60%
• F: below 60%.

The instructor reserves the right to lower these thresholds, based on the distribution of scores. The instructor also reserves the right to lower a student's grade as penalty for violating the requirements of professional and civil conduct, as described in the student conduct section of this syllabus.

Any request for re-grading must be made within 5 days of receipt of that grade. Re-grading can lead to a higher or lower grade, depending on grading errors that are discovered.

There will be little or no extra credit. If there are extra credit opportunities, they will be included as part of the assignments, and they will be available to all students. There will be no make-up opportunities, and
there will be no way for individual students to do extra work and improve their grade at the end of the semester.

IMPORTANT: It should be clear to every student that course grades will depend EXCLUSIVELY on the above grading criteria. Students should not request nor expect any other factor to be considered in computing the course grade. For example, factors that will NOT be considered are: need of a better grade to keep financial aid, to stay in the program, to qualify for a job offer, or to graduate. Students are expected to carefully monitor their own performance throughout the semester and seek guidance from available sources (including the instructor) if they are concerned about their performance and the course grade that they will earn. However, if the assignment scores are not good enough to warrant the desired grade at the end of the semester, there will be no other recourse for improving the grade.

Students are expected to keep track of their performance throughout the semester which Canvas facilitates, and seek guidance from available sources (including the instructor) if their performance drops below satisfactory levels; see “Student Support Services,” below.

Expectations for Out-of-Class Study
Beyond the time required to attend each class meeting, students enrolled in this course should expect to spend an additional minimum of 9 hours per week of their own time in course-related activities, including reading required materials and completing assignments. Significantly more time may be needed for people having difficulties understanding the material, having a relatively weak mathematical or programming background, or having a relatively weak background in the prerequisite materials for this course.

Grade Grievances
Any appeal of a grade in this course must follow the procedures and deadlines for grade-related grievances as published in the current University Catalog.

Class Participation
Class participation during lectures is optional, and will not be considered for the course grade. At the same time, students are highly encouraged to participate, by asking questions, as well as answering questions by the instructor. Class participation can be an important resource for students who have difficulty understanding any part of the course material.

Student Conduct
Each student is expected to work on each assignment INDIVIDUALLY and submit his or her own work. The instructor will report to the Office of Student Conduct all violations of this policy, and all cases that are suspicious of such violations.

Students are expected to be professional and civil in their language and conduct:

- During lectures.
- During office hours.
- In any oral, written or electronic communication with the instructor and TAs.
- In assignment submissions.

For any student violating this policy, the instructor reserves the right to impose any grading penalties that the instructor considers appropriate, including a failing grade for the class, regardless of any other aspects of student performance. Examples of violations include language that is vulgar, insulting,
disrespectful or threatening, making noise or talking with other students during lectures, disrupting lectures in any way, or making it difficult for other students to follow lectures in any way.

**Course Schedule**

NOTE: the schedule of future lecture topics is tentative and subject to change. Changes will be posted on the course website.

  - Slides: Overview of course syllabus. [PPT], [PDF].
- Lecture 2: Fri 01/22 - Elementary Image Operations.
  - Slides: [PPT], [PDF].
  - Code: [main script], [all code], [all code zipped].
  - Data: [all files], [all files zipped].
- Lecture 4: Wed 01/27 - Canny Edge Detection.
  - Slides: [PPT], [PDF].
  - Code: [main script], [all code], [all code zipped].
  - Data: [all files], [all files zipped].
- Lecture 5: Fri 01/29 - Canny Edge Detection, continued.
- Lecture 6: Mon 02/01 - Canny Edge Detection, continued.
- Lecture 7: Wed 02/03 - Canny Edge Detection, continued.
- **WEDNESDAY FEBRUARY 03: CENSUS DATE.**
- Lecture 8: Fri 02/05 - Hough Transforms.
  - Slides: [PPT], [PDF].
  - Code: [main script].
  - Data: [all files], [all files zipped].
- Lecture 9: Mon 02/08 - Hough Transforms, continued.
- Lecture 10: Wed 02/10 - Hough Transforms, continued.
- Lecture 11: Fri 02/12 - Template Matching and Object Detection.
  - Slides: [PPT], [PDF].
- Lecture 12: Mon 02/15 - Template Matching and Object Detection, continued.
- Lecture 14: Fri 02/19 - Template Matching and Object Detection, continued.
- Lecture 15: Mon 02/22 - Template Matching and Object Detection, continued.
- Lecture 16: Wed 02/24 - Edge Templates, Tracking, Recognition.
  - Slides: [PPT], [PDF].
- Lecture 17: Fri 02/26 - Edge Templates, Tracking, Recognition (continued).
- Lecture 18: Mon 03/01 - Camera Models, Calibration, Stereo Vision.
  - Slides: [PPT], [PDF].
- Lecture 19: Wed 03/03 - Camera Models, Calibration, Stereo Vision (continued).
- Lecture 20: Fri 03/05 - Camera Models, Calibration, Stereo Vision (continued).
- Lecture 21: Mon 03/08 - Camera Models, Calibration, Stereo Vision (continued).
- Lecture 23: Fri 03/12 - Guidelines for Assignment 4.
  - Slides: [PPT], [PDF].
- Lecture 24: Mon 03/22 - 3D Estimation Using Stereo Vision.
  - Slides: [PPT], [PDF].
- Lecture 25: Wed 03/24 - Depth Cameras.
  - Slides: [PPT], [PDF].
- Lecture 26: Fri 03/26 - Depth Cameras (continued).
- **FRIDAY MARCH 26: LAST DAY TO DROP CLASSES. Submit requests to advisor prior to 4:00pm.**
- Lecture 27: Mon 03/29 - Principal Component Analysis.
  - Slides: [PPT], [PDF].
• Lecture 28: Wed 03/31 - Principal Component Analysis (continued).
• Lecture 29: Fri 04/02 - Local Features: Shape Context, HOG Features, Keypoints, Rotation and Scale Invariance.
  o Slides: PPT, PDF.
• Lecture 30: Mon 04/05 - Local Features (continued).
• Lecture 31: Wed 04/07 - Local Features (continued).
• Lecture 32: Fri 04/09 - Gesture Recognition.
  o Slides: PPT, PDF.
• Lecture 33: Mon 04/12 - Gesture Recognition (continued).
• Lecture 34: Wed 04/14 - Gesture Recognition (continued).
• Lecture 35: Fri 04/16 - Gesture Recognition (continued).
• Lecture 36: Mon 04/19 - Gesture Recognition (continued).
• Lecture 37: Wed 04/21 - Neural Networks.
  o Slides: PPT, PDF.
• Lecture 38: Fri 04/23 - Neural Networks (continued).
• Lecture 39: Mon 04/26 - Convolutional Neural Networks.
  o Slides: PPT, PDF.
• Lecture 40: Wed 04/28 - Convolutional Neural Networks (continued).
• Lecture 41: Fri 04/30 - Convolutional Neural Networks (continued).
• Lecture 42: Mon 05/03 - Convolutional Neural Networks (continued).
• No Final Exam. The last assignment is due Thursday May 06, at 5:00pm.

Institution Information

UTA students are encouraged to review the below institutional policies and informational sections and reach out to the specific office with any questions. To view this institutional information, please visit the Institutional Information page (https://resources.uta.edu/provost/course-related-info/institutional-policies.php) which includes the following policies among others:

- Drop Policy
- Disability Accommodations
- Title IX Policy
- Academic Integrity
- Student Feedback Survey
- Final Exam Schedule

Additional Information

Mandatory Face Covering Policy
All students and instructional staff are required to wear facial coverings while they are on campus, inside buildings and classrooms. Students that fail to comply with the facial covering requirement will be asked to leave the class session. If students need masks, they may obtain them at the Central Library, the E.H. Hereford University Center’s front desk or in their department. Students who refuse to wear a facial covering in class will be asked to leave the session by the instructor, and, if the student refuses to leave, they may be reported to UTA’s Office of Student Conduct.

Attendance
At The University of Texas at Arlington, taking attendance is not required but attendance is a critical indicator of student success. Each faculty member is free to develop his or her own methods of evaluating students' academic performance, which includes establishing course-specific policies on attendance. As the instructor of this section, I will use the following attendance policy: Attendance is NOT mandatory for lectures. Attendance in lectures will NOT be used in calculating the semester grade. However, students are responsible for the material covered in the lectures. Lecture recordings will be available online on Microsoft Stream for students to review at any time. However, while UT Arlington does not require instructors to take attendance in their courses, the U.S. Department of Education
requires that the University have a mechanism in place to mark when Federal Student Aid recipients “begin attendance in a course.” UT Arlington instructors will report when students begin attendance in a course as part of the final grading process. Specifically, when assigning a student a grade of F, faculty report must the last date a student attended their class based on evidence such as a test, participation in a class project or presentation, or an engagement online via Canvas. This date is reported to the Department of Education for federal financial aid recipients.

**Student Success Programs**
UT Arlington provides a variety of resources and programs designed to help students develop academic skills, deal with personal situations, and better understand concepts and information related to their courses. Resources include tutoring by appointment, drop-in tutoring, etutoring, supplemental instruction, mentoring (time management, study skills, etc.), success coaching, TRIO Student Support Services, and student success workshops. For additional information, please email resources@uta.edu, or view the Maverick Resources website.

The **IDEAS Center** ([https://www.uta.edu/ideas/](https://www.uta.edu/ideas/)) (2nd Floor of Central Library) offers FREE tutoring and mentoring to all students with a focus on transfer students, sophomores, veterans and others undergoing a transition to UT Arlington. Students can drop in or check the schedule of available peer tutors at www.uta.edu/IDEAS, or call (817) 272-6593.

The **English Writing Center** (411LIBR)
The Writing Center offers FREE tutoring in 15-, 30-, 45-, and 60-minute face-to-face and online sessions to all UTA students on any phase of their UTA coursework. Register and make appointments online at the Writing Center ([https://uta.mywconline.com](https://uta.mywconline.com)). Classroom visits, workshops, and specialized services for graduate students and faculty are also available. Please see Writing Center: OWL for detailed information on all our programs and services.

The Library’s 2nd floor **Academic Plaza** ([http://library.uta.edu/academic-plaza](http://library.uta.edu/academic-plaza)) offers students a central hub of support services, including IDEAS Center, University Advising Services, Transfer UTA and various college/school advising hours. Services are available during the library’s hours of operation.

**Librarian to Contact**
Each academic unit has access to Librarians by Academic Subject that can assist students with research projects, tutorials on plagiarism and citation references as well as support with databases and course reserves.

**Emergency Phone Numbers**

In case of an on-campus emergency, call the UT Arlington Police Department at 817-272-3003 (non-campus phone), 2-3003 (campus phone). You may also dial 911. Non-emergency number 817-272-3381

**Library Information**

**Research or General Library Help**
Ask for Help
- **Academic Plaza Consultation Services** ([library.uta.edu/academic-plaza](library.uta.edu/academic-plaza))
- **Ask Us** ([ask.uta.edu/](ask.uta.edu/))
- **Research Coaches** ([http://libguides.uta.edu/researchcoach](http://libguides.uta.edu/researchcoach))

Resources
- **Library Tutorials** ([library.uta.edu/how-to](library.uta.edu/how-to))
- **Subject and Course Research Guides** ([libguides.uta.edu](libguides.uta.edu))
- **Librarians by Subject** ([library.uta.edu/subject-librarians](library.uta.edu/subject-librarians))
- **A to Z List of Library Databases** ([libguides.uta.edu/az.php](libguides.uta.edu/az.php))
- **Course Reserves** ([https://uta.summon.serialssolutions.com/#!/course_reserves](https://uta.summon.serialssolutions.com/#!/course_reserves))
• Study Room Reservations (openroom.uta.edu/)