CSCI 585 – Computer Vision

**General Information**

* Teacher: Dr. Khalil Khan (khalil.khan@nu.edu.kz)
* Online class times: Tue, Thu, 12:00 pm - 13:15 pm
* Classroom location: 7E.217

**Course Overview**

This course is a one-semester course intended for M.S. students in Computer Science and Data Science graduate programs. Some advanced topics will also be covered, PhD students can also enroll in this course. It enhances the student’s knowledge in computer vision and approaches such as image formation, camera imaging geometry, feature detection and matching, stereo, image classification, scene understanding, and deep learning. In class, we will develop the intuitions and mathematics of the vision approaches. We will expose students to a number of real-world applications that are important to our daily lives. To further differentiate between theory and practice, we will guide students through a series of research projects such that they will have chance to implement cutting-edge computer vision algorithms. Students will also gain experience through research papers, with an emphasis on proper computer vision practices with appropriate applications.

**Course Learning Outcomes**

By the end of the course students will be able to:

* To understand and explain concepts related to computer vision such as image formation, feature detection and matching, stereo, image classification, scene understanding, and deep learning.
* To be able to recognize and describe both the theoretical and practical aspects of computing with images.
* To be able to successfully implement several interesting and cutting-edge vision algorithms which are widely used in real-world applications.
* To understand the strengths and weaknesses of various computer vision approaches.
* To be able to read and understand scholarly articles in computer vision and come up with new ideas to solve similar problems.

**Course Aims**

The aims of the computer vision course are:

* To expose students to various computer vision concepts and approaches such as image formation, feature detection and matching, stereo, motion estimation and tracking, image classification, scene understanding, and deep learning.
* To familiarize students with state-of-the-art computer vision techniques.
* To present students the various ways to further improve the performance of state-of-the-art computer vision techniques.

**Course Materials**

The course material, websites, and books details will be shared from time to time during lectures. The slides will be shared via Moodle regularly. The primary course resources will be provided online via Moodle. We will also be using Moodle as the place to submit assignments.

Besides, we will use the Piazza platform for handling general questions and answers from students. The primary purpose of the piazza is to help all of you if you are struggling with starting the assignments, lectures, and some other technical problems. Piazza should reduce the number of repetitions of the same questions due to the big number of students enrolled in the course. Please follow the following instructions:

1. Please use **YOUR REAL FULL-NAME** on Piazza. Any account which is NOT connected with a real student will be removed immediately. You can use Piazza to ask/answer questions, which were not clearly specified in the specification of the assignment, lectures, technical issues, or organizational issues.
2. The instructors will make some official announcements through Piazza and Moodle.  Students should make sure that Piazza sends email notifications to their NU address so that they can receive and read these announcements daily.
3. You should read the previously asked and answered question, and **please, do not ask the same question several times**. If the question will be repeated or very similar to the one which was already answered, your question will be removed or said that it was answered already, which means you should scroll down and find it.
4. **You are not allowed to post any codes/solutions on Piazza, regardless of public or private mode**. Anyone who does it will be counted as cheating.
5. **You are not allowed to insult each other and your TAs/Instructors.** The instructor and TAs have the right to suspend and remove any irrelevant topics.

**Class Structure**

We will conduct classes in physical mode only. Assignments must be submitted before the given deadline to Moodle. Otherwise, you will receive no credit for the assignment. If you are caught plagiarizing code/assignment from other students, using code obtained online, or getting unauthorized help from others, you will get a zero for the programming assignment. Written assignments should be written up clearly and concisely. You may lose points if your answers are unclear or unnecessarily complicated.

Two quizzes are planned for this semester. These quizzes will test your knowledge and problem-solving skills on the preceding lectures and assignments. Along with quizzes, assignments and semester project will also be part of the evaluation. Note that the mid-term exam is not a quiz and will concern the knowledge from the whole mid-term. You cannot use any external aids, e.g., computers, phones, mobile devices, notes, etc. - **just a calculator, pen or pencil, and an eraser**. IF you miss a quiz because of a valid reason, for example, you have a **Spravka** confirmed by the Student Affairs office, you can be exempted from that quiz ONCE. Your marks will be transferred to the next quiz. There will be no make-up quiz and make-up mid term.

**Class Assessment**

The final grade is calculated as follows:

* Two 30-minute quizzes: 20%
* Assignments: 25 %
* Mid-Term: 25 %
* Semester Project (Presentation): 10%
* Semester Project (demo, report, presentation): 20%

**Note 1:** the content of the quizzes/exams will include the lectures’ slides and the corresponding narration/explanation from the instructors.

**Note 2:** all the quizzes/exams will be arranged based on Astana time. Any absence regarding the difference in time zone is unacceptable.

**Note 4:** Students with spravka/valid reasons **MUST** inform the instructors at least **TWO DAYS** before the **quizzes**.

Final note: do NOT try to request any “extra” assignments/special favor to pass the course. This actually violates the school policy and really be unfair to other students.

Final letter grades will be assigned using the following:

|  |  |  |  |
| --- | --- | --- | --- |
| A | 95 or above | C | 65 up to 70 |
| A- | 90 up to 95 | C- | 60 up to 65 |
| B+ | 85 up to 90 | D+ | 55 up to 60 |
| B | 80 up to 85 | D | 50 up to 55 |
| B- | 75 up to 80 | F | 0 up to 50 |
| C+ | 70 up to 75 |  |  |

**Late Policies**

Assignments must be submitted by the Astana time specified at the time of the assignment. They must be submitted to the proper place in Moodle on the announced due date. In case Moodle does not work, assignments need to be submitted by email to your instructors and teaching assistants by the same time and day as specified in the assignment.

If you finish your written assignments after the deadline, their scanned copy **must be submitted by email** to your instructors and teaching assistants.

**We do not allow late submissions**. Therefore, in cases of illness or family emergency, you must inform your instructor immediately if you believe you will not be able to submit your assignment on time. In such cases, an exception may be made at the discretion of your instructor. In addition, live grading will be done if the instructor feels that the assignment/homework is a result of plagiarism.

**Class schedule**

(Computer Vision is fast changing field, therefore contents given bellow may be changed as the course progresses)

|  |  |  |
| --- | --- | --- |
| **Week** | **Dates** | **Topics** |
| W1 | 12-16 Aug | Introduction to Computer Vision |
| W2 | 19-23 Aug | Linear Filters, Spatial Domain |
| W3 | 26-30 Aug | Linear Filters, Frequency Domain (Q1) |
| W4 | 02-06 Sep | Image restoration and reconstruction |
| W5 | 09-13 Sep | Compression |
| W6 | 16-20 Sep | Segmentation (A1) |
| W7 | 23-27 Sep | Mid term |
| **W8** | **30 Sep – 06 Oct** | **Fall Break** |
| W9 | 07-11 Oct | Project presentations |
| W10 | 14-18 Oct | Segmentation |
| W11 | 21-25 Oct | Features extraction (Q2) |
| W12 |  | Object detection and tracking |
| W13 | 28-31 Oct | Classification (A2) |
| W14 | 04-08 Nov | Scene understanding |
| Week 14 | 11-15 Nov | Deep learning and its applications in computer vision (A3) |
| Week 15 | 18-22 Nov | Projects presentation |