

North South University

Department of Electrical and Computer Engineering

CSE 583: Digital Image Processing

Course Outline – Fall 2022

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| **Course Instructor:** Dr. Shafin Rahman  **Office Location:** SAC 921  **Email:** [shafin.rahman@northsouth.edu](mailto:shafin.rahman@northsouth.edu)  **Office hours:** Appointment basis | **Credit:** 3 credit hours.  **Class hours:** 10:00 am - 12:30pm (Friday)  **Classroom:** LIB 608 |

**Catalog Description (Syllabus)**

Introduction; Point operations; Histograms; Spatial operations; Affine transformations; Image rectification; Interpolation and other transformations; Contrast enhancement; Convolution operation, Magnification, and Zooming; Fourier transform; Edge detection; Boundary extraction and representation; Mathematical morphology.

**Course Objectives**

1. To provide an introduction to basic concepts and methodologies for the formation, representation, enhancement, compression, segmentation, and classification of digital images.
2. To describe and implement basic image processing algorithms and operations.

**Textbook**

1. “Digital Image Processing”, R.C. Gonzalez and R.E. Woods, 4th Edition, Pearson, 2018
2. “Digital Image Processing using MATLAB”, R.C. Gonzalez and R.E. Woods, 2nd Edition

**Marks distribution**

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| Assignments (3) | **15%** |
| Midterm Exam (1) | **20%** |
| Final Exam (1) | **25%** |
| Project + Presentation | **15%** |
| Quiz | **10%** |
| Online Programming Performance | **10%** |
| Attendance | **5%** |

**Assignments**

During the course of the semester, **3 assignments** will be provided to you. These assignments will typically involve solving mathematical problems, answering short theoretical queries, and have a simple programming component based on performing a series of operations on an example image. **MATLAB** can be used to complete these programming assignments. Assignments are to be submitted individually - cheating on an assignment will result in an **automatic** **zero** on that assignment. If there are repeat offenses, you will receive an F grade on the course. **AI plagiarism** (like ChatGPT) is not allowed.

**Exams**

No electronic devices except non-programmable calculators will be allowed during exams. Calculators cannot be shared with friends. You must bring your own calculator during exams. Requests for **makeup midterms** must be made **before** the scheduled date of the midterm to be considered. No makeup will be held for the Final Exam – please make sure to attend it during the allotted slot.

**Project**

Students will be divided into **groups of three** (you are encouraged to form your own teams). As part of the team, students will have to **submit a project** which takes a deep dive into a particular technology or application of digital image processing/computer vision and concisely summarizes the state-of-the-art for that application in IEEE format. Additionally, each team will also have to **present** their findings to the rest of the class during the last 1-2 classes of the semester and complete a **final report** at the end of the semester. The programming project must be completed using **MATLAB** or **Python**.

**Grading policy**

NSU grading policy will be followed – if you want to pass this course, you will have to aim for obtaining at least 60 percent (<http://www.northsouth.edu/academic/grading-policy.html>). Any curve to the raw score will be contingent on your attendance over the semester. I believe it is valid to curve a student’s grade (**within reason**) if they performed poorly in spite of putting in their best effort to succeed. If a student is **unable to complete the simple task of being present during lectures**, that indicates they are not putting in their best effort to the faculty, and will therefore forego their curve.

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| **Numerical Scores** | **Letter Grade** | **Grade Points Per Credit** |
| 93 and above | A Excellent | 4.0 |
| 90 – 92 | A- | 3.7 |
| 87 – 89 | B+ | 3.3 |
| 83 – 86 | B Good | 3.0 |
| 80 – 82 | B- | 2.7 |
| 77 – 79 | C+ | 2.3 |
| 73 – 76 | C Average | 2.0 |
| 70 – 72 | C- | 1.7 |
| 67 – 69 | D+ | 1.3 |
| 60 – 66 | D Poor | 1.0 |
| Below 60 | F\* Failure | 0.0 |

**General course administration**

The class presentations will be interactive lectures and discussions. Canvas will be used for assignment, project, quiz, and exams.

MATLAB download link:

**Topics covered and level of coverage (Topic/Hours):**

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| No. | Topic | Coverage |
| 1 | Introduction, basics, image formation, applications | 3 Hours |
| 2 | Spatial filtering, intensity transformation, Contrast enhancement, histogram processing **[Assignment]** | 3 Hours |
| 3 | Smoothing, sharpening, high/low pass filter, Point operations, Convolution operation | 3 Hours |
| 4 | Affine transformations, Interpolation and other transformations, Magnification and Zooming **[Assignment]** | 3 Hours |
| 5 | Filtering in the Frequency Domain | 3 Hours |
| 6 | Edge detection, Boundary extraction and representation **[Assignment]** | 3 Hours |
| 7 | Mid Term Exam | 3 Hours |
| 8 | Image Compression | 3 Hours |
| 9 | Mathematical morphology | 3 Hours |
| 10 | Image segmentation **[Assignment]** | 3 Hours |
| 11 | Feature Extraction, Image Pattern Classification | 3 Hours |
| 12 | Project Presentation | 3 Hours |

**Academic Honesty:** Any means of unauthorized assistance in preparing materials which a student submits as original work is deemed to be cheating and constitutes grounds for disciplinary action. Instructors are expected to use reasonably practical means of preventing and detecting cheating. Any student judged to have engaged in cheating might receive a reduced grade for the work in question, a failing grade in the course, or such other lesser penalty, as the instructor deems appropriate. Serious instances may be referred to the Disciplinary Committee in the Office of the Vice-Chancellor.