ELECTRICAL AND ELECTRONICS ENGINEERING

EE409 – Digital Image Processing

Term Project

Please select the projects from the ones given below and send your **3 preferences** with the names of your teammates (3 students per group) to sezgindulkadir@aybu.edu.tr until **29.10.2023, 22:00**. The project assignments will be done according to the "first come first served" basis. Next to the project topics, in parenthesis, you will see the number of groups that can take that project and the number of team members for each group.

In order to do these projects, you may need to do some research and be able to learn some of the image processing concepts by yourself. You must prepare a functional **GUI** (Graphical User Interface) in order to satisfy the user interactions (load/save images, adjust parameters etc.) in your projects. GUI is also expected to handle user faults and show warnings where required. The schedule of events is given in the following table.

Date	Task	Explanation
26.11.2023 Sunday, 22.00	Preliminary Report	Report must include the explanation of the methods you learned on your project topic and the details of your selected method
24.12.2023 Sunday, 22.00	Final Report & Codes	Report must include the detailed explanation of your method, your GUI and test results for different inputs and parameters
27.12.2023 Wednesday,13.30	Presentation/ Oral Exam	You must demonstrate your project in 5 minutes with different inputs and parameters. You must answer oral questions related to your project and the course topics.

Project Topics:

1. Cartoonize an image (1 group, 3 people/group)

Convert a given image into a cartoon looking image as shown in the example below. The cartoonization level ([0, 10]; 0:Least, 10:Most) must be adjustable over the GUI.
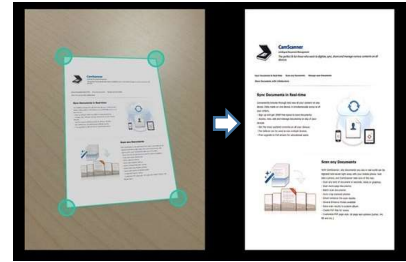

2. Automatic Retouch (1 group, 3 people/group)

Develop an automatic image retouch algorithm for passport photographs. The retouching amount ([0, 10]; 0:Least, 10:Most) must be adjustable over the GUI.
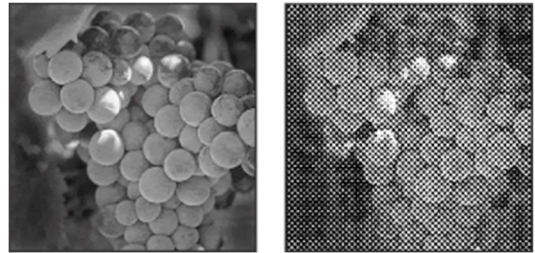
3.   Camera Scanner (1 group, 3 people/group)

Convert a photograph of a document into a scanned-like document image as an example below.

4.   Halftone image converter (1 group, 3 people/group)

Write an algorithm that converts a given grayscale/color image into a halftone binary image.

5.   Auto White Balance (1 group, 3 people/group)

Automatically correct the colors in a photo that is taken under an illumination that is not white.

Auto White Balance

6.   Coin Calculator (1 group, 3 people/group)

Count the number of each TL coin in an image and calculate the total amount of money. Coins may appear on both heads and tails upside.
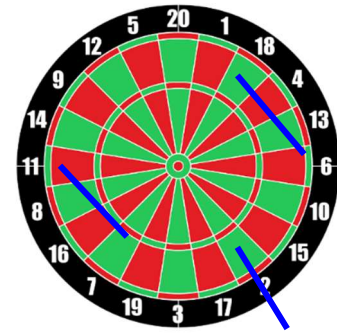

7.   Geometric Shape Counter (1 group, 3 people/group)

Automatically detect the type of the geometric shapes in an image and count the number of each shape, their perimeters, areas and center of mass.
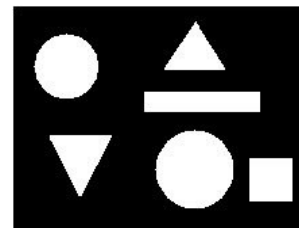
8. Dartboard score calculator (1 group, 3 people/group)

Calculate the score on a dartboard with dart arrows as line segments as shown below. You may do the required assumptions.

9. Image quality assessment (IQA) (1 group, 3 people/group)

Develop an objective image quality assessment method in terms of resolution, brightness, contrast, sharpness, color saturation. Your algorithm must compare 2 images by evaluating their qualities based on the calculated quality score. Test your IQA algorithm with a number of noisy, blurred, low/high contrast, low/high resolution, color/grayscale images. Demonstrate the effect of contrast enhancement, sharpening, noise removal methods on your IQA score.
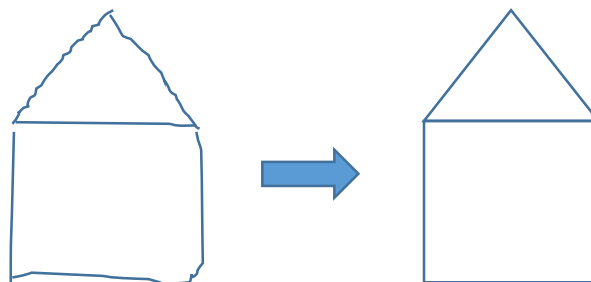

IQA score: 30   IQA score: 60   IQA score: 70

10. Redrawing handwritten linear sketches (2 groups, 3 people/group)

Convert a given an image with hand-drawn linear sketches into a computer drawn image with perfect lines.


11. Steganography (Hiding messages in images) (1 group, 3 people/group)

Steganography is the practice of hiding a secret data within another public data. Implement a steganography technique to hide the data of a text (having 1-200 characters) into an image (resolution between 0.1MP - 1MP) data and then recover that message.
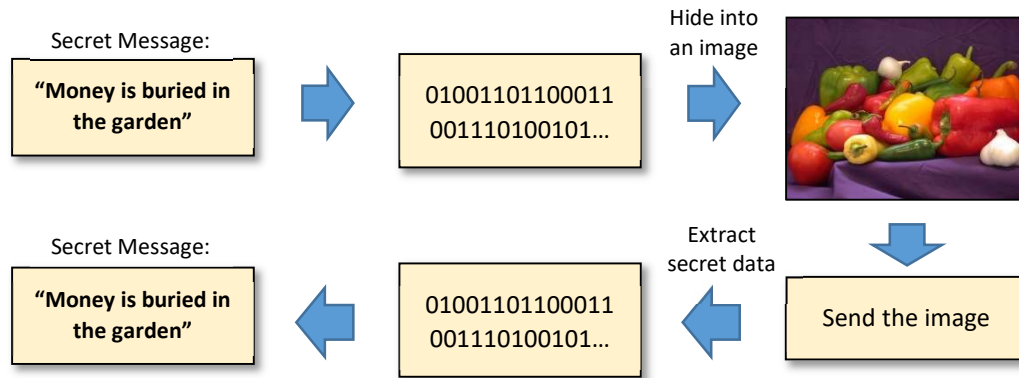
## 12. Blurring an image with a stencil (1 group, 3 people/group)

Apply a blur to a given image according to a given black&white stencil as shown in the example below. The black parts of the stencil means that part of the image must be blurred and white parts should be kept as the original. The blurring level must be adjustable over the GUI.
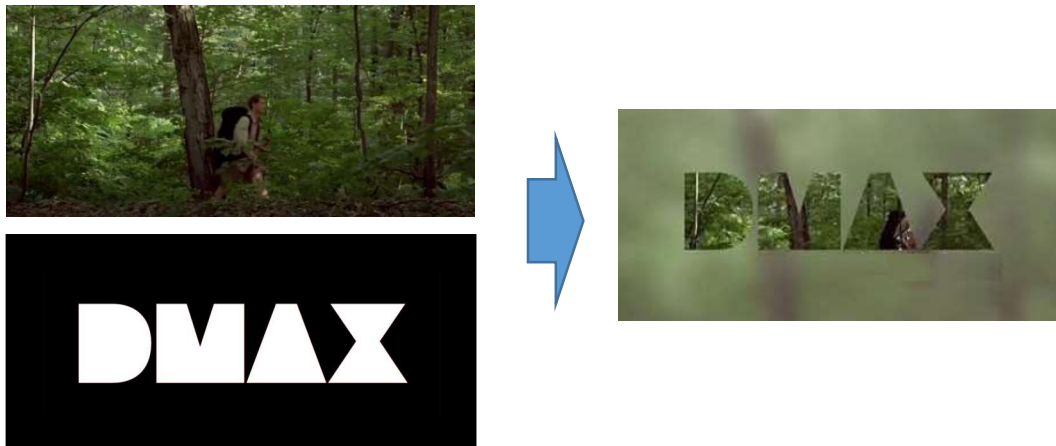
## 13. Censoring parts of an image (1 group, 3 people/group)

Apply the censoring methods to a given image as shown in the example below. The part of the image that will be censored must be selected with mouse. The area inside the selected region must be censored and other parts should be kept as the original.

- Pixelating censor effect: Pixelating blocks' size and pixelating amount ([0, 10]; 0:Least, 10:Most) must be adjustable over the GUI.
- Blurring censor effect: Blurring amount must be adjustable over the GUI.
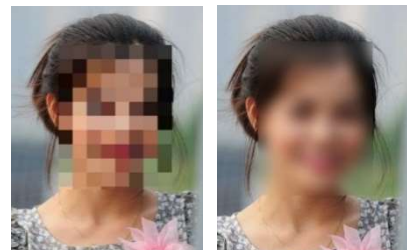
14. Camera roll motion blur simulation (1 group, 3 people/group)

Simulate the motion blur effect on an image due to the roll motion of the camera as an example below.
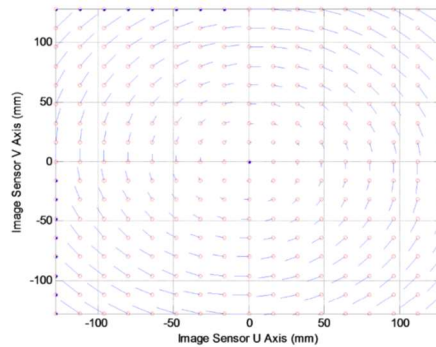
15. Image Effects (1 group, 3 people/group)

Apply the following effects to a given image:

- Puzzling effect: Puzzle square size and shifting range must be adjustable over the GUI.
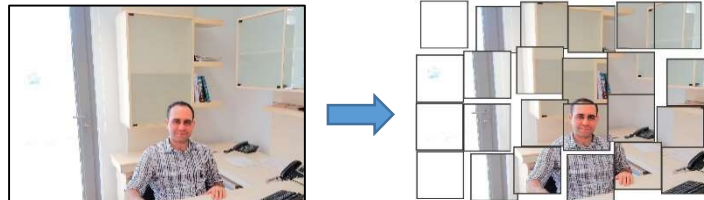
- Checkerboard square effect: Square size and brightness variation range must be adjustable over the GUI.


- Snow effect: Snowflakes' center must be bright white and it must fade out (becomes more transparent) thorough the edges. Each snowflake must have a different radius and they must be randomly distributed over the image. The size range (minimum and maximum radius) of snowflakes and the total number of snowflakes must be adjustable over the GUI.
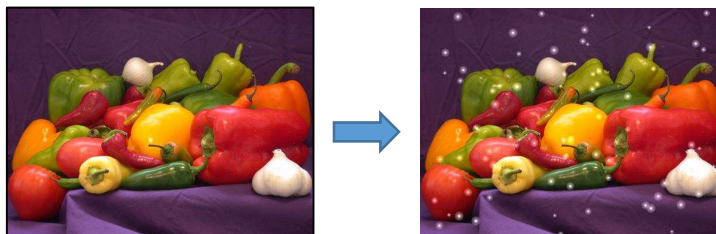
16. Watermarking an image with a given logo (1 group, 3 people/group)

Place any selected logo onto any selected image as a watermark. The logo scale("width:height" scaling ratio, e.g. 1.5:0.8 means that, the width of the logo must be scaled by 1.5, height must be scaled by 0.8) must be selected over the GUI and it must be placed over the image at the location selected with a mouse click.

Apply the following watermarking methods:

- <u>Direct Watermarking:</u> Watermark the image with direct pixel colors of the logo foreground.
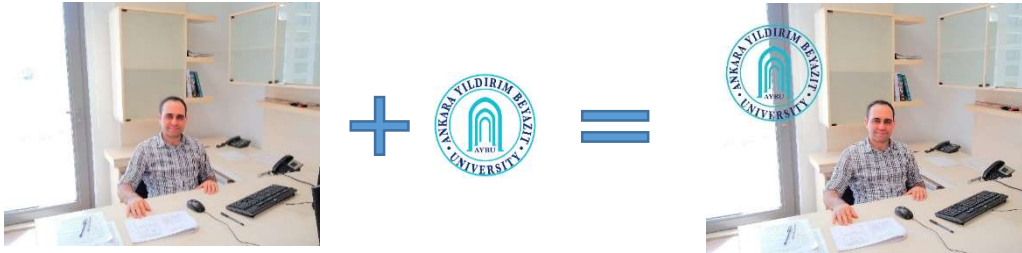
- <u>Transparent Watermarking:</u> Watermark the image with a semi-transparent logo foreground. The transparency level ([0, 1]; 0:No transparency, 1:Full transparency) must be adjustable over the GUI.

- <u>Emboss Watermarking:</u> Watermark the image with a bright semi-transparent embossment of the logo foreground. The embossment brightness level ([0, 1]; 0:Lowest brightness, 1:Full brightness) must be adjustable over the GUI.

17. Multiple Camera System Calibration (1 group, 3 people/group)

Camera calibration is used to find the intrinsic and extrinsic parameters of cameras. Calibrate a multiple camera system setup that has at least 2 cameras.