BLG453E – Example Questions for Final Exam (YHS&GU)

Q1) [3 pts] Explain how foreground is determined using Gaussian fitting method. What is the purpose of confidence interval in Gaussian fitting method?

Q2) [3 pts] Draw separately motion field and optical flow of the barber pole that is shown at the right.


Q3) [3 pts] Explain two basic assumptions of Optical Flow algorithm using their equations.

Q4) [3 pts] According to which criteria are principal components selected in PCA analysis? Explain why.

Q5) [3 pts] Give the image transformation matrix of $\frac{\pi}{4}$ rad rotation, (5, 0) translation, and (0.5, 0.5) scaling in order.

Q6) [5 pts] Which morphologic operator does perform the operation that is shown at the right?
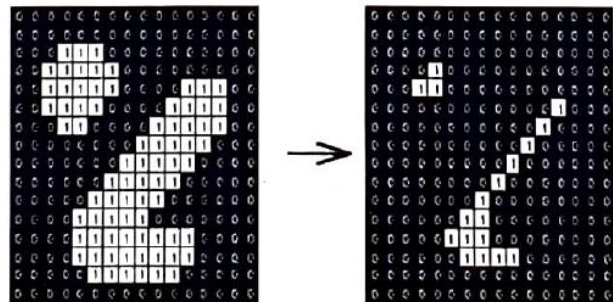

Q7) [20 pts] Suppose that you have 3D images containing randomly generated tubular structures as in the figure on the left. The creation pseudocode of an image is given below.


```
img = zeros(500,500,500)
for i=1:tube_count
        for j=1:join_count
                >Select random (x,y,z) position inside the image
                >Place a sphere with radius r centered at (x,y,z)
                >Combine the created spheres with cylinders as given in the
                figure below to create a tube.
Add Gaussian noise to the image.
```
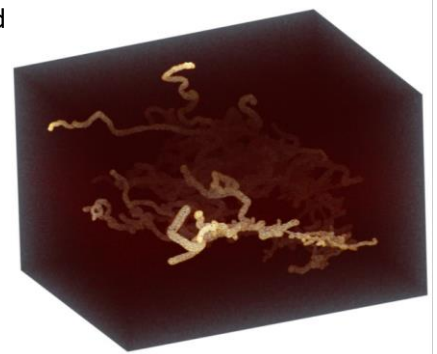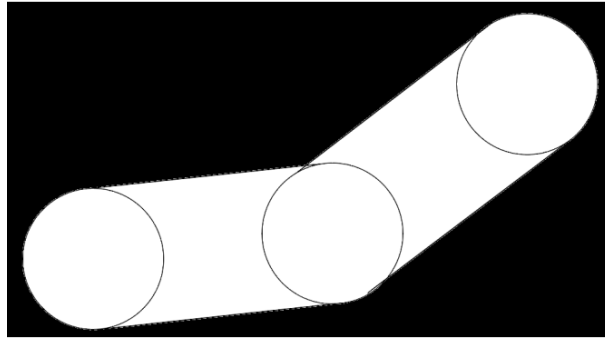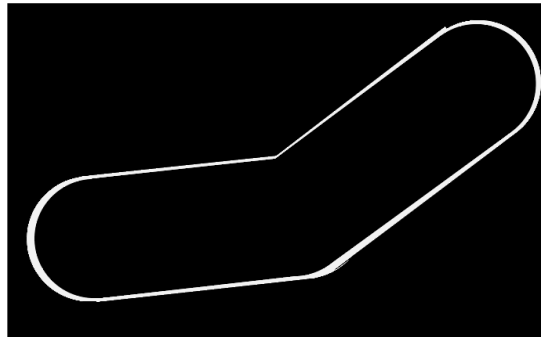
Knowing that the tubular structures always have greater intensity than the background, how can we find out that whether all the created tubes are connected? Describe the steps and write the pseudocode.

Q8) [10 pts] By using what kind of filters we can obtain only the borders of each tubular structure as given in the figure below? Write the pseudocode.

Q9) [10 pts] How can we find out the r parameter used in the creation process?

Q10) [10 pts] In this part of the exam, we will deal with an old football video game having a top-down view. Full width of the field is always shown to the player. However, only a part of the length of the field can be seen by the game camera is shown. The game camera is adjusted so that it slides up and down to contain the ball in its view. A screenshot from the game and the camera's position is given below.


Camera's view
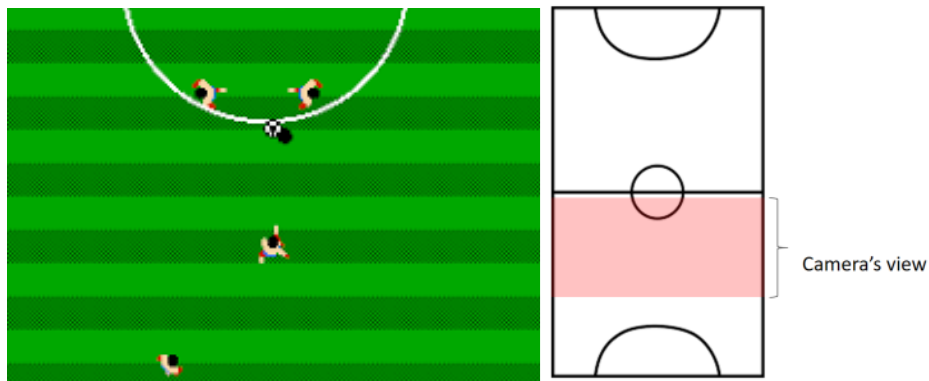
Suppose that we have the necessary segmentation algorithm to segment the players of both teams and the ball. How could we make an analysis of total running amounts between the players of two teams from a full gameplay video? **Suppose that the camera is not moving.** Write the algorithm step by step. You are only responsible from the players inside the view.

Q11) [10 pts] Redesign the algorithm for the conditions when the camera is also moving. How can you decide that a player is not changing his position? Add some steps to the procedure in the previous part.

Q12) [10 pts] You have a part of gameplay video where a goalkeeper gives the ball to a defensive player from the same team and after some passes and ball losses another player from the same team scores the goal to the opposing team's net. Could we check the total count of players from this gameplay video?

Q13) [15 pts] A mukhtar from Central Anatolia received a payment from the municipality to use Computer Vision techniques to monitor the patterns of behavior of sheep on his barn. Fixed cameras will be mounted below the ceilings of the rooms in which the sheep are kept, looking down on the animals in their pens, connected by a small corridor. The sheep are numbered by writing digits on their wool. The floorplan of the barn is given below. Each camera's field of view will cover a whole pen. The cameras will be networked to a powerful computer system running vision software. At times when the system is in use, the sheep will be well illuminated.
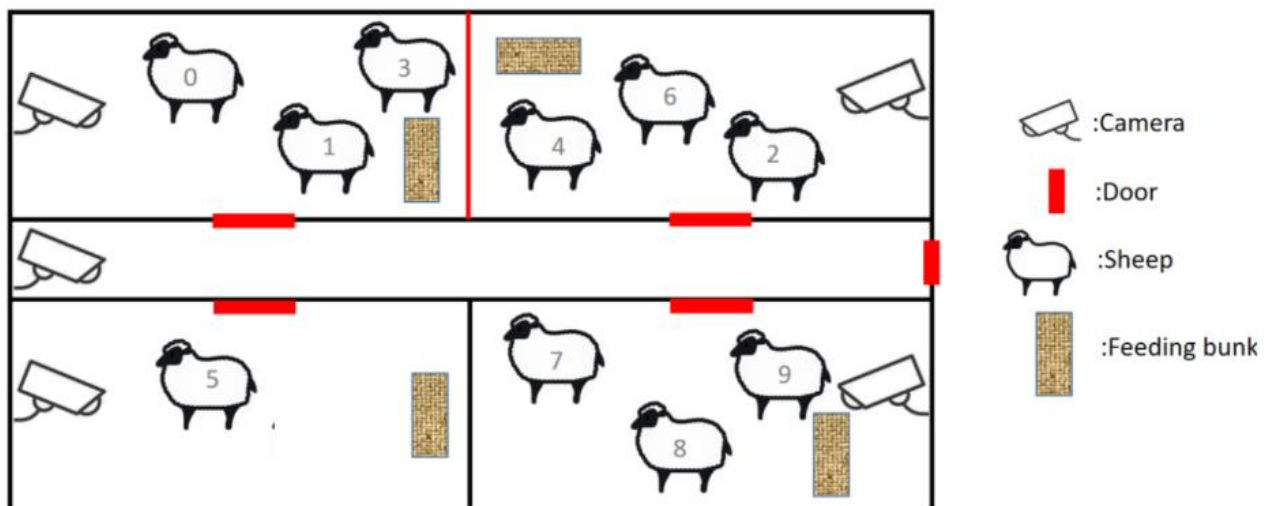
The company wishes to collect statistical information about:

      1- number of sheep in each pen
      2- popular areas where sheep spend time in each pen
      3- whether a selected sheep is eating something (Standing in front of a feeding bunk)
      4- whether a selected sheep is sleeping (Staying still)

It is therefore necessary for the software to track individual sheep and record where in the pen they are at each moment, as well as their current activity as far as possible. Note that the sheep are likely to spend some time very close to one another. Outline an overall algorithm to carry out this task. Pay particular attention to the choice of methods and how they will fit together, giving reasons for your choices. You are not required to describe individual methods in detail.

Q14) [15 pts] What kind of problems may occur which causes the failure of these algorithms? State two failure cases.