

Advanced Driver Assistance Systems

AEZC442/AELZC442/ETZC442

Comprehensive Exam: Regular Question Paper

[40 M]

- Q.1 Set. (A) Compare the Laplacian kernel, with and without diagonal terms of the following matrix at any two edge locations. Comment on the results.

$$\begin{bmatrix} 128 & 128 & 128 & 128 & 128 & 128 \\ 128 & 128 & 128 & 128 & 128 & 128 \\ 128 & 1 & 1 & 1 & 1 & 128 \\ 128 & 128 & 128 & 128 & 128 & 128 \\ 128 & 128 & 128 & 128 & 128 & 128 \\ 128 & 128 & 128 & 128 & 128 & 128 \end{bmatrix}$$

[7]

- Q.1 Set. (B) Compare the Laplacian kernel, with and without diagonal terms of the following matrix at any two edge locations. Comment on the results.

$$\begin{bmatrix} 128 & 128 & 128 & 128 & 128 & 128 \\ 128 & 128 & 128 & 128 & 128 & 128 \\ 128 & 128 & 128 & 1 & 128 & 128 \\ 128 & 128 & 128 & 1 & 128 & 128 \\ 128 & 128 & 128 & 1 & 128 & 128 \\ 128 & 128 & 128 & 128 & 128 & 128 \end{bmatrix}$$

[7]

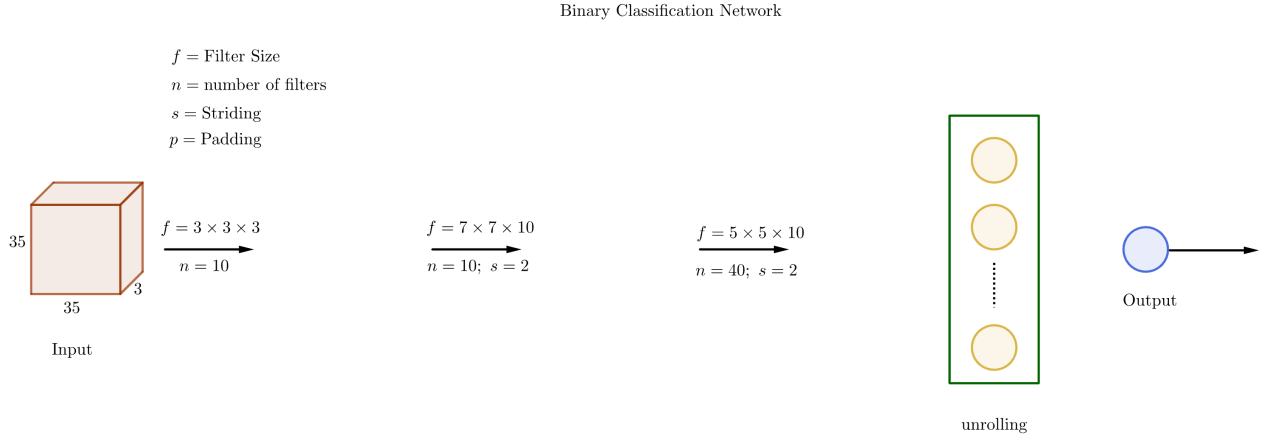
- Q.2 Set. (A) Consider the position of a target measured by an automotive radar at different time instants $(t[s], x[m]) = (0.5, 2.1)$, and $(2, 5.2)$. Fit a straight line using matrix inverse method and determine the initial position and velocity of the target. [7]

- Q.2 Set. (B) Consider the position of a target measured by an automotive radar at different time instants $(t[s], x[m]) = (0.5, 3.1)$, and $(2, 6.2)$. Fit a straight line using matrix inverse method and determine the initial position and velocity of the target. [7]

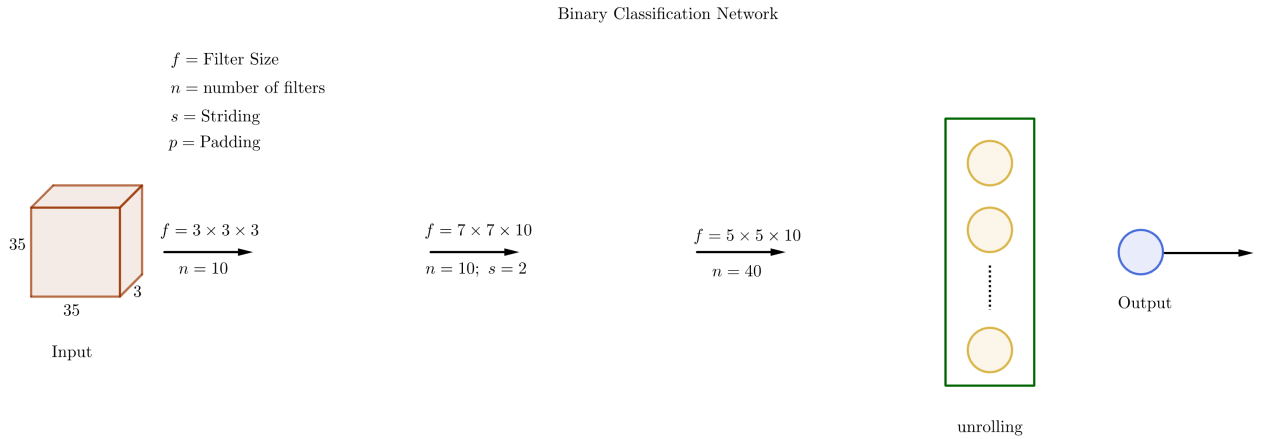
- Q.3 Set. (A) Consider steepest gradient descent (SGD) method for determining $m - c$ parameter of a straight line passing through the points $(1.5, 6)$, and $(2, 7)$. Determine the cost function and one iteration of SGD. Assume step as 0.001, and initial values of slope and intercept as 1.5 and 2.5 respectively. [7]

- Q.3 Set. (B) Consider steepest gradient descent (SGD) method for determining $m - c$ parameter of a straight line passing through the points $(1, 5)$, and $(2, 7)$. Determine the cost function and one iteration of SGD. Assume step as 0.001, and initial values of slope and intercept as 1.5 and 2.5 respectively. [7]

- Q.4 Set. (A) Represent the image pixel points $(x_1 = 0.5, y_1 = 1)$, $(x_2 = 2, y_2 = 4)$, and $(x_3 = 3, y_3 = 6)$ in Hough parametric space ($m - c$ plane) and also determine the parameters of straight line passing through these points. Restrict $0 \leq m \leq 3$, and $0 \leq c \leq 3$. [7]
- Q.4 Set. (A) Represent the image pixel points $(x_1 = 0.5, y_1 = 1)$, $(x_2 = 2.5, y_2 = 5)$, and $(x_3 = 3, y_3 = 6)$ in Hough parametric space ($m - c$ plane) and also determine the parameters of straight line passing through these points. Restrict $0 \leq m \leq 3$, and $0 \leq c \leq 3$. [7]
- Q.5 Set. (A) Consider the CNN shown in the below figure. Determine the model summary, i.e, size of the weights and bias. What is the activation function used here? [4]



- Q.5 Set. (B) Consider the CNN shown in the below figure. Determine the model summary, i.e, size of the weights and bias. What is the activation function used here? [4]



- Q.6 Set. (A) What is the need for GPS, and IMU sensors on autonomous vehicles. How accelerometer can be used to determine the location of the vehicle? [4]
- Q.6 Set. (B) What is the need for GPS, and IMU sensors on autonomous vehicles. Differentiate between gyroscope and accelerometer. [4]

Q.7 Set. (A) Explain the different steps involved in Kalman filtering. [4]

Q.7 Set. (B) Differentiate between linear and logistic regression. [4]