

Exam:

Due date: **Friday, October 29, 2021 at 11:59pm**

Note: This exam contains two problems. Please answer each question in detail with clear explanation. :)

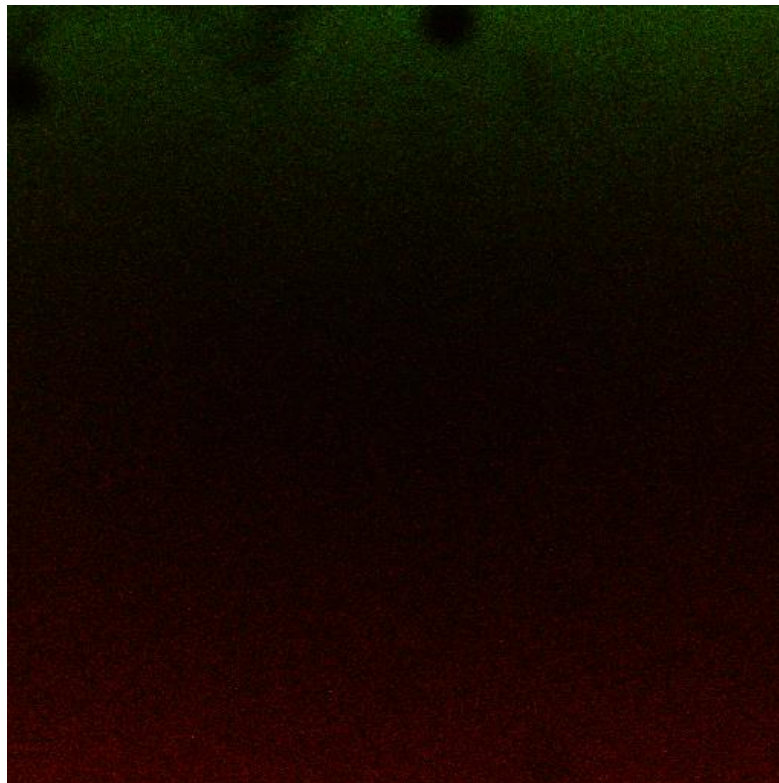
Note: Please type your answer.

Note: Any help taken online or from other people will result in a [failing grade](#).

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Problem 1. An image called “dyes.png” is given to you. In this image, two dyes are diffusing through the system, one from the top (green) and one from the bottom (red). Your job in this problem is to find the boundary of diffusions in this picture.

- A.** How would you find the boundary of the diffusion of each dye? (Note: If you have multiple answers in mind, break them apart and explain each one separately.) **Explain each solution/algorithm in detail.**
- B.** Implement your answer using any programming language you want and save the resulting image.

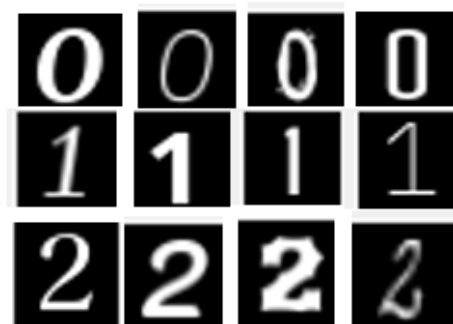


Problem 2. A set of 2500 tiny grayscale images (28x28 pixels each) that represent handwritten digits 0 to 4 and their labels are given to you. The images are stored in “digits.mat” as a matrix of size 784x2500 where each column represents an image. The labels of the images are saved in “labels.mat”. Design a model that could recognize the digit value of any given image.

- A.** How would you create your model to classify the digits? (Note: If you have multiple answers in mind, break them apart and explain each one separately.) **Explain each solution/algorithm in detail.**
- B.** Implement your answer using any programming language you want and save the resulting accuracy rate.

Note: Please use K-fold cross validation for the given dataset.

Note: If the given dataset is too large for your laptop and it takes a long time to run the code, you could use the smaller dataset that has 500 images: “500digits.mat” and “500labels.mat”



Note: Images are part of MNIST Original dataset
<https://www.kaggle.com/avnishnish/mnist-original?select=mnist-original.mat>