Problem 1

Automatically detect the objects in “shape.png” and then specify its polygonal type based on its signature.

Problem 2

The image “blocks.png” includes circles and squares of various sizes. Some of the objects have one or two holes in them. You are to provide algorithms that use morphological and logical operations to answer the following questions. The answers may be in the form of a block diagram of your algorithms, m-files and the results.

a. What fraction of the image pixels is white?

b. How many objects are in the image?

c. How many holes are in the image?

d. How many objects have one or more holes?

e. How many square objects are in the image?

f. Identify the square objects that have holes.

g. Identify the circular objects that have no holes

Problem 3

Satellite images are usually corrupted with some turbulences. Here, we are going to model them using a Gaussian impulse response function. We also assume there is additive white noise in the images.

Load the images “sat1.tiff” and “sat2.tiff”. The Gaussian SD of 5 for the corruption impulse response of the first image and 6 for the second image is estimated before.

a. Now, use your own algorithm to estimate the SD of the white noise from the images. Report your estimated value for each image clearly.

b. Try to perform inverse filtering using the previously estimated values of the Gaussian SD for each image. Discuss about the quality of your restored image. You can use the “deconvwnr” function.

c. Now, it is time to perform Wiener filtering on each image. Use your estimated values of "Part a" and the previously estimated values of the Gaussian SD for each image to implement the Wiener filtering. Again, discuss the quality of your restored images. You can use the "deconvwnr" function.

d. Compare the results of "Part b" and "Part c".

Problem 4

In this problem, you will create and analyze synthetic data with two features (X1, X2), similar to the data shown in Fig. 2.

For class number "1", generate the data as follows.

X1: generate 50 random numbers with Normal distribution (Mean = 1, SD = 0.6)

X2: generate 50 random numbers with Normal distribution (Mean = 1, SD = 0.3)

For class number "2", generate the data as follows.

X1: generate 30 random numbers with Normal distribution (Mean = -1, SD = 0.6)

X2: generate 30 random numbers with Normal distribution (Mean = -1, SD = 0.4)

Then, use the following methods to classify the data.

Perceptron Neural Network

Train a perceptron neural network for classification. Use the training and learning rule that has been mentioned in your textbook. Present your results nicely and explain enough about your implementation.

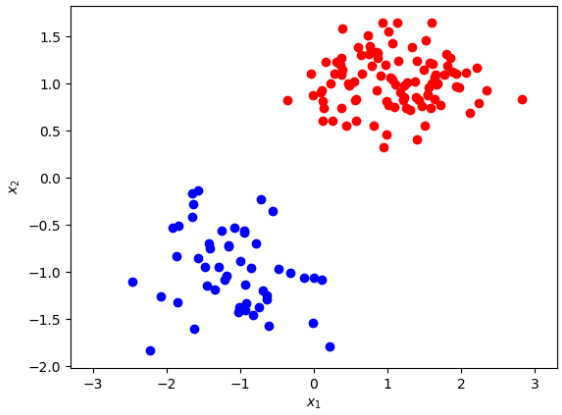

Fig. 2