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BÀI TẬP THỰC HÀNH 3

Q1.

```
function ShowImageTrain(n)
    fprintf('\n Load du lieu train');
    imgTrainAll = loadMNISTImages('train-images.idx3-
ubyte');
    lblTrainAll = loadMNISTLabels('train-labels.idx1-
ubyte');

    figure;
    img = imgTrainAll(:, n);
    img2D = reshape(img, 28, 28);
    strLabelImage = num2str(lblTrainAll(n));
    imshow(img2D);
    title(strLabelImage);
end
```

n	Giá trị
1	5
500	8
5000	2
10000	7
59000	4

Q2.

```
function ShowImageTest(n)
    fprintf('\n Load du lieu test');
    imgTestAll = loadMNISTImages('t10k-images.idx3-
ubyte');
    lblTestAll = loadMNISTLabels('t10k-labels.idx1-
ubyte');

    figure;
    img = imgTestAll(:, n);
    img2D = reshape(img, 28, 28);
    strLabelImage = num2str(lblTestAll(n));
    imshow(img2D);
    title(strLabelImage);
end
```

n	Giá trị
1	7
500	6
5000	0
9000	0

Q3.

```
function CountLabelOfTrainImage()
    fprintf('\n Load du lieu train\n');
    lblTrainAll = loadMNISTLabels('train-
labels.idx1-ubyte');
    lblTrainAllCount = size(lblTrainAll, 1);

    index = 1;
    a = zeros(10);

    while index <= lblTrainAllCount
        label = lblTrainAll(index);
        a(label + 1) = a(label + 1) + 1;
        index = index + 1;
    end

    for i = 1 : 10
        fprintf('Label %d co %d anh. \n', i - 1, a(i));
    end
end
```

Label	SL	Label	SL
0	5923	5	5421
1	6742	6	5918
2	5958	7	6265
3	6131	8	5851
4	5842	9	5949

Q4.

```
function CountLabelOfTestImage()
    fprintf('\n Load du lieu test\n');
    lblTestAll = loadMNISTLabels('t10k-
labels.idx1-ubyte');
    lblTestAllCount = size(lblTestAll, 1);

    index = 1;
    a = zeros(10);

    while index <= lblTestAllCount
        label = lblTestAll(index);
        a(label + 1) = a(label + 1) + 1;
        index = index + 1;
    end

    for i = 1 : 10
        fprintf('Label %d co %d anh. \n', i - 1, a(i));
    end
end
```

Label	SL	Label	SL
0	980	5	892
1	1135	6	958
2	1032	7	1028
3	1010	8	974
4	982	9	1009

Q5.

```
function label = TestRecognition(n)
    fprintf('\n Load du lieu train');
    imgTrainAll = loadMNISTImages('train-images.idx3-
ubyte');
    lblTrainAll = loadMNISTLabels('train-labels.idx1-
ubyte');

    Mdl = fitcknn(imgTrainAll', lblTrainAll);

    fprintf('\n Load du lieu test \n');
    imgTestAll = loadMNISTImages('t10k-images.idx3-
ubyte');
    lblTestAll = loadMNISTLabels('t10k-labels.idx1-ubyte');
```

n	Giá trị
5	4
500	6
900	8

```
    imgTest = imgTestAll(:,n);
    lblPredictTest = predict(Mdl, imgTest');

    label = lblPredictTest;
end
```

Q6.

```
function ShowTestRecognition(n)
    fprintf('\n Load du lieu train');
    imgTrainAll = loadMNISTImages('train-images.idx3-ubyte');
    lblTrainAll = loadMNISTLabels('train-labels.idx1-ubyte');

    Mdl = fitcknn(imgTrainAll', lblTrainAll);

    fprintf('\n Load du lieu test \n');
    imgTestAll = loadMNISTImages('t10k-images.idx3-ubyte');
    lblTestAll = loadMNISTLabels('t10k-labels.idx1-ubyte');

    imgTest = imgTestAll(:,n);
    lblPredictTest = predict(Mdl, imgTest');

    figure;
    img = imgTestAll(:, n);
    img2D = reshape(img, 28, 28);
    strLabelImage = num2str(lblTestAll(n));
    imshow(img2D);

    caption = ['Label: ', strLabelImage, ' | Predict: ',
num2str(lblPredictTest)];

    if(lblTestAll(n) == lblPredictTest)
        caption = [caption, ' ~ KHOP'];
    else
        caption = [caption, ' ~ KHONG KHOP'];
    end

    title(caption);
end
```

Q6*.

Q7.

```
function FailedTestRecognitionCount = FailedTestRecognition(n)
    fprintf('\n Load du lieu train');
    imgTrainAll = loadMNISTImages('train-images.idx3-ubyte');
    lblTrainAll = loadMNISTLabels('train-labels.idx1-ubyte');

    Mdl = fitcknn(imgTrainAll', lblTrainAll);

    fprintf('\n Load du lieu test \n');
    imgTestAll = loadMNISTImages('t10k-images.idx3-ubyte');
    lblTestAll = loadMNISTLabels('t10k-labels.idx1-ubyte');
    lblTestAllCount = size(lblTestAll, 1);

    index = 1;
    FailedTestRecognitionCount = 0;

    while index ~= lblTestAllCount
        if(lblTestAll(index) == n)
            imgTest = imgTestAll(:,index);
            lblPredictTest = predict(Mdl, imgTest');

            if(lblPredictTest ~= n)
                FailedTestRecognitionCount = FailedTestRecognitionCount +
1;
            end
        end

        index = index + 1;
    end
end
```

n	Sai	n	Sai
0	7	5	32
1	6	6	14
2	40	7	36
3	40	8	54
4	38	9	42

Q7*.

```
function ToConfusionMatrix()
    a = zeros(10, 10);

    fprintf('\n Load du lieu train');
    imgTrainAll = loadMNISTImages('train-images.idx3-ubyte');
    lblTrainAll = loadMNISTLabels('train-labels.idx1-ubyte');

    Mdl = fitcknn(imgTrainAll', lblTrainAll);

    fprintf('\n Load du lieu test \n');
    imgTestAll = loadMNISTImages('t10k-images.idx3-ubyte');
    lblTestAll = loadMNISTLabels('t10k-labels.idx1-ubyte');

    for index = 1:10000
        imgTest = imgTestAll(:,index);
        lblPredictTest = predict(Mdl, imgTest');

        if(lblPredictTest ~= lblTestAll(index))
            a(lblTestAll(index) + 1, lblPredictTest + 1) =
a(lblTestAll(index) + 1, lblPredictTest + 1) + 1;
        end
    end

    disp(a);
end
```

CONFUSION MATRIX										
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
0	973	1	1	0	0	1	3	1	0	0
1	0	1129	3	0	1	1	1	0	0	0
2	7	6	992	5	1	0	2	16	3	0
3	0	1	2	970	1	19	0	7	7	3
4	0	7	0	0	944	0	3	5	1	22
5	1	1	0	12	2	860	5	1	6	4
6	4	2	0	0	3	5	944	0	0	0
7	0	14	6	2	4	0	0	992	0	10
8	6	1	3	14	5	13	3	4	920	5
9	2	5	1	6	10	5	1	11	1	967

Q8**

```
function Accuracy = ComputeAccuracy(k)
    fprintf('\n Load du lieu train');
    imgTrainAll = loadMNISTImages('train-images.idx3-ubyte');
    lblTrainAll = loadMNISTLabels('train-labels.idx1-ubyte');

    Mdl = fitcknn(imgTrainAll', lblTrainAll, 'NumNeighbors', k);

    fprintf('\n Load du lieu test \n');
    imgTestAll = loadMNISTImages('t10k-images.idx3-ubyte');
    lblTestAll = loadMNISTLabels('t10k-labels.idx1-ubyte');
    lblTestAllCount = size(lblTestAll, 1);

    fprintf('\nPredicting... ');

    lblPredictTest = predict(Mdl, imgTestAll');
    count = (lblPredictTest == lblTestAll);

    Accuracy = sum(count) / lblTestAllCount;
end
```

	k = 1	k = 3
Accuracy	96.91%	97.06%