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### Q1

```
function showImageNTrain(n)
    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	1	500	5000	10000	59000
Kết quả	5	8	2	7	4

### Q2

```
function showImageNTest(n)
    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	1	500	5000	9000
Kết quả	7	6	0	0

### Q3

```
function countImagesTrainByLabels()

    lblTrainAll = loadMNISTLabels('./train-labels.idx1-ubyte');
    nTrainImages = size(lblTrainAll);

    data = [0 1 2 3 4 5 6 7 8 9;
            0 0 0 0 0 0 0 0 0 0];

    for i = 1:nTrainImages
        switch lblTrainAll(i)
            case 0
                data(2,1) = data(2,1) + 1;
            case 1
                data(2,2) = data(2,2) + 1;
            case 2
```

```

        data(2,3) = data(2,3) + 1;
    case 3
        data(2,4) = data(2,4) + 1;
    case 4
        data(2,5) = data(2,5) + 1;
    case 5
        data(2,6) = data(2,6) + 1;
    case 6
        data(2,7) = data(2,7) + 1;
    case 7
        data(2,8) = data(2,8) + 1;
    case 8
        data(2,9) = data(2,9) + 1;
    case 9
        data(2,10) = data(2,10) + 1;
    end
end
xlswrite('train.xls',data);
end

```

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

Q4

```

function countImagesTestByLabels()

    lblTestAll = loadMNISTLabels('./t10k-labels.idx1-ubyte');
    nTestImages = size(lblTestAll);

    data = [0 1 2 3 4 5 6 7 8 9;
            0 0 0 0 0 0 0 0 0 0];

    for i = 1:nTestImages
        switch lblTestAll(i)
            case 0
                data(2,1) = data(2,1) + 1;
            case 1
                data(2,2) = data(2,2) + 1;
            case 2
                data(2,3) = data(2,3) + 1;
            case 3
                data(2,4) = data(2,4) + 1;
            case 4
                data(2,5) = data(2,5) + 1;
            case 5
                data(2,6) = data(2,6) + 1;
            case 6
                data(2,7) = data(2,7) + 1;
            case 7
                data(2,8) = data(2,8) + 1;
            case 8
                data(2,9) = data(2,9) + 1;
            case 9
                data(2,10) = data(2,10) + 1;
        end
    end
end

```

```

        end
    end
    xlswrite('test.xls',data);
end

```

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

## Q5

```

function result = recognitionNInTests(n)

    imgTrainAll = loadMNISTImages('./train-images.idx3-ubyte');
    lblTrainAll = loadMNISTLabels('./train-labels.idx1-ubyte');
    Mdl = fitcknn(imgTrainAll',lblTrainAll);

    imgTestAll = loadMNISTImages('./t10k-images.idx3-ubyte');
    lblTestAll = loadMNISTLabels('./t10k-labels.idx1-ubyte');

    imgTest = imgTestAll(:,n);

    lblPredictTest = predict(Mdl,imgTest');
    lblImageTest = lblTestAll(n);

    if(lblPredictTest ==lblImageTest)
        result = true;
    else
        result = false;
    end
end

```

n	5	500	900
Kết quả	True	True	True

## Q6

```

function recognitionNInTests_Show(n)

    imgTrainAll = loadMNISTImages('./train-images.idx3-ubyte');
    lblTrainAll = loadMNISTLabels('./train-labels.idx1-ubyte');
    Mdl = fitcknn(imgTrainAll',lblTrainAll);

    imgTestAll = loadMNISTImages('./t10k-images.idx3-ubyte');
    lblTestAll = loadMNISTLabels('./t10k-labels.idx1-ubyte');

    imgTest = imgTestAll(:,n);

    lblPredictTest = predict(Mdl,imgTest');
    lblImageTest = lblTestAll(n);
    figure;
    img2D = reshape(imgTest,28,28);
    imshow(img2D);
    strLabelImage = 'Ban dau ';

```

```

strLabelImage = [strLabelImage,num2str(lblTestAll(n)),'.'];
strLabelImage = [strLabelImage,' Du doan: '];
strLabelImage = [strLabelImage, num2str(lblPredictTest),'.'];
if(lblPredictTest ==lblImageTest)
    strLabelImage = [strLabelImage,' Ket qua dung.'];
else
    strLabelImage = [strLabelImage,' Ket qua sai.'];
end
title(strLabelImage);
end

```

Q6\*

Q7

```

function count = countWrongImgs(n)

imgTrainAll = loadMNISTImages('./train-images.idx3-ubyte');
lblTrainAll = loadMNISTLabels('./train-labels.idx1-ubyte');
Mdl = fitcknn(imgTrainAll',lblTrainAll);

imgTestAll = loadMNISTImages('./t10k-images.idx3-ubyte');
lblTestAll = loadMNISTLabels('./t10k-labels.idx1-ubyte');
nTestImgs = size(imgTestAll,2);

dem = 0;
for i = 1:nTestImgs
    if(lblTestAll(i) == n)
        imgTest = imgTestAll(:,i);

        lblPredictTest = predict(Mdl,imgTest');
        lblImageTest = lblTestAll(i);

        if(lblPredictTest ~= lblImageTest)
            dem = dem + 1;
        end
    end
end
count = dem;
end

```

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