BÀI TẬP THỰC HÀNH 2
CÁC THAO TÁC CƠ BẢN TRÊN MATLAB

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Link github: https://github.com/tanUIT/VRA

Q1:

```
function question1(n)
  allImagesTrain = loadMNISTImages('train-images.idx3-ubyte');
  allLabelsTrain = loadMNISTLabels('train-labels.idx1-ubyte');
  img2D = reshape(allImagesTrain(:, n), 28, 28);
  imgLabel = num2str(allLabelsTrain(n));
  figure
  imshow(img2D);
  title(imgLabel);
end
```

n	1	500	5000	10000	59000
Kết quả	5	8	2	7	4

Q2:

```
function question2(n)
  allImagesTest = loadMNISTImages('t10k-images.idx3-ubyte');
  allLabelsTest = loadMNISTLabels('t10k-labels.idx1-ubyte');
  img2D = reshape(allImagesTrain(:, n), 28, 28);
  imgLabel = num2str(allLabelsTrain(n));
  figure
  imshow(img2D);
  title(imgLabel);
end
```

n	1	500	5000	9000
Kết quả	7	6	0	0

Q3:

```
function question3()
  allLabelsTrain = loadMNISTLabels('train-labels.idx1-ubyte');
  numLabelsTrain = size(allLabelsTrain, 1);
  fprintf('Tong so label la: %d\n',numLabelsTrain);
  countNum0 = 0;
  countNum1 = 0;
  countNum2 = 0;
```

```
    countNum3 = 0;
    countNum4 = 0;
    countNum5 = 0;
    countNum6 = 0;
    countNum7 = 0;
    countNum8 = 0;
    countNum9 = 0;
    for i = 1:numLabelsTrain
        if (allLabelsTrain(i) == 0)
            countNum0 = countNum0 + 1;
        elseif (allLabelsTrain(i) == 1)
            countNum1 = countNum1 + 1;
        elseif (allLabelsTrain(i) == 2)
            countNum2 = countNum2 + 1;
        elseif (allLabelsTrain(i) == 3)
            countNum3 = countNum3 + 1;
        elseif (allLabelsTrain(i) == 4)
            countNum4 = countNum4 + 1;
        elseif (allLabelsTrain(i) == 5)
            countNum5 = countNum5 + 1;
        elseif (allLabelsTrain(i) == 6)
            countNum6 = countNum6 + 1;
        elseif (allLabelsTrain(i) == 7)
            countNum7 = countNum7 + 1;
        elseif (allLabelsTrain(i) == 8)
            countNum8 = countNum8 + 1;
        else
            countNum9 = countNum9 + 1;
        end
    end
    fprintf('So anh co label 0 la: %d\n', countNum0);
    fprintf('So anh co label 1 la: %d\n', countNum1);
    fprintf('So anh co label 2 la: %d\n', countNum2);
    fprintf('So anh co label 3 la: %d\n', countNum3);
    fprintf('So anh co label 4 la: %d\n', countNum4);
    fprintf('So anh co label 5 la: %d\n', countNum5);
    fprintf('So anh co label 6 la: %d\n', countNum6);
    fprintf('So anh co label 7 la: %d\n', countNum7);
    fprintf('So anh co label 8 la: %d\n', countNum8);
    fprintf('So anh co label 9 la: %d\n', countNum9);
end
```

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

Q4:

```
function question4()
  allLabelsTest = loadMNISTLabels('t10k-labels.idx1-ubyte');
  numLabelsTest = size(allLabelsTest, 1);
  fprintf('Tong so label la: %d\n',numLabelsTest);
  countNum0 = 0;
  countNum1 = 0;
  countNum2 = 0;
  countNum3 = 0;
  countNum4 = 0;
  countNum5 = 0;
  countNum6 = 0;
  countNum7 = 0;
  countNum8 = 0;
  countNum9 = 0;
  for i = 1:numLabelsTest
    if (allLabelsTest(i) == 0)
      countNum0 = countNum0 + 1;
    elseif (allLabelsTest(i) == 1)
      countNum1 = countNum1 + 1;
    elseif (allLabelsTest(i) == 2)
      countNum2 = countNum2 + 1;
    elseif (allLabelsTest(i) == 3)
      countNum3 = countNum3 + 1;
    elseif (allLabelsTest(i) == 4)
      countNum4 = countNum4 + 1;
    elseif (allLabelsTest(i) == 5)
      countNum5 = countNum5 + 1;
    elseif (allLabelsTest(i) == 6)
      countNum6 = countNum6 + 1;
    elseif (allLabelsTest(i) == 7)
      countNum7 = countNum7 + 1;
    elseif (allLabelsTest(i) == 8)
      countNum8 = countNum8 + 1;
    else
      countNum9 = countNum9 + 1;
    end
  end
  fprintf('So anh co label 0 la: %d\n', countNum0);
  fprintf('So anh co label 1 la: %d\n', countNum1);
  fprintf('So anh co label 2 la: %d\n', countNum2);
  fprintf('So anh co label 3 la: %d\n', countNum3);
  fprintf('So anh co label 4 la: %d\n', countNum4);
  fprintf('So anh co label 5 la: %d\n', countNum5);
  fprintf('So anh co label 6 la: %d\n', countNum6);
  fprintf('So anh co label 7 la: %d\n', countNum7);
```

```
    fprintf('So anh co label 8 la: %d\n', countNum8);
    fprintf('So anh co label 9 la: %d\n', countNum9);
end
```

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

Q5:

```
function question5(n)
    imgTrainAll = loadMNISTImages('./train-images.idx3-ubyte');
    lblTrainAll = loadMNISTLabels('./train-labels.idx1-ubyte');

    Mdl = fitcknn(imgTrainAll' , lblTrainAll);

    imgTestAll = loadMNISTImages('./t10k-images.idx3-ubyte');
    imgTest = imgTestAll(:, n);
    lblPredictTest = predict(Mdl, imgTest');
    fprintf('Ket qua nhan dang cua anh co thu tu %d trong tap test la: %d\n', n,
lblPredictTest);
end
```

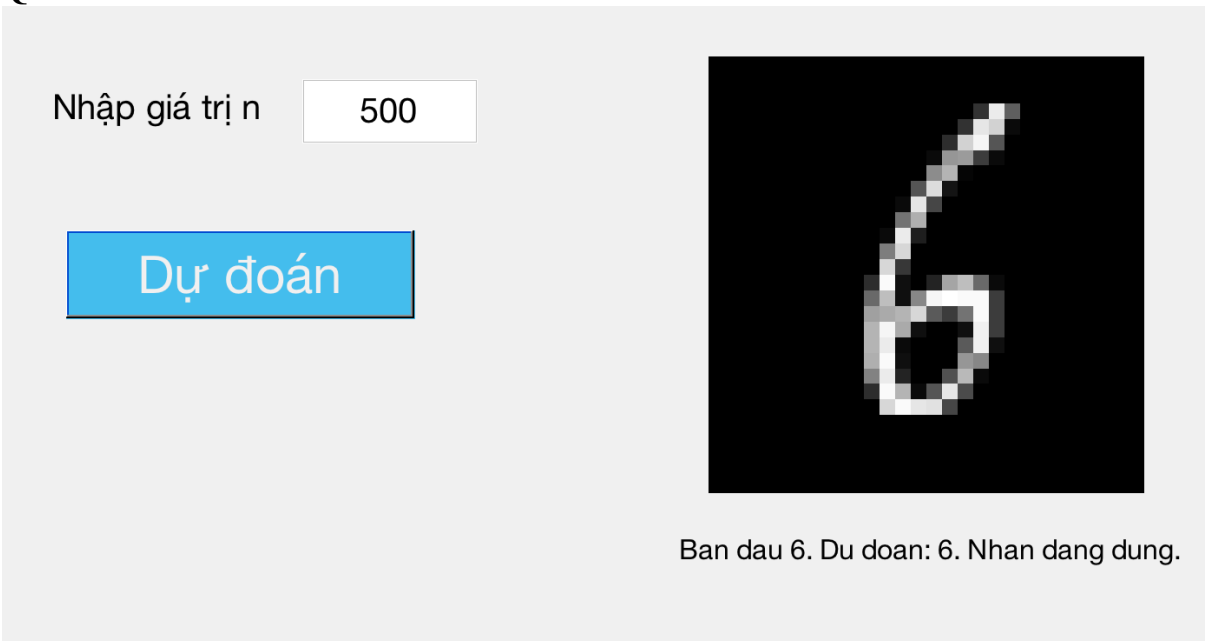
n	5	500	900
Kết quả tiên đoán	4	6	8

Q6:

```
function question6(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(lblImageTest), '.'];
    strLabelImage = [strLabelImage, ' Du doan: '];
    strLabelImage = [strLabelImage, num2str(lblPredictTest), '.'];
```

```
    if(lblPredictTest == lblImageTest)
        strLabelImage = [strLabelImage, ' Nhan dang dung.'];
    else
        strLabelImage = [strLabelImage, ' Nhan dang sai.'];
    end
    title(strLabelImage);
end
```

Q6*:



Q7:

```
function question7(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');

    arrImagesNTest = [];
    for i = 1:size(imgTestAll, 2)
      if (lblTestAll(i) == n)
        arrImagesNTest = [arrImagesNTest, imgTestAll(:, i)];
      end
    end

    countFailure = 0;
```

```
    for i = 1:size(arrImagesNTest,2)
        imgTest = arrImagesNTest(:, i);
        lblPredictTest = predict(Mdl, imgTest');
        if (lblPredictTest ~= n)
            countFailure = countFailure + 1;
        end
    end

    fprintf('So luong anh co label %d bi nhan dang sai la: %d\n', n, countFailure);
end
```

n	0	1	2	3	4	5	6	7	8	9
số ảnh bị nhận dạng sai	7	6	40	40	38	32	14	36	54	42

Q7*:

```
function question7_advance(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');

    arrImagesNTest = [];
    for i = 1:size(imgTestAll, 2)
      if (lblTestAll(i) == n)
        arrImagesNTest = [arrImagesNTest, imgTestAll(:, i)];
      end
    end

    countFailure = [0 0 0 0 0 0 0 0 0 0];
    for i = 1:size(arrImagesNTest,2)
        imgTest = arrImagesNTest(:, i);
        lblPredictTest = predict(Mdl, imgTest');
        if (lblPredictTest ~= n)
            countFailure(lblPredictTest + 1) = countFailure(lblPredictTest + 1) + 1;
        end
    end

    for i = 0:9
      if (i ~= n)
            fprintf('So luong anh co label %d bi nhan dang sai thanh %d la: %d\n', n, i,
            countFailure(i + 1));
```

```
        end
    end
end
```

	0	1	2	3	4	5	6	7	8	9
0	x	1	1	0	0	1	3	1	0	0
1	0	x	3	0	1	1	1	0	0	0
2	7	6	x	5	1	0	2	16	3	0
3	0	1	2	x	1	19	0	7	7	3
4	0	7	0	0	x	0	3	5	1	22
5	1	1	0	12	2	x	5	1	6	4
6	4	2	0	0	3	5	x	0	0	0
7	0	14	6	2	4	0	0	x	0	10
8	6	1	3	14	5	13	3	4	x	5
9	2	5	1	6	10	5	1	11	1	x

Label ảnh test

Label ảnh bị nhận dạng sai

Số lượng ảnh bị nhận dạng sai

Q8:**

```
function question8_advance(k)
    imgTrainAll = loadMNISTImages('./train-images.idx3-ubyte');
    lblTrainAll = loadMNISTLabels('./train-labels.idx1-ubyte');

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

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

    lblResult = predict(Mdl,imgTestAll');
    nResult = (lblResult == lblTestAll);
    nCount = sum(nResult);

    percentageAccuracy = nCount*100/size(imgTestAll, 2);
    fprintf('=> Do chinh xac cua thuat toan knn voi %d nearest neighbors la %.2f\n', k,
percentageAccuracy);
end
```