Computer Vision hw 7 q2-3

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q2 a:

```matlab
clear all; clc; close all;
addpath(genpath('./materials'));

txt = read_data('unknown_text.dat');
blackBox = zeros(size(txt));

figure(1); set(gcf, 'Position', [100, 100, 1100, 450]);
subplot(1,2,1);
imagesc(txt); colormap(gray(255));
subplot(1,2,2);
imagesc(blackBox); colormap(gca, 'jet'); hold on

letters = ['i', 'k', 'o', 'v', 'x'];
fileExtension = '_text.dat';


for l = letters
    file_name = sprintf('%s%s',l, fileExtension);
    letterImage = read_data(file_name);
    [Y, X] = findLetter(txt, letterImage);
    text(X, Y, l, 'Color', 'r', 'FontSize', 20);
end

hold off;
```
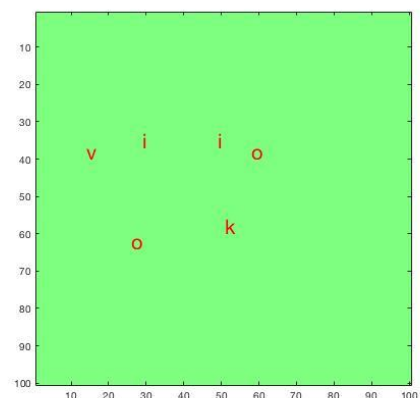
q2 b:

```matlab
txt = read_data('unknown_text_s.dat');
blackBox = zeros(size(txt));

fprintf("If we desire to make the decision rule corrleation=1 we need
 to apply Italic style to the reference letters.\n")
figure(2); set(gcf, 'Position', [100, 100, 1100, 450]);
subplot(1,2,1);
imagesc(txt); colormap(gray(255));
subplot(1,2,2);
imagesc(blackBox); colormap(gca, 'jet'); hold on

for l = letters
    file_name = sprintf('%s%s',l, fileExtension);
    letterImage = read_data(file_name);
    [Y, X] = findLetter(txt, letterImage, 0.76);
    text(X, Y, l, 'Color', 'r', 'FontSize', 20);
end

hold off
```
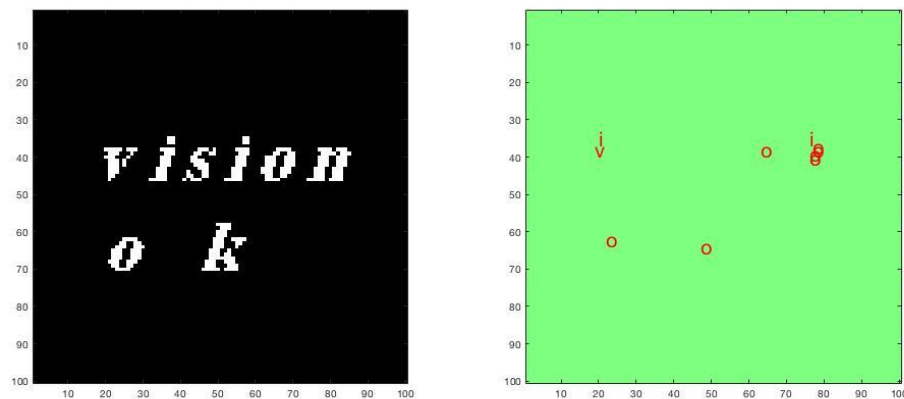
*If we desire to make the decision rule corrleation=1 we need to apply
 Italic style to the reference letters.*

Used Functions

```matlab
function [J, I] = findLetter(mat, letter, thresh)

if nargin < 3
    thresh = 0.99;
end

cm = correlationMatrix(mat, letter);
[J, I] = find(cm > thresh);

end
```

```matlab
function [corrMat] = correlationMatrix(A, B)

B = crop_letter(B);
corrMat = zeros(size(A));
flippedB = rot90(B, 2);
B_corr = convn(B, flippedB, 'valid');

subMats = getSubMatrices(A,B);

[~, ~, mat_i, mat_j] = size(subMats);

for i = 1:mat_i
    for j = 1:mat_j
        mat = subMats(:,:,i,j);
        flippedMat = rot90(mat, 2);
        convedMat = convn(mat, flippedB, 'valid');
        denominator = sqrt(B_corr) * sqrt(convn(mat,
 flippedMat, 'valid'));
        if denominator==0; denominator=1; end
        corrMat(i,j) = convedMat / denominator;
    end
end
end

function [cropped] = crop_letter(letter)

horizon = sum(letter);
h_indices = find(horizon~=0);
h_start = h_indices(1);
h_end = h_indices(end);

vertical = sum(letter,2);
v_indices = find(vertical~=0);
v_start = v_indices(1);
v_end = v_indices(end);

cropped = letter(v_start:v_end, h_start:h_end);
end

function [ sm ] = getSubMatrices(A, B)
    C = im2col(A, size(B),'sliding');
    sm = reshape(C, [size(B), (size(A)+1-size(B))]);
end
```

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