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Roll no. : 1610110152

Instructer: Prof. Vijay Chakka

Lab 6

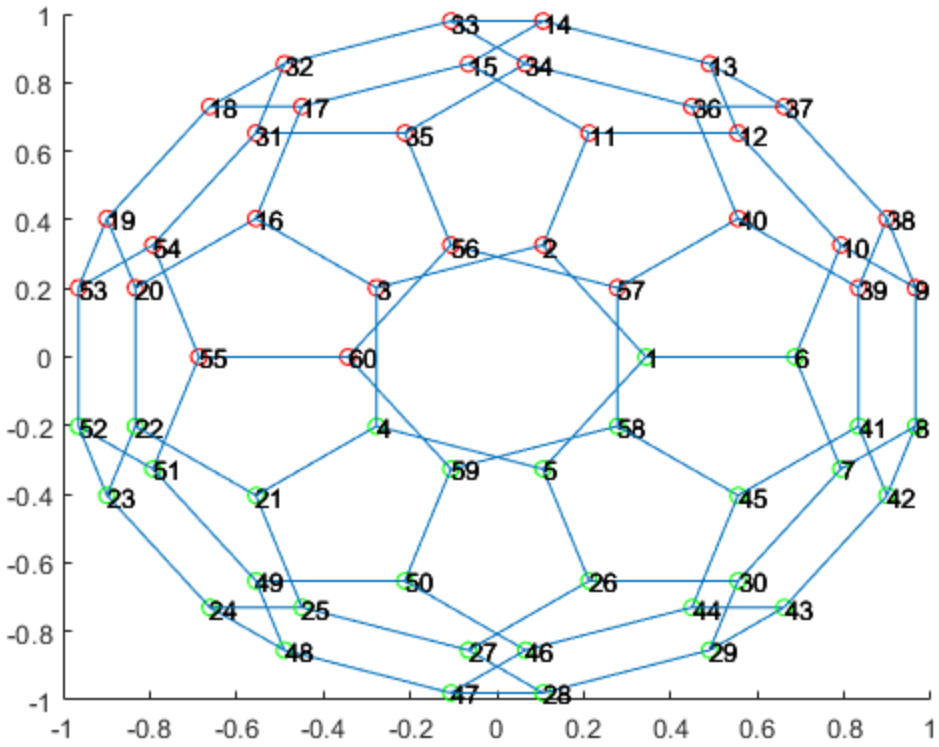
Aim: Spectral methods for graph clustering

```
clc
clear all
close all
```

Question 1

```
[Bucky,xy] = bucky;
Lap_bucky = laplacianMat(full(Bucky));
[U1,Lam1] = eig(Lap_bucky);

vecIDX1 = [2 3 4];
for i = 1:length(vecIDX1)
    figure;
    gClustering(Bucky,xy,U1,vecIDX1(i));
end
```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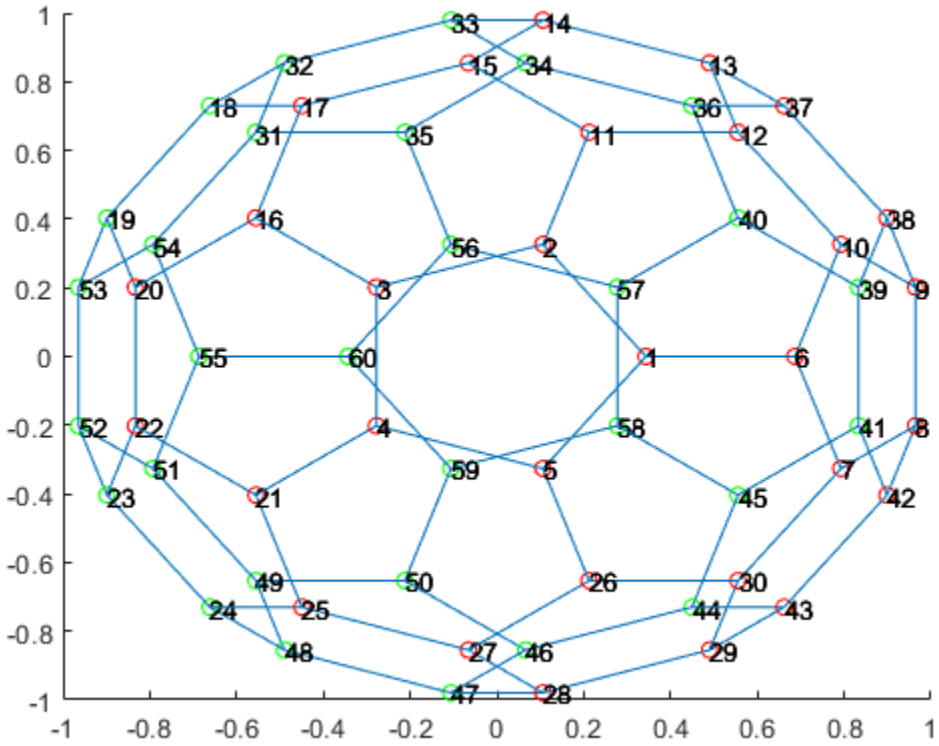
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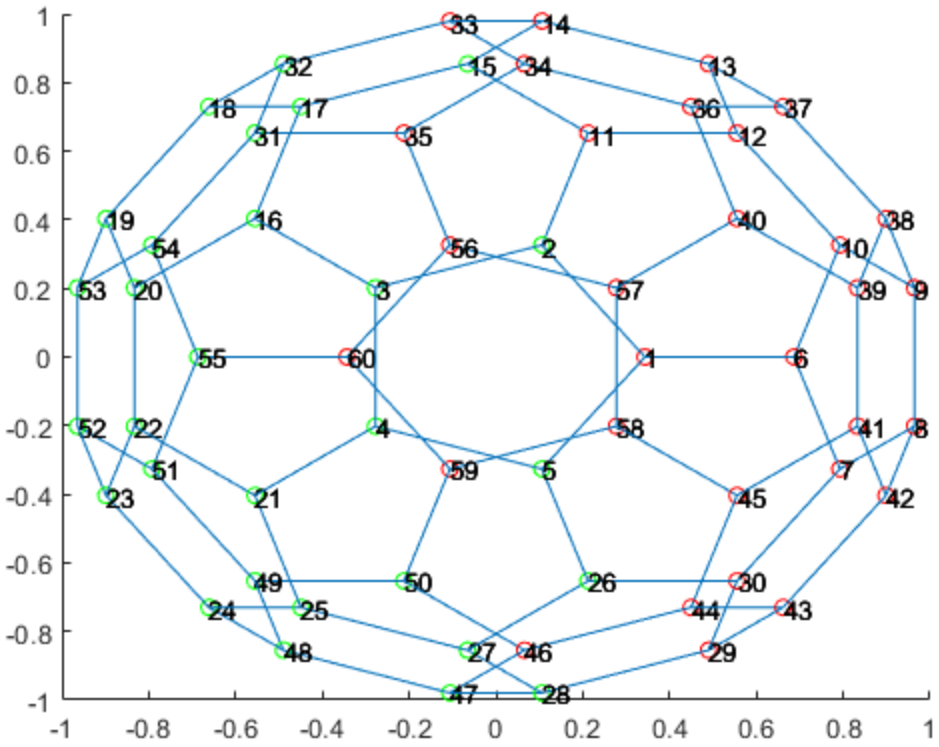
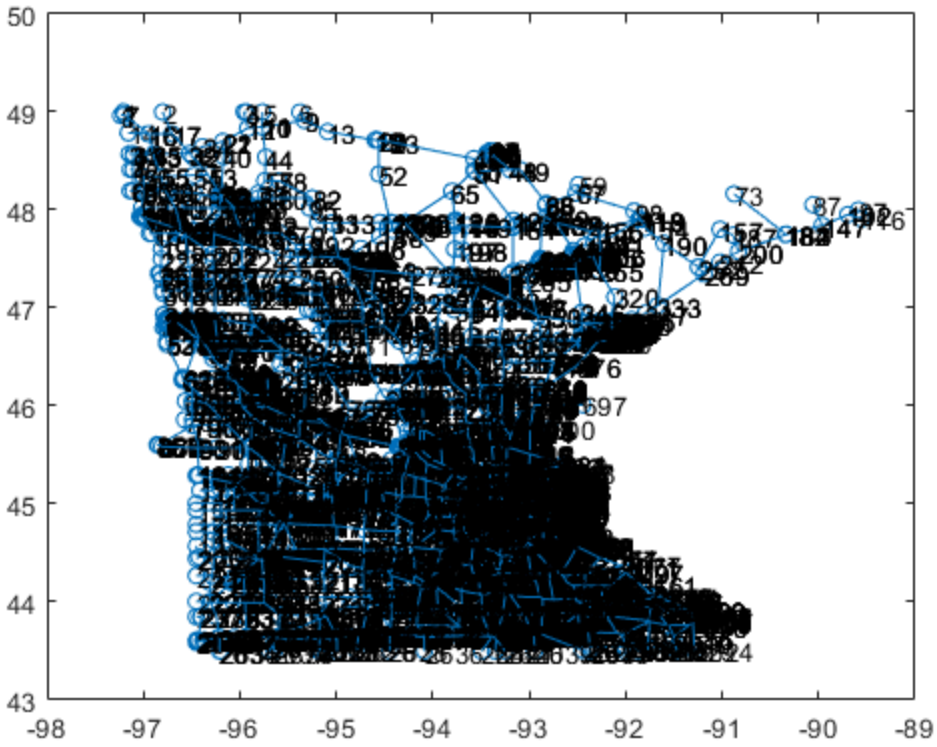


Question 2

```
load('minnesota.mat')
minnesota_A = full(Problem.A);
minnesota_coord = Problem.aux.coord;
plot2DGraph(minnesota_A,minnesota_coord)

lap_minnesota = laplacianMat(minnesota_A);
[U2, lam2] = eig(lap_minnesota);

for i = 1:length(vecIDX1)
    figure;
    gClustering2D(minnesota_A, minnesota_coord, U2, vecIDX1(i));
end
```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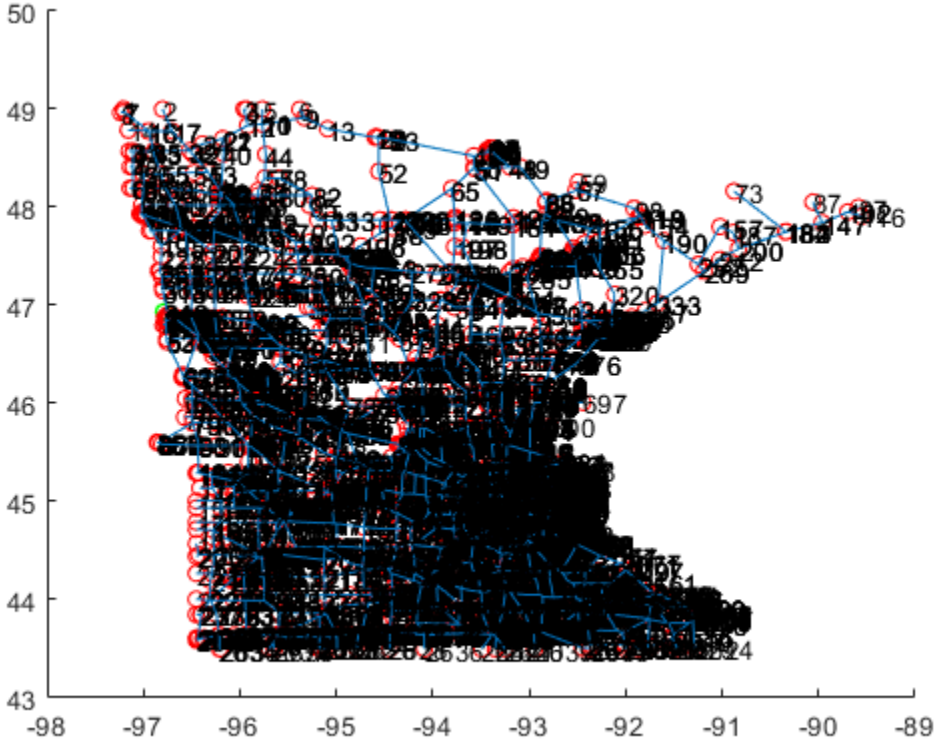
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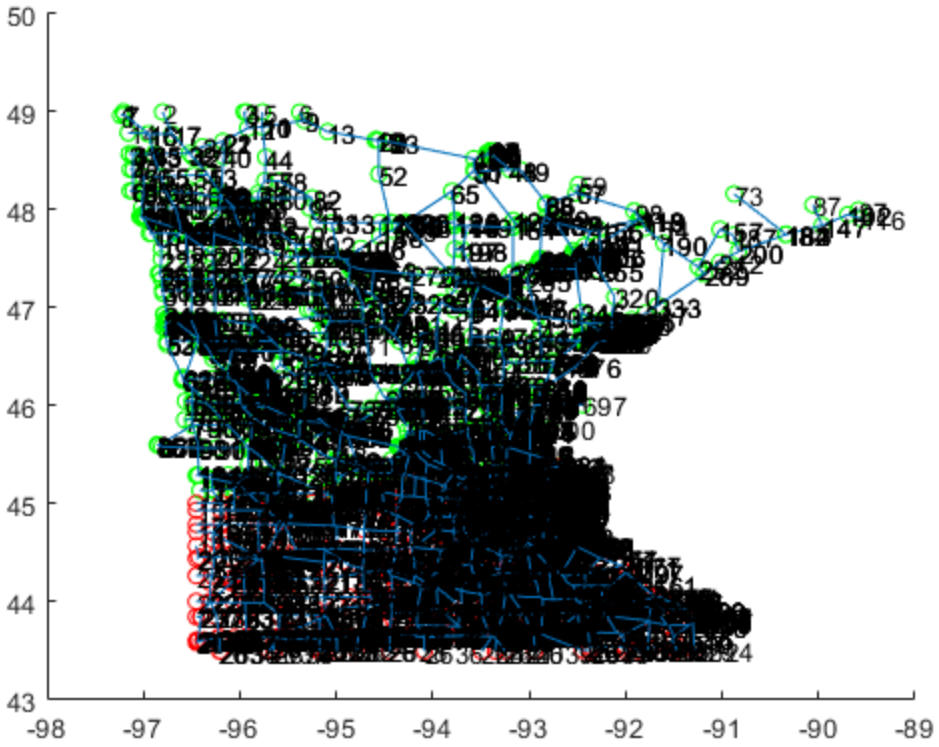
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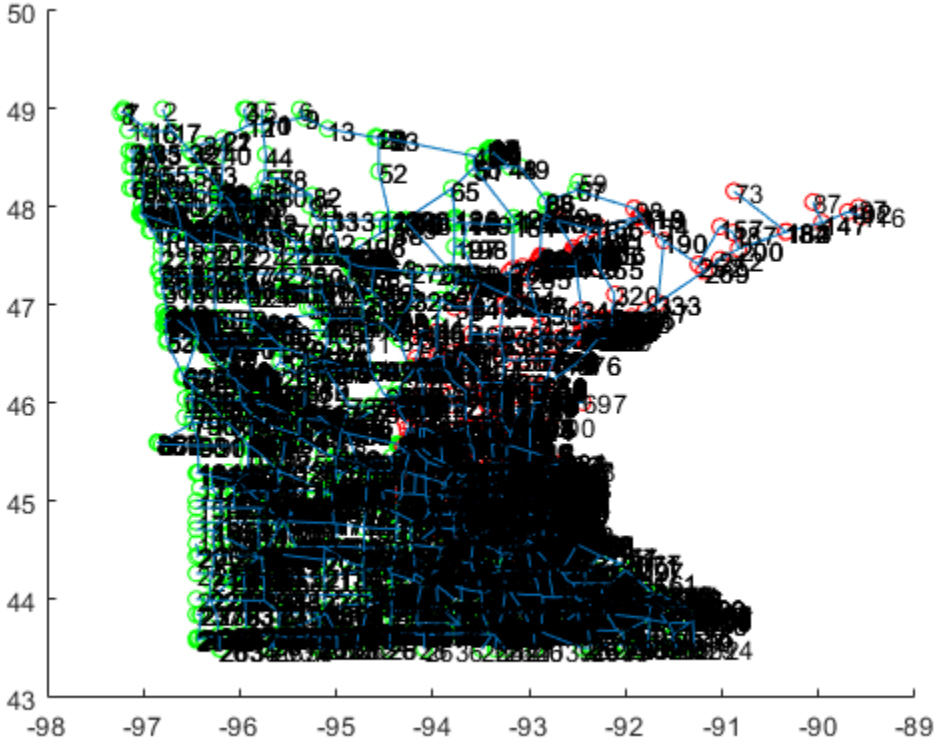
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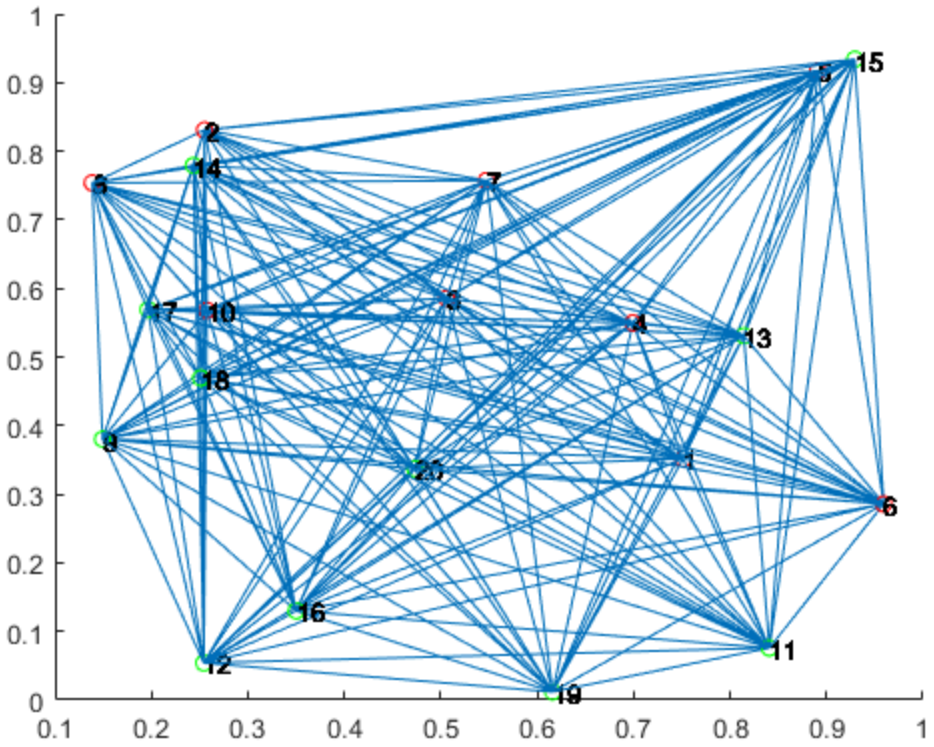
Question 3

```
x1 = imread('gestureData\1.jpg');
x2 = imread('gestureData\2.jpg');
x3 = imread('gestureData\3.jpg');
x4 = imread('gestureData\4.jpg');
x5 = imread('gestureData\5.jpg');
x6 = imread('gestureData\6.jpg');
x7 = imread('gestureData\7.jpg');
x8 = imread('gestureData\8.jpg');
x9 = imread('gestureData\9.jpg');
x10 = imread('gestureData\10.jpg');
x11 = imread('gestureData\11.jpg');
x12 = imread('gestureData\20.jpg');
x13 = imread('gestureData\22.jpg');
x14 = imread('gestureData\33.jpg');
x15 = imread('gestureData\44.jpg');
x16 = imread('gestureData\55.jpg');
x17 = imread('gestureData\66.jpg');
x18 = imread('gestureData\77.jpg');
x19 = imread('gestureData\88.jpg');
x20 = imread('gestureData\99.jpg');

images = [x1 x2 x3 x4 x5 x6 x7 x8 x9 x10 x11 x12 x13 x14 x15 x16 x17
 x18 x19 x20];
num_imgs = length(images)/128;
ssim_mat = [];
for i = 0:num_imgs-1
    image1 = images(:,(i*128)+1:((i+1)*128));
    ssim_mat2 = [];
    for j = 0:num_imgs-1
        image2 = images(:,(j*128)+1:((j+1)*128));
        ssim_mat2 = [ssim_mat2 ssim(image1,image2)];
    end
    ssim_mat = [ssim_mat; ssim_mat2];
end

ssim_mat = ssim_mat - eye(length(ssim_mat));
lap_ssim_mat = laplacianMat(ssim_mat);
[U3,lam3] = eig(lap_ssim_mat);

cord_ssim = rand(20,3);
vecIDX1 = [2 3 4];
y_pred = [];
for i = 1:length(vecIDX1)
    figure;
    pred_y = gClustering(ssim_mat,cord_ssim,U3,vecIDX1(i));
    y_pred = [y_pred pred_y];
end
```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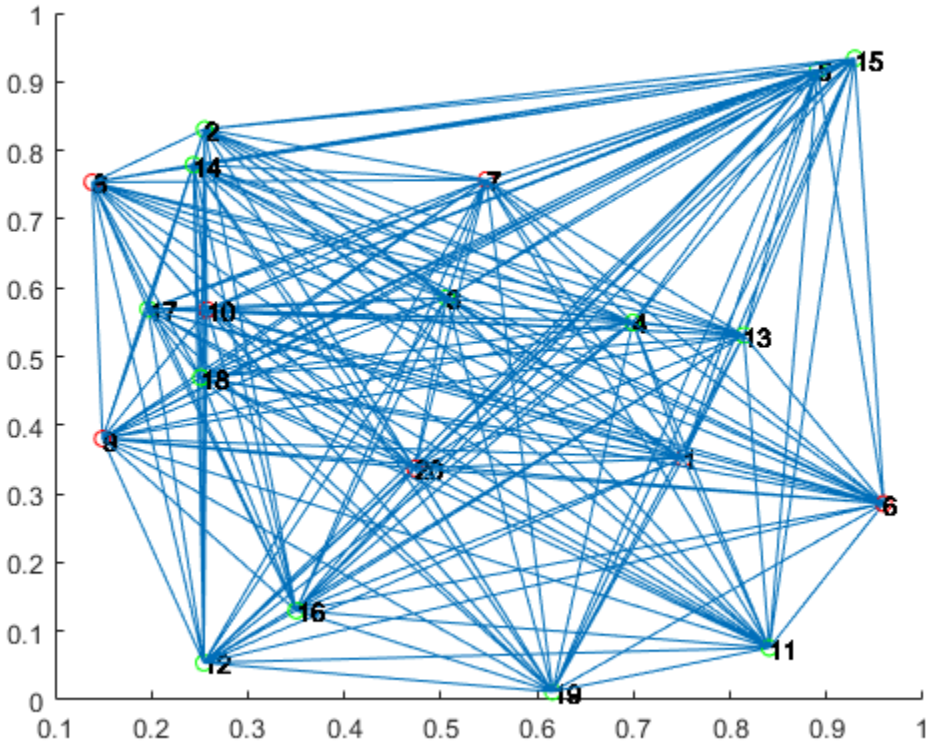
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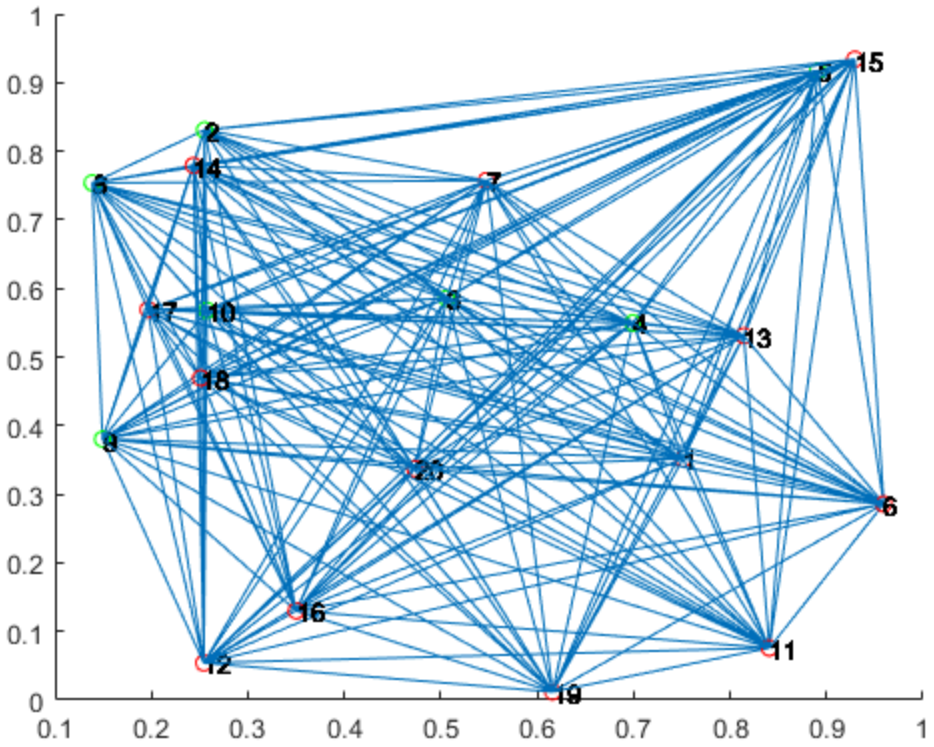

Accuracy

```
actualVal = [1; 1; 1; 1; 1; 1; 1; 1; 1; 1; 0; 0; 0; 0; 0; 0; 0; 0; 0;
 0;];
acc = accuracy(actualVal, y_pred);


function [E,F] = gClustering2D(A,cord,U,vecIDX)
E = [];
F = [];
vector = U(:,vecIDX);

for j = 1:length(vector)
    hold on
    if vector(j) > 0
        plot(cord(j,1),cord(j,2),'marker','O','color','r')

    else
        plot(cord(j,1),cord(j,2),'marker','O','color','g');

    end
    hold off
end

for k = 1: length(A)
    for i = 1:length(A)
```

```
        if A(k,i) ~= 0
            x = [cord(k,1) cord(i,1)];
            y = [cord(k,2) cord(i,2)];
            k1 = int2str(k);
            text(cord(k,1),cord(k,2),k1)
            line(x,y);
        end
    end
end

end



function class_OP = gClustering(A,cord,U,vecIDX)

vector = U(:,vecIDX);
class_OP = [];
for j = 1:length(vector)
    hold on
    if vector(j) > 0
        plot3(cord(j,1),cord(j,2),cord(j,3),'marker','O','color','r');
        class_OP = [class_OP; 1];
    else
        plot3(cord(j,1),cord(j,2),cord(j,3),'marker','O','color','g');
        class_OP = [class_OP; 0];
    end
    hold off
end

for k = 1: length(A)
    for i = 1:length(A)
        if A(k,i) ~= 0
            x = [cord(k,1) cord(i,1)];
            y = [cord(k,2) cord(i,2)];
            z = [cord(k,3) cord(i,3)];
            k1 = int2str(k);
            text(cord(k,1),cord(k,2),cord(k,3),k1)
            line(x,y,z);
        end
    end
end

end



function acc = accuracy(y,y_pred_Mat)
    acc = [];
    for k = 1:size(y_pred_Mat,2)
        y_pred = y_pred_Mat(:,k);
        correct_count = 0;
        incorrect_count = 0;
```

```
        for i = 1:length(y)
            if abs(y(i) - y_pred(i)) == 0
                correct_count = correct_count + 1;
            else
                incorrect_count = incorrect_count + 1;
            end
        end
        total = length(y);
        acc_per = (correct_count/total)*100;
        acc = [acc; acc_per];
    end
end
```

```
function A = LineGraph(n)
first_row = [0 1 zeros(1,n-2)];
last_row = [zeros(1,n-2) 1 0];
A = [first_row];
for i=0:n-3
    next_row = [zeros(1,i) 1 0 1 zeros(1, n-3-i)];
    A = [A; next_row];
end
A = [A;last_row];
end
```

```
function y = linearSearch(X,ele)
for i= 1:length(X)
    if X(i) == ele
        y = 1;
        return;
    end
end
y = 0;
return;
end
```

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