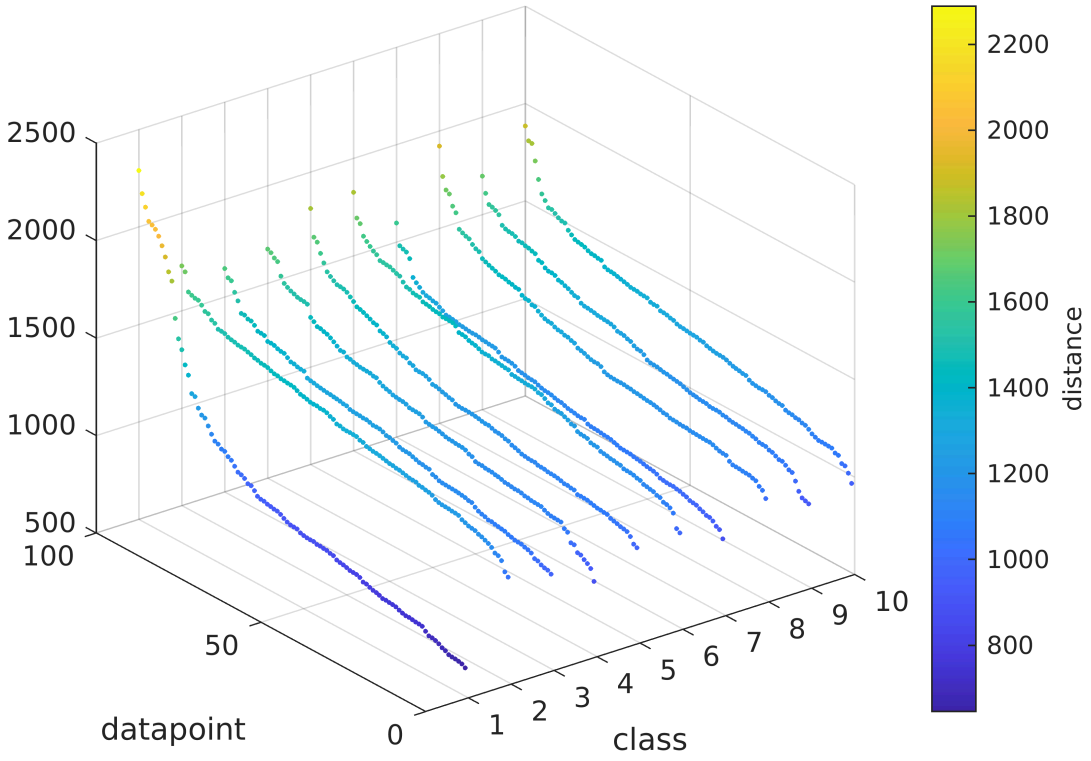
```
% Problem 1
data = load(['604_files/usps_all.mat']);
data = cell2mat(struct2cell(data));
distances = zeros(10, 100);
x = zeros(10,100);
y = zeros(10,100);
for i = 1:10
    mean_img = mean(data(:,:,i), [2, 3]);
    distances(i, :) = sort(vecnorm(double(data(:,1:100,i)) - mean_img));
    x(i, :) = i;
    y(i, :) = linspace(1, 100, 100);
end
x = reshape(x.',1,[]);
y = reshape(y.',1,[]);
distances = reshape(distances.',1,[]);
scatter3(x, y, distances,  '.' , 'CData', distances(:));
h = colorbar;
xticks(linspace(1,10,10));
xlabel('class');
ylabel('datapoint');
ylabel(h, 'distance');
```




```
% Problem 2
for i = 1:10
    mean_img = mean(data(:,:,i), [2, 3]);
    distance = mean(vecnorm(double(data(:,1:100,i)) - mean_img))
```

```
end
```

```
distance = 1.0332e+03
distance = 1.3537e+03
distance = 1.2373e+03
distance = 1.2516e+03
distance = 1.2432e+03
distance = 1.3318e+03
distance = 1.1496e+03
distance = 1.2872e+03
distance = 1.2539e+03
distance = 1.2993e+03
```

```
% Problem 3
for i = 1:10
    mean_img = mean(data(:,:,i), [2, 3]);
    [Distances, Indices] = sort(vecnorm(double(data(:,1:100,i)) ...
        - mean_img));
    Indices = Indices(1:20)
end
```

```
Indices = 1×20
    50    41    96    33    30    11    17    88    87    89    14     6   100 ···
Indices = 1×20
    96    37    82    55    66    54    14    60    73    44    65    78     3 ···
Indices = 1×20
   100    60    16    36    26    99    39    61    23     6    15    90    35 ···
Indices = 1×20
    46    34    95    72    32    45     5    91    78    68     7    49    76 ···
Indices = 1×20
    40    37    95    46    58    28    71    57    63    47    62    74    67 ···
Indices = 1×20
    23     4    80    24    84    88    60    47    63    54    25    92    40 ···
Indices = 1×20
    84    51    12    39    20    67    35    69     6    34    64    22    66 ···
Indices = 1×20
    76    94     2    27    34    75    41    22    56    52    85    97    72 ···
Indices = 1×20
    49    48    22    23    21    63    12    17    90    89    10    59    56 ···
Indices = 1×20
    18    91    81    15    35    62    73    90    19    11     8    37    31 ···
```

```
% Problem 5
for i = 1:10
    mean_img = mean(data(:,:,i), [2, 3]);
    [l2_Distances, l2_Indices] = sort(vecnorm(double(data(:,1:100,i)) ...
        - mean_img));
    l2_Indices = l2_Indices(1:20);
    [l1_Distances, l1_Indices] = sort(vecnorm(double(data(:,1:100,i)) ...
        - mean_img, 1));
    l1_Indices = l1_Indices(1:20);
    % Compare the nearest neighbors
    intersection = intersect(l2_Indices, l1_Indices)
end
```

```
intersection = 1×20
```

```
     6    11    14    17    30    32    33    41    47    48    50    53    65 ···
intersection = 1×19
     3     8    14    22    32    33    37    44    54    55    59    60    65 ···
intersection = 1×19
     6     8    10    15    16    23    26    35    36    39    43    60    61 ···
intersection = 1×18
     5     7    19    29    32    34    45    46    49    60    64    68    72 ···
intersection = 1×16
    17    27    28    37    40    46    47    57    58    63    67    71    74 ···
intersection = 1×19
     4     6    23    24    25    33    38    40    47    54    58    60    63 ···
intersection = 1×18
     6    12    20    22    34    35    39    50    51    64    65    66    67 ···
intersection = 1×17
     2     3    19    22    27    28    34    41    52    56    72    75    76 ···
intersection = 1×19
    10    12    13    17    21    22    23    48    49    53    56    59    63 ···
intersection = 1×20
     8    11    12    15    18    19    27    31    32    35    37    46    61 ···
```