Assignment 4

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1. Feature Selection

1.2

Which looks the most informative about class? (The colors=class in the histogram appear to overlap the least)? Which looks least informative about class?

- The most informative : Statutory-holidays
- The least informative : Pension

1.3

Which attribute, when removed, gave the best accuracy?

- vacation

This defines the best 4-attribute subset. What is it?

The best 4-attribute subset:

- Wage-increase-first-year;
- pension, statutory-holidays;
- vacation;
- contribution-to-health-plan.

Which sized subset, and which set of attributes gets the best accuracy?

Subset Size	Attributes Selected	Accuracy	Attribs Removed
5	All: W, P, Hol, Vac, Health	85.9%	None
4	W, P, Hol, Health	89.4737 %	Vac
3	W, P, Hol	91.2281 %	Vac, Health
2	W, P	85.9649 %	Vac, Health, Hol
1	P	80.7018 %	Vac, Health, Hol, W

The graph shows that when the subset size is 3 and the attributes is W,P,Hol will get the highest accuracy (91.2281 %).

1.4

How many and which attributes are selected? Do they match the results from Q3?

There are 3 attributes are selected:

Selected attributes:

1. w age-increase-first-year
2. pension
3. statutory-holidays

The selected attributes match the attributes founded in Q3 w hen Subset size is 3.

1.5

Which attributes does it pick (and hence which are discarded?)

Pick attributes

- petallength
- petalw idth

Discarded attributes

- sepallength
- sepalw idth
- Copy of sepallength
- Copy of sepalw idth
- Copy of Copy of sepallength
- Copy of Copy of sepalw idth
- Copy of Copy of Copy of sepallength
- Copy of Copy of Copy of sepalw idth

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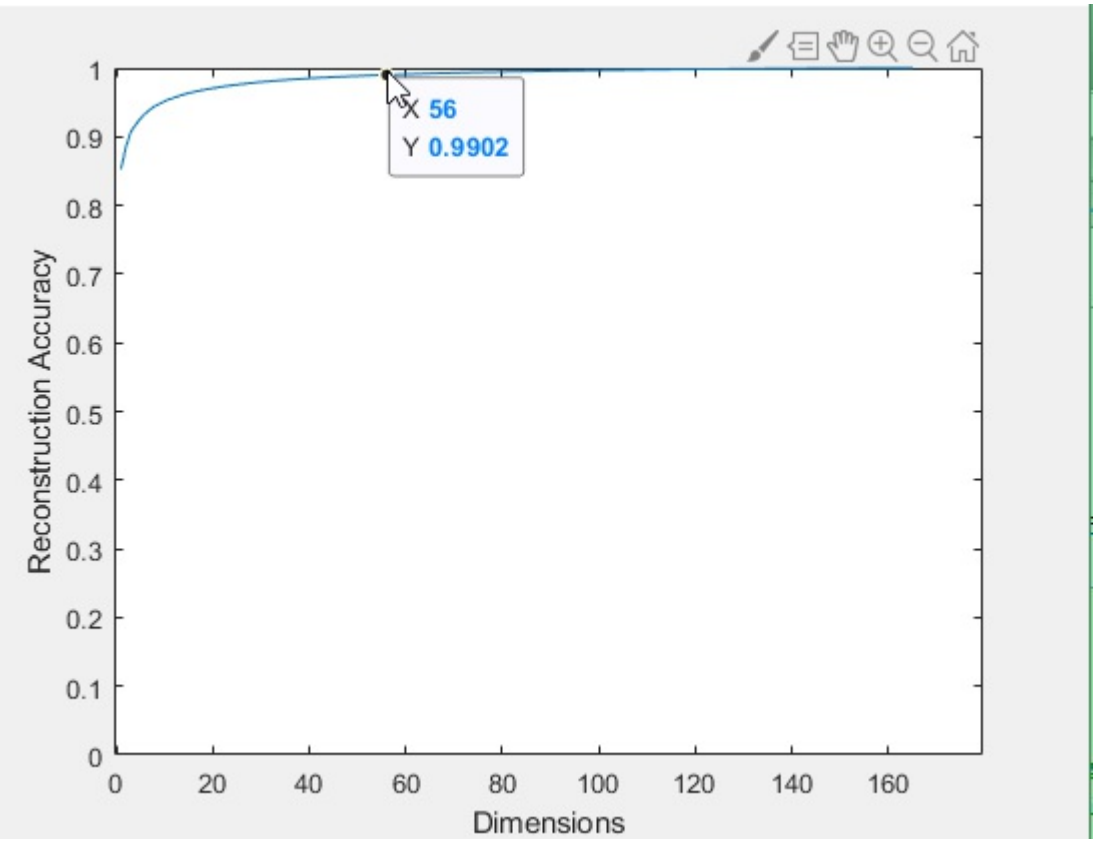
2. Dimensionality Reduction

2.8

Use the data cursor on the plot to find out what # of PCs is required to explain 99% of the data variance (achieve 99% reconstruction accuracy). What # is this and does it match the value from Q2.6?

When PCs/database dimension is 56, the reconstruction accuracy achieve 99.02% reconstruction accuracy.



The number is not match the value from Q2.6. In Q2.6 the PCs/database dimension value found is 58. And when the PCs/database dimension number between 54 to 57 , the reconstruction error is 0.010.In Q2.6, it is hard to infer which number the accuracy reconstruction error will under 0.010 around 54 to 58 because of rounding. However, in the graph shows that the reconstruction accuracy achieve will achieve 99.02% when PCs/database dimension value is 56.

2.9

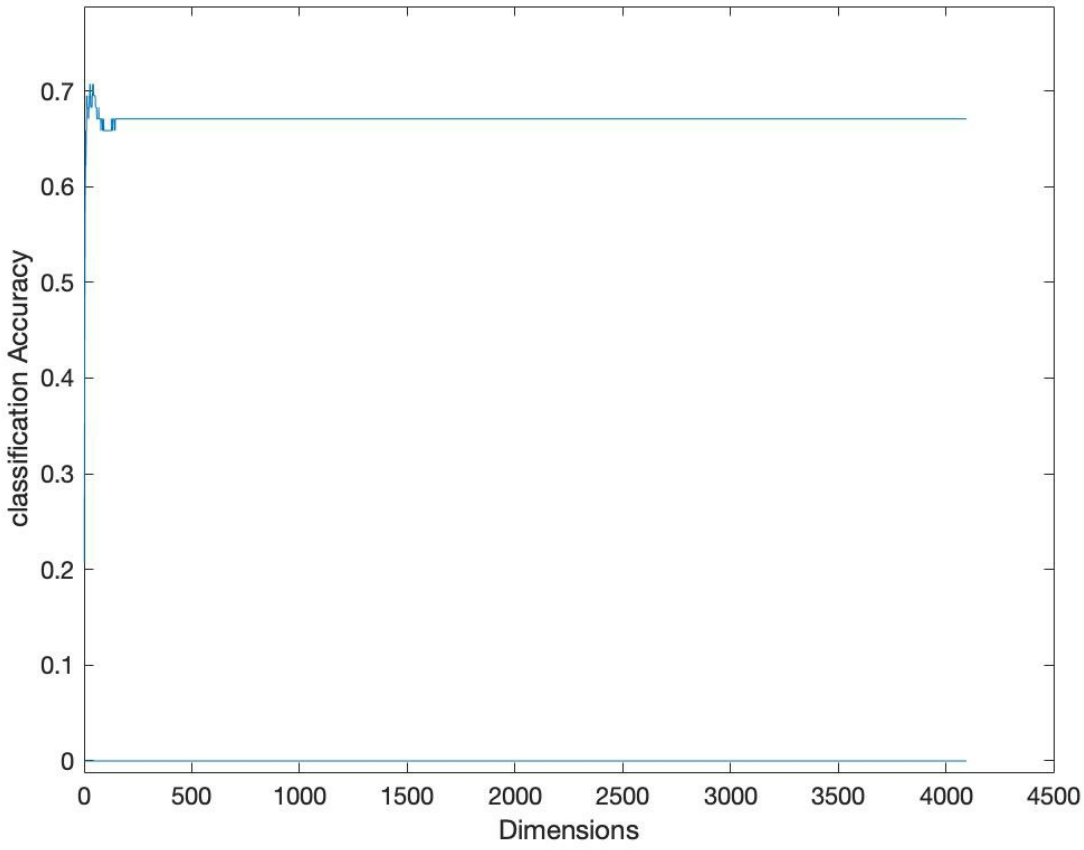
***Which number of PCA dimensions gets maximum face recognition accuracy? Is it better or worse than accuracy classifying the raw images? ***

Modify the Cell 5 to generated a graph from 1 dimension to 4096 dimensions:

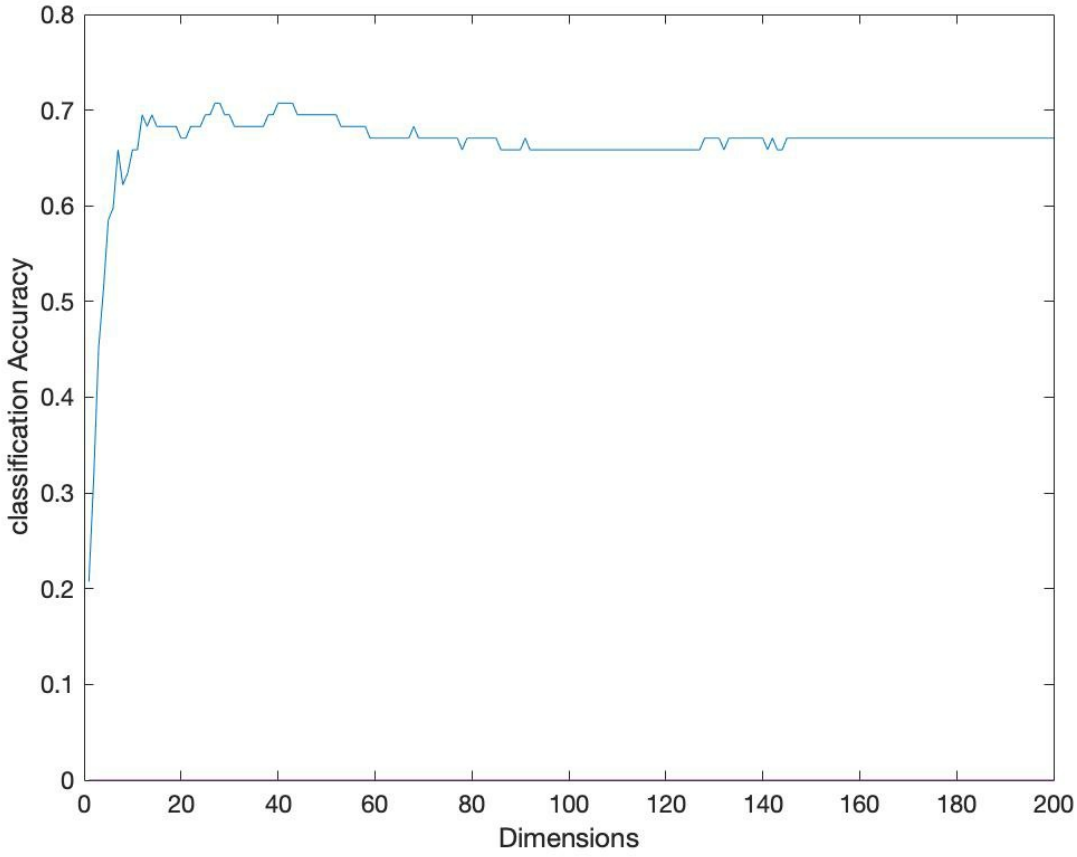
```
%% Cell 5.
% Find out how classification accuracy varies with PCA dimensions.
array = zeros(4096);
for i = 1: 4096
    nPCA = i;
    pcaFaces  = U(:,1:nPCA)'*(faces-meanFace*ones(1,N));    %PCA Encoding.
    xTr = pcaFaces(:,1:2:end); yTr = gnd(1:2:end);
    xTe = pcaFaces(:,2:2:end); yTe = gnd(2:2:end);
    % class = knnclassify(xTe', xTr', yTr);

    model = fitcknn(xTr', yTr);
    class = predict(model, xTe');


    % fprintf(1,'Dimensions: %d. Accuracy: %1.2f\n', nPCA, sum(class==yTe)/numel(yTe));
    array(i) = sum(class==yTe)/numel(yTe);

end

plot(array);
xlabel('Dimensions');
```

```
ylabel('classification Accuracy');
```

The Dimensions from 1 to 4096:



The Dimensions from 1 to 200:



In the graph shows that after 145 dimensions the classification accuracy will stay in 67%. The highest accuracy is 71%, when the nPCA is 27. it better than raw images(accuracy is 67%, when nPCA is 4096).