

Diamonds analysis

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Contribution Table

Task	Oriade	Pietro
Student ID	s172084	s231756
Question 1	x	
Question 2	x	
Question 3		x
Question 4		x
Exam Prob 1		x
Exam Prob 2	x	
Exam Prob 3	x	
Exam Prob 4		x
Exam Prob 5		x
Exam Prob 6	x	

1) Description of the dataset

- Explain what your data is about. I.e. what is the overall problem of interest?
- Provide a reference to where you obtained the data.
- Summarize previous analysis of the data. (i.e. go through one or two of the original source papers and read what they did to the data and summarize their results).
- You will be asked to apply (1) classification and (2) regression on your data in the next report. For now, we want you to consider how this should be done. Therefore: Explain, in the context of your problem of interest, what you hope to accomplish/learn from the data using these techniques?. Explain which attribute you wish to predict in the regression based on which other attributes? Which class label will you predict based on which other attributes in the classification task? If you need to transform the data in order to carry out these tasks, explain roughly how you plan to do this.

One of these tasks (1)–(5) is likely more relevant than the rest and will be denoted the main machine learning aim in the following. The purpose of the following questions, which asks you to describe/visualize the data, is to allow you to reflect on the feasibility of this task.

2) Explanation of the attributes of the data

- Describe if the attributes are discrete/continuous, Nominal/Ordinal/Interval/ Ratio,
- Give an account of whether there are data issues (i.e. missing values or corrupted data) and describe them if so.
- Include basic summary statistics of the attributes.

If your data set contains many similar attributes, you may restrict yourself to describing a few representative features (apply common sense).

3) Data visualization

Principal component analysis

The aim of the Principal Component Analysis (“PCA” from now on), is to simplify the problem dimension by reducing the number of variables which explains the behavior of the diamonds’ price.

The PCA requires the standardization of the attributes so that the variability of each of them is comparable. But such operation cannot be carried out for non-numeric values, like the three ordinal variables *cut*, *color* and *clarity*. For these reason they are converted into ordinal numbers (from 1 to the upper level number) according to their ranking.

After these operations, the dataset appears as below:

Table 2: Head of the diamonds dataset arranged for the PCA

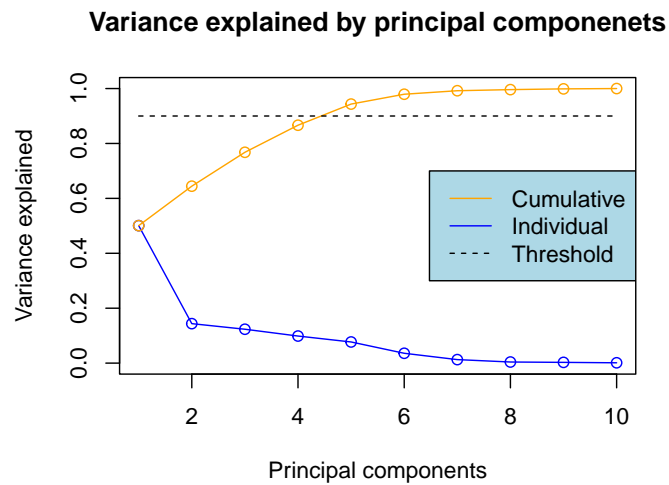
carat	cut	color	clarity	depth	table	price	x	y	z
0.23	5	2	2	61.5	55	326	3.95	3.98	2.43
0.21	4	2	3	59.8	61	326	3.89	3.84	2.31
0.23	2	2	5	56.9	65	327	4.05	4.07	2.31
0.29	4	6	4	62.4	58	334	4.20	4.23	2.63
0.31	2	7	2	63.3	58	335	4.34	4.35	2.75
0.24	3	7	6	62.8	57	336	3.94	3.96	2.48

Now the dataset contains all numeric variables, so the next step is to compare the standard deviations of each variable and check whether they are different.

Below the standard deviations of the variables are shown:

##	carat	cut	color	clarity	depth	table	price	x	y	z
##	0.47	1.12	1.70	1.65	1.43	2.23	3989.44	1.12	1.14	0.71

Since standard deviation of *price* is some orders of magnitude larger than the others, the dataset has to be standardized by subtracting the mean and dividing by the standard deviation of the whole set of observations of that variable.



The new standardized dataset can be now used to perform the Singular Value Decomposition (SVD). By the extraction of the diagonal of the matrix Σ , it can be seen how much variance is explained by each principal component. The cumulative explained variance should reach the percentage of 90% in order to describe properly the main features of the dataset.

The figure below shows that the first 4 principal components explain little less than the 90% of variance:

4) Results: what data have shown

Two columns

Below is a Div containing three child Divs side by side. The Div in the middle is empty, just to add more space between the left and right Divs.

