Data mining - Atividade 1 Heart Failure Prediction Dataset

Available in [Kaggle]

Context Cardiovascular diseases (CVDs) are the number 1 cause of death globally, taking an estimated 17.9 million lives each year, which accounts for 31% of all deaths worldwide. Four out of 5CVD deaths are due to heart attacks and strokes, and one-third of these deaths occur prematurely in people under 70 years of age. Heart failure is a common event caused by CVDs and this dataset contains 11 features that can be used to predict a possible heart disease.

People with cardiovascular disease or who are at high cardiovascular risk (due to the presence of one or more risk factors such as hypertension, diabetes, hyperlipidaemia or already established disease) need early detection and management wherein a machine learning model can be of great help.

Attribute Information Age: age of the patient [years] Sex: sex of the patient [M: Male, F: Female] ChestPainType: chest pain type [TA: Typical Angina, ATA: Atypical Angina, NAP: Non-Anginal Pain, ASY: Asymptomatic] RestingBP: resting blood pressure [mm Hg] Cholesterol: serum cholesterol [mm/dl] FastingBS: fasting blood sugar [1: if FastingBS > 120 mg/dl, 0: otherwise] RestingECG: resting electrocardiogram results [Normal: Normal, ST: having ST-T wave abnormality (T wave inversions and/or ST elevation or depression of > 0.05 mV), LVH: showing probable or definite left ventricular hypertrophy by Estes' criteria] MaxHR: maximum heart rate achieved [Numeric value between 60 and 202] ExerciseAngina: exercise-induced angina [Y: Yes, N: No] Oldpeak: oldpeak = ST [Numeric value measured in depression] ST_Slope: the slope of the peak exercise ST segment [Up: upsloping, Flat: flat, Down: downsloping] HeartDisease: output class [1: heart disease, 0: Normal] Source This dataset was created by combining different datasets already available independently but not combined before. In this dataset, 5 heart datasets are combined over 11 common features which makes it the largest heart disease dataset available so far for research purposes. The five datasets used for its curation are:

Cleveland: 303 observations Hungarian: 294 observations Switzerland: 123 observations Long Beach VA: 200 observations Stalog (Heart) Data Set: 270 observations Total: 1190 observations Duplicated: 272 observations

Final dataset: 918 observations

Every dataset used can be found under the Index of heart disease datasets from UCI Machine Learning Repository on the following link: https://archive.ics.uci.edu/ml/machine-learning-databases/heart-disease/

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```
#importing the libraries
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
```

```
#Load dataset
ht = pd.read_csv('heart.csv')
```

```
#get information
ht.head(11).T
```

	0	1	2	3	4	5	6	7	8
Age	40	49	37	48	54	39	45	54	37
Sex	M	F	M	F	M	M	F	M	M
ChestPainType	ATA	NAP	ATA	ASY	NAP	NAP	ATA	ATA	ASY
RestingBP	140	160	130	138	150	120	130	110	140
Cholesterol	289	180	283	214	195	339	237	208	207
FastingBS	0	0	0	0	0	0	0	0	0
RestingECG	Normal	Normal	ST	Normal	Normal	Normal	Normal	Normal	Norma
MaxHR	172	156	98	108	122	170	170	142	130
ExerciseAngina	N	N	N	Y	N	N	N	N	Y
Oldpeak	0.0	1.0	0.0	1.5	0.0	0.0	0.0	0.0	1.5
ST_Slope	Up	Flat	Up	Flat	Up	Up	Up	Up	Fla
HeartDisease	0	1	0	1	0	0	0	0	1

```
type(ht)
ht.dtypes
```

```
Age                int64
Sex               object
ChestPainType     object
RestingBP          int64
Cholesterol        int64
FastingBS          int64
RestingECG        object
MaxHR              int64
```

```
     ExerciseAngina     object
     Oldpeak           float64
     ST_Slope           object
     HeartDisease        int64
     dtype: object
```

1 - Apresentar a media, moda, variância e desvio padrão para todos os atributos da base;

```
# Para excluir os dados não numéricos = (numeric_only=true)
mean = (ht.mean(numeric_only=True).T)
mode = (ht.mode(numeric_only=True).T)
var = (ht.var(numeric_only=True).T)
std = (ht.std(numeric_only=True).T)
#Visualizando os dados
print ('Média:\n',mean,'\n')
print ('Moda:\n',mode,'\n')
print ('Variância:\n',var,'\n')
print ('Desvio_padrão:\n',std,'\n')

#Apresentando todos os dados de "maneira inteligente"
ht.describe().T
```

```
Média:
 Age              53.510893
RestingBP       132.396514
Cholesterol     198.799564
FastingBS         0.233115
MaxHR           136.809368
Oldpeak           0.887364
HeartDisease      0.553377
dtype: float64

Moda:
                   0
Age            54.0
RestingBP     120.0
Cholesterol     0.0
FastingBS       0.0
MaxHR         150.0
Oldpeak         0.0
HeartDisease    1.0

Variância:
```

2 - Apresentar os valores da mediana e quartil utilizando o gráfico de caixas (boxplot);

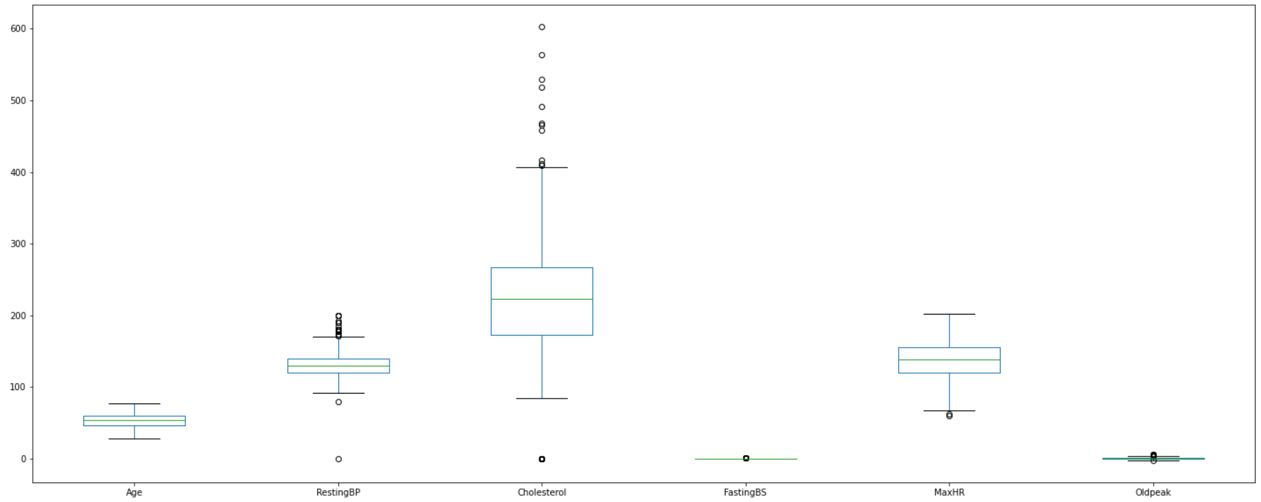
```
Cholesterol     11964.891079
```

```
#Apresentando os dados
median = (ht.median(numeric_only=True).T)
print ('Mediana:\n', median,'\n')
ht.quantile([0.25,0.5,0.75]).T
```

```
Mediana:
 Age              54.0
RestingBP       130.0
Cholesterol     223.0
FastingBS         0.0
MaxHR           138.0
Oldpeak           0.6
HeartDisease      1.0
dtype: float64
```

	0.25	**0.50**	**0.75**
Age	47.00	54.0	60.0
RestingBP	120.00	130.0	140.0
Cholesterol	173.25	223.0	267.0
FastingBS	0.00	0.0	0.0
MaxHR	120.00	138.0	156.0
Oldpeak	0.00	0.6	1.5
HeartDisease	0.00	1.0	1.0

```
#BoxPlot
boxplot = ht.boxplot(column=['Age','RestingBP','Cholesterol','FastingBS','MaxHR','Oldpeak'
```



3 - Refazer os exercícios 1 e 2 separando os dados pelas respectivas classes do problema;

```
#Média
mean_class = ht.groupby(['HeartDisease']).mean().T
#Moda (Não existe moda entre 1 e 0)
#mode_class = ht.groupby(['HeartDisease']).mode().T
#Variância
var_class = ht.groupby(['HeartDisease']).var().T
#Desvio padrão
std_class = ht.groupby(['HeartDisease']).std().T

print ('Média entre os doentes cardíacos:','\n',mean_class,'\n')
print ('Variância entre os doentes cardíacos:','\n',var_class,'\n')
print ('Desvio padrão entre os doentes cardíacos:','\n',std_class,'\n')
```

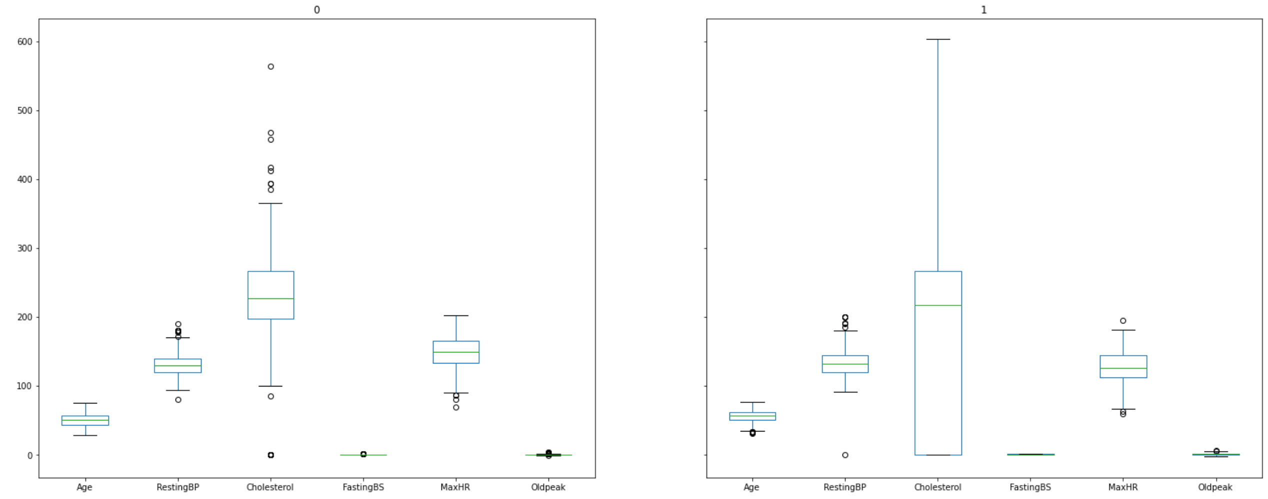
```
Média entre os doentes cardíacos:
 HeartDisease           0           1
Age             50.551220   55.899606
RestingBP      130.180488  134.185039
Cholesterol    227.121951  175.940945
FastingBS        0.107317    0.334646
MaxHR          148.151220  127.655512
```

```
Oldpeak          0.408049    1.274213

Variância entre os doentes cardíacos:
 HeartDisease            0             1
Age                89.206417     76.161499
RestingBP         272.236293    393.176738
Cholesterol      5570.332280  15974.785460
FastingBS           0.096034      0.223097
MaxHR             542.334045    546.948155
Oldpeak             0.489593      1.326809

Desvio padrão entre os doentes cardíacos:
 HeartDisease          0           1
Age               9.444915    8.727056
RestingBP        16.499585   19.828685
Cholesterol      74.634659  126.391398
FastingBS         0.309894    0.472332
MaxHR            23.288067   23.386923
Oldpeak           0.699709    1.151872
```

```
ht_class = ht.groupby('HeartDisease')
box2 = ht_class.boxplot(column=['Age','RestingBP','Cholesterol','FastingBS','MaxHR','Oldpe
```



```
class_median = (ht_class.median(numeric_only=True).T)
print ('Mediana:\n', class_median,'\n')
ht_class.quantile([0.25,0.5,0.75]).T
```

```
Mediana:
 HeartDisease      0      1
Age             51.0   57.0
RestingBP      130.0  132.0
Cholesterol    227.0  217.0
FastingBS        0.0    0.0
MaxHR          150.0  126.0
Oldpeak          0.0    1.2
```

HeartDisease	0			1		
	0.25	0.50	0.75	0.25	0.50	0.75
Age	43.00	51.0	57.00	51.0	57.0	62.00
RestingBP	120.00	130.0	140.00	120.0	132.0	145.00
Cholesterol	197.25	227.0	266.75	0.0	217.0	267.00
FastingBS	0.00	0.0	0.00	0.0	0.0	1.00
MaxHR	134.00	150.0	165.00	112.0	126.0	144.25
Oldpeak	0.00	0.0	0.60	0.0	1.2	2.00

4 - Refazer o item 1 utilizando uma amostragem estratificada de 50% da base de dados.

```
#Selecionando amostra aleatória de 50%
ht_halfsample = ht.sample(frac=0.5)
ht_halfsample.head()
```

	Age	Sex	ChestPainType	RestingBP	Cholesterol	FastingBS	RestingECG	MaxH
265	54	M	ATA	160	305	0	Normal	17
808	35	M	ASY	126	282	0	LVH	15
752	56	M	ASY	125	249	1	LVH	14
467	63	F	ATA	132	0	0	Normal	13
892	39	F	NAP	138	220	0	Normal	15

```
mean_hs = (ht_halfsample.mean(numeric_only=True).T)
mode_hs = (ht_halfsample.mode(numeric_only=True).T)
var_hs = (ht_halfsample.var(numeric_only=True).T)
std_hs = (ht_halfsample.std(numeric_only=True).T)
#Visualizando os dados
print ('Média(50%):\n',mean_hs,'\n')
print ('Moda(50%):\n',mode_hs,'\n')
print ('Variância(50%):\n',var_hs,'\n')
print ('Desvio_padrão(50%):\n',std_hs,'\n')
```

```
Média(50%):
 Age              53.050109
RestingBP       132.056645
Cholesterol     196.466231
FastingBS         0.206972
MaxHR           137.904139
Oldpeak           0.839434
HeartDisease      0.527233
dtype: float64

Moda(50%):
                   0      1
Age            54.0    NaN
RestingBP     120.0  130.0
Cholesterol     0.0    NaN
FastingBS       0.0    NaN
MaxHR         150.0    NaN
Oldpeak         0.0    NaN
HeartDisease    1.0    NaN

Variância(50%):
 Age                93.309711
RestingBP         357.787177
Cholesterol     11871.035429
FastingBS           0.164493
MaxHR             650.877254
Oldpeak             1.137110
HeartDisease        0.249803
dtype: float64

Desvio_padrão(50%):
 Age               9.659695
RestingBP        18.915263
Cholesterol     108.954281
FastingBS         0.405577
MaxHR            25.512296
Oldpeak           1.066353
HeartDisease      0.499803
dtype: float64
```

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