Stellar classification

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overview

stellar classification, scheme for assigning stars to different types according to their temperatures as estimated from their spectra. One of the most significant classifications in astronomy, is the Hertzsprung-Russell diagram. The Hertzsprung-Russell diagram shows the relationship between a star's temperature and its luminosity. It is also often called the H-R diagram or color-magnitude diagram. It is a very useful graph because it can be used to chart the life cycle of a star.

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01 exploration

Data exploration

Stars in the universe can be classified into several groups . The groups I have used here are :

- Brown dwarf
- Red dwarf
- White dwarf
- Main sequence
- Supergiant
- Hypergiant

These groups are classified based on several characteristics of stars such as :

- Luminosity(L/L0)
- Radius (R/R0)
- Temperature(T/T0)
- Absolute Magnitude (Mv)
- Spectral Class (O, B,A,F,G,K,M)

The Luminosity , Radius and Temperature are taken with respect to that of Sun’s . Subscript 0 denotes these values of Sun.

dataset

	Temperature	L	R	A_M	Color	Spectral_Class	Type
0	3068	0.00	0.17	16.12	Red	M	0
1	3042	0.00	0.15	16.60	Red	M	0
2	2600	0.00	0.10	18.70	Red	M	0
3	2800	0.00	0.16	16.65	Red	M	0
4	1939	0.00	0.10	20.06	Red	M	0

- This dataset didn’t have any duplicated or null value.

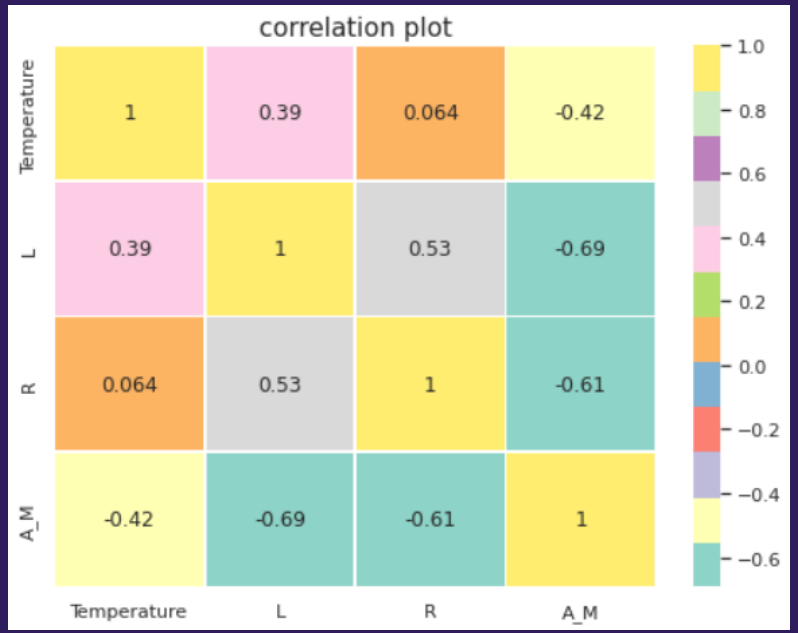
02 Visualization

Correlation plot

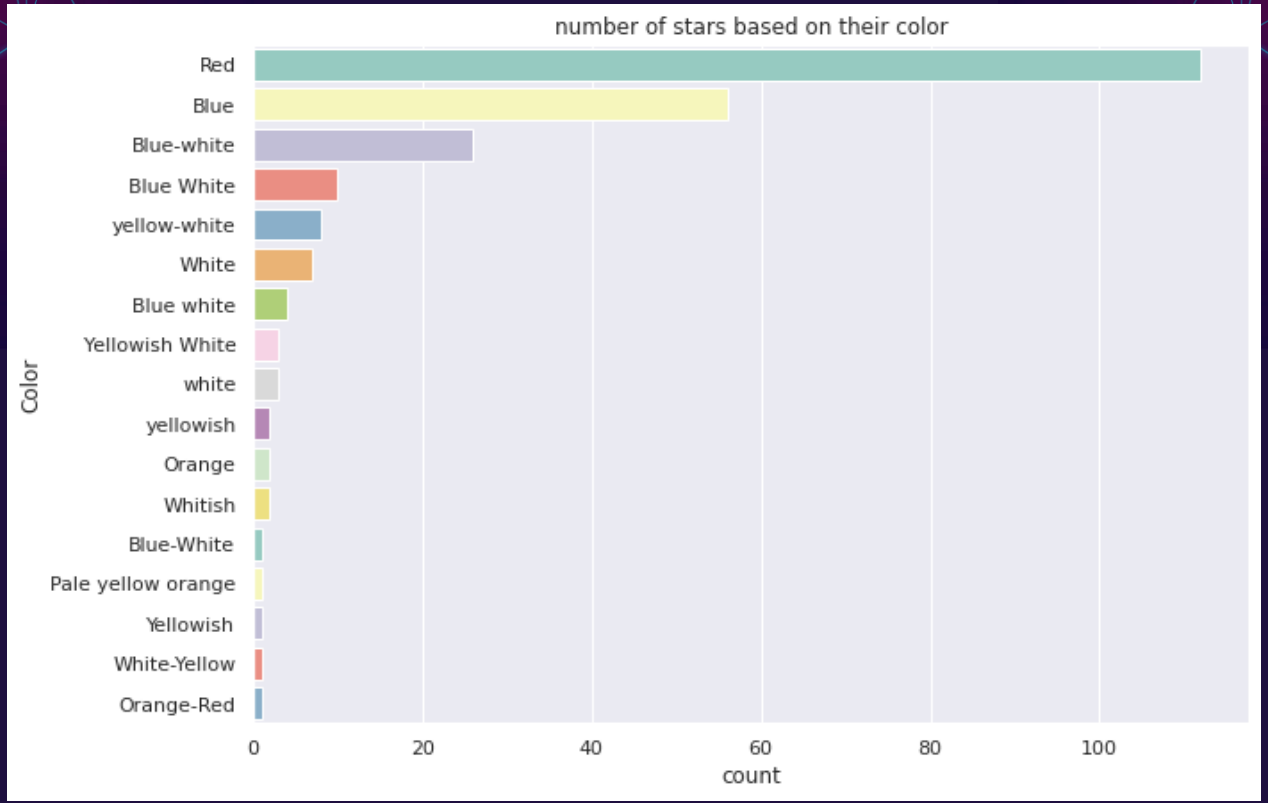
Absolute magnitude is anti-correlated with other features

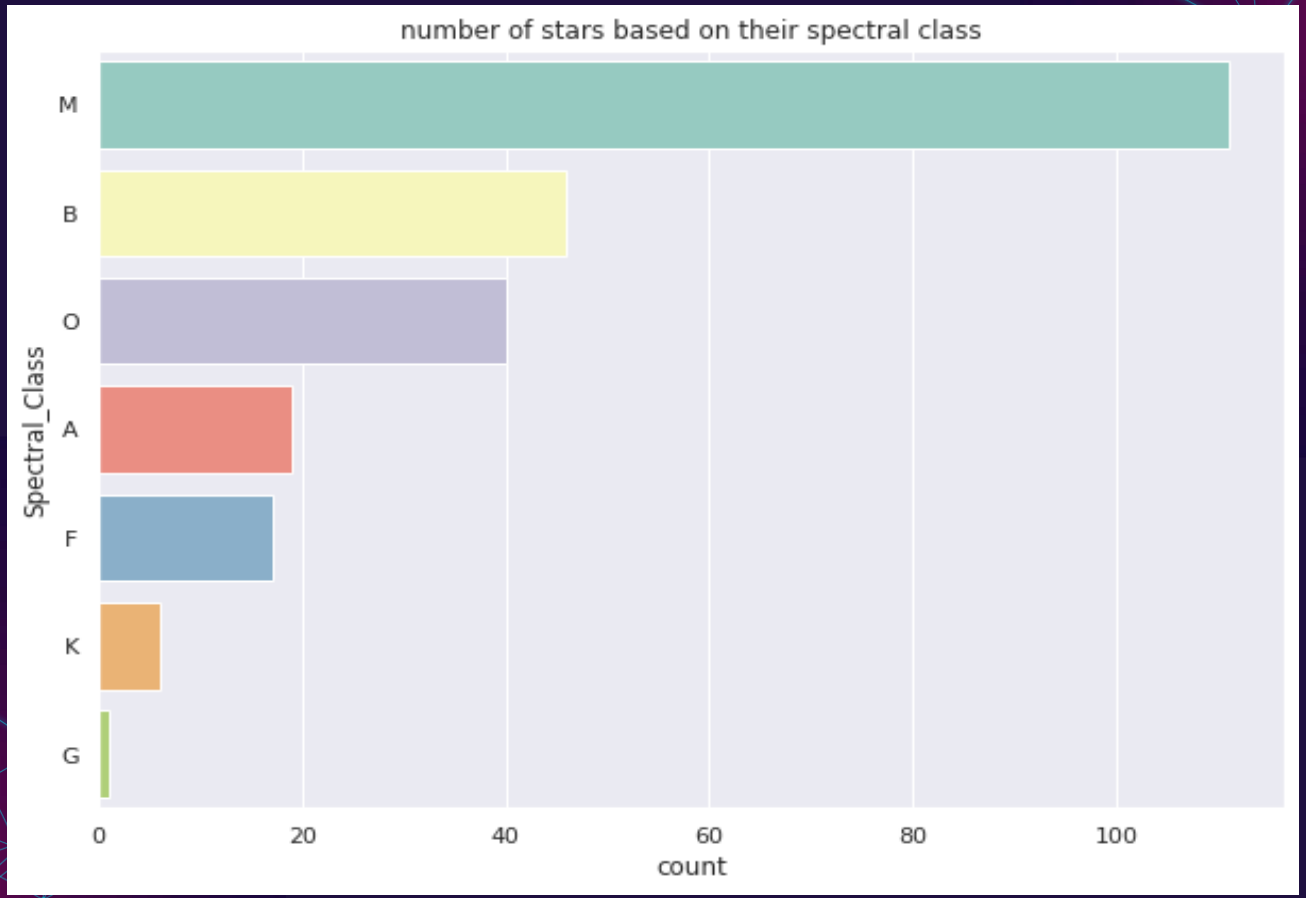
Radius and temperature are approximately uncorrelated

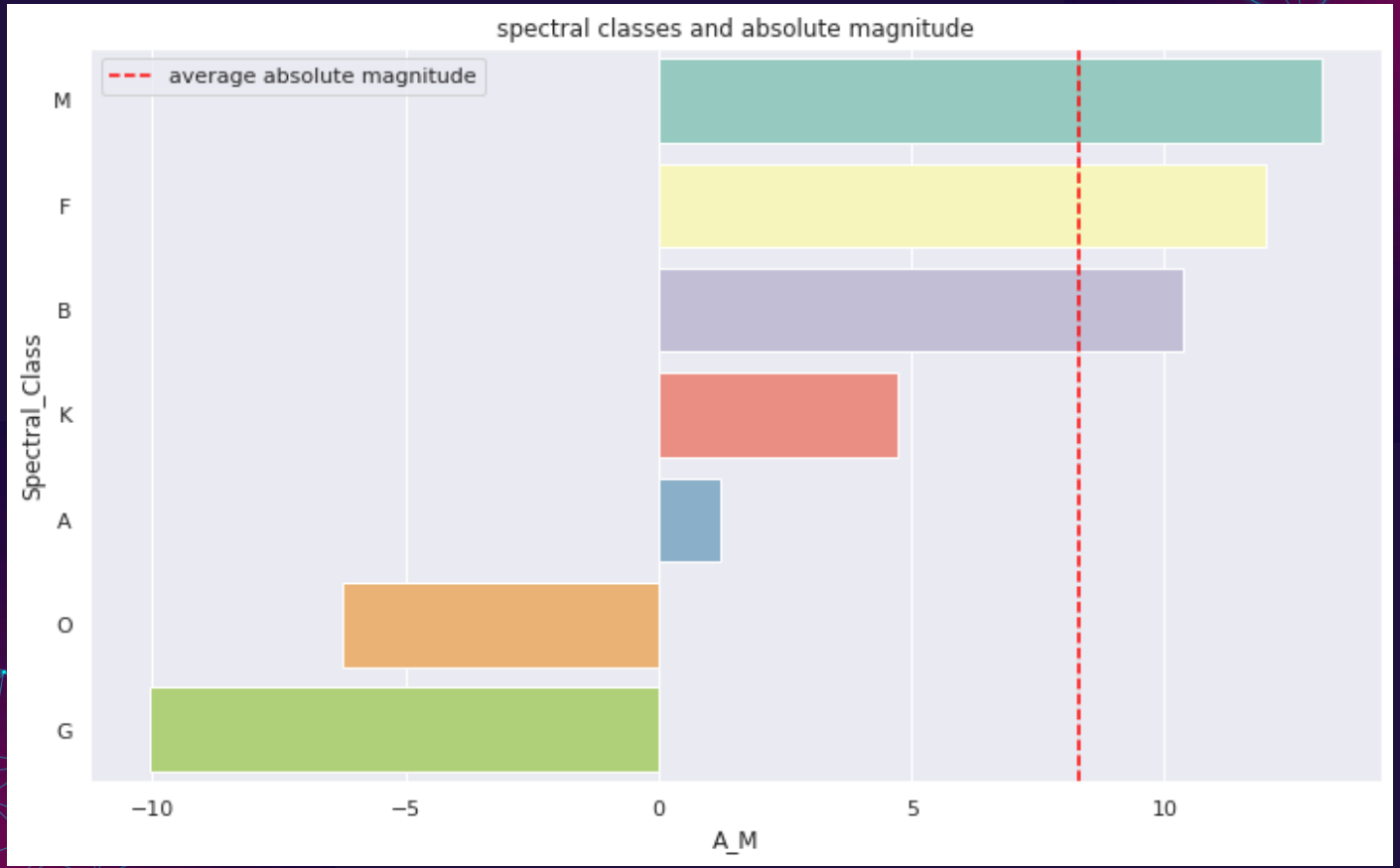
Luminosity is correlated with temperature and radius

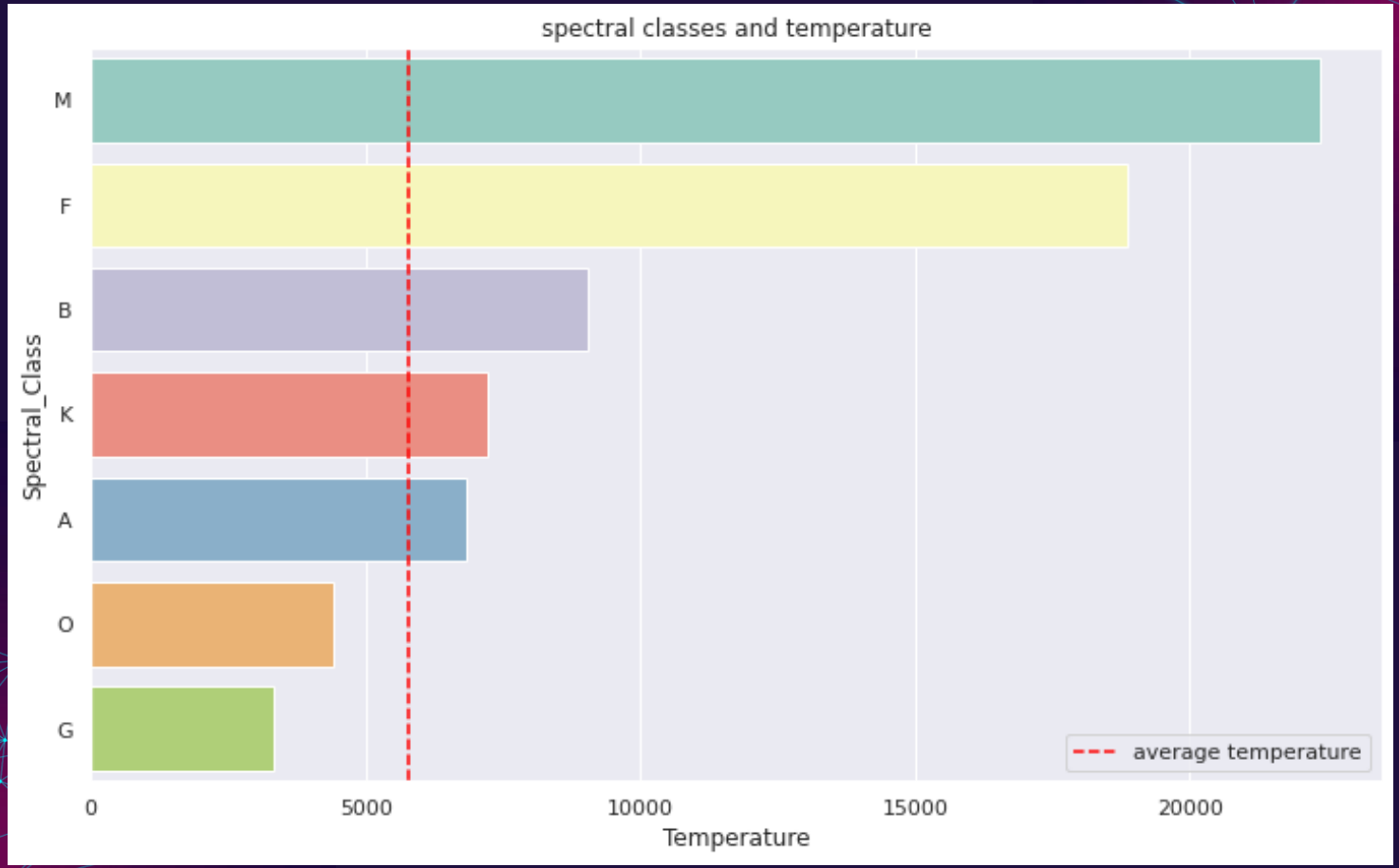


Count plots

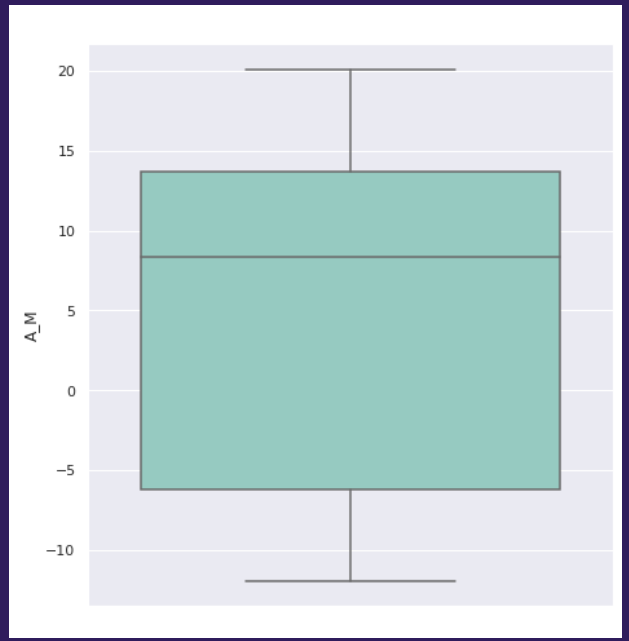

number of stars based on their color
Red
Blue
Blue-white
Blue White
yellow-white
White
Blue white
Yellowish White
white
yellowish
Orange
Whitish
Blue-White
Pale yellow orange
Yellowish
White-Yellow
Orange-Red
Color
0
20
40
60
80
100
count

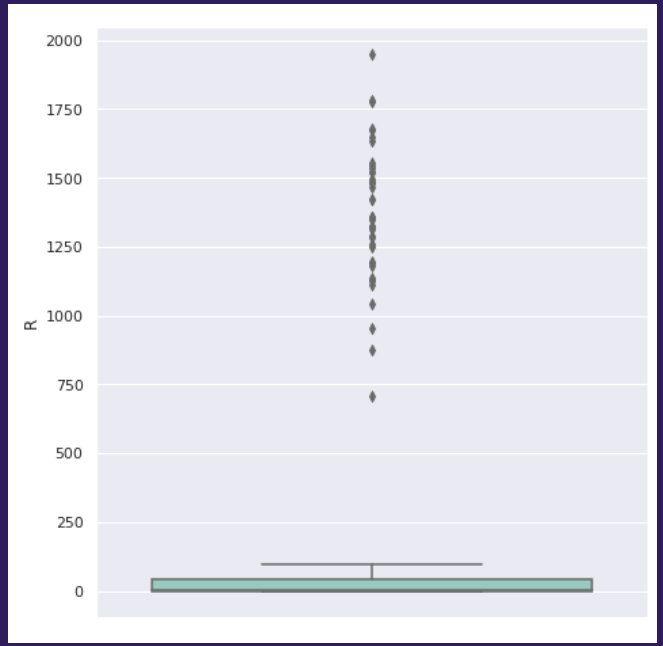

number of stars based on their spectral class
Spectral_Class
M
B
O
A
F
K
G
0
20
40
60
80
100
count


spectral classes and absolute magnitude
average absolute magnitude
Spectral_Class
M
F
B
K
A
O
G
−10
−5
0
5
10
A_M

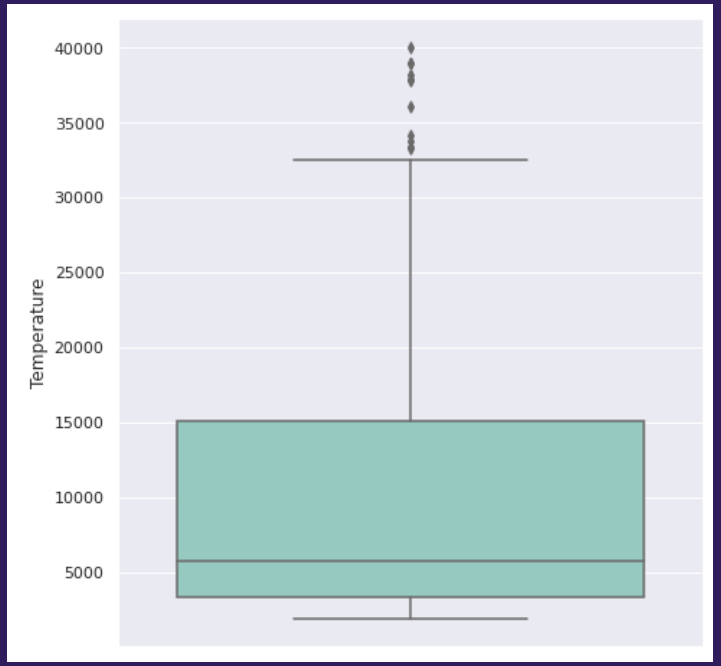

spectral classes and temperature
M
F
B
K
A
O
G
Spectral_Class
average temperature
0
5000
10000
15000
20000
Temperature

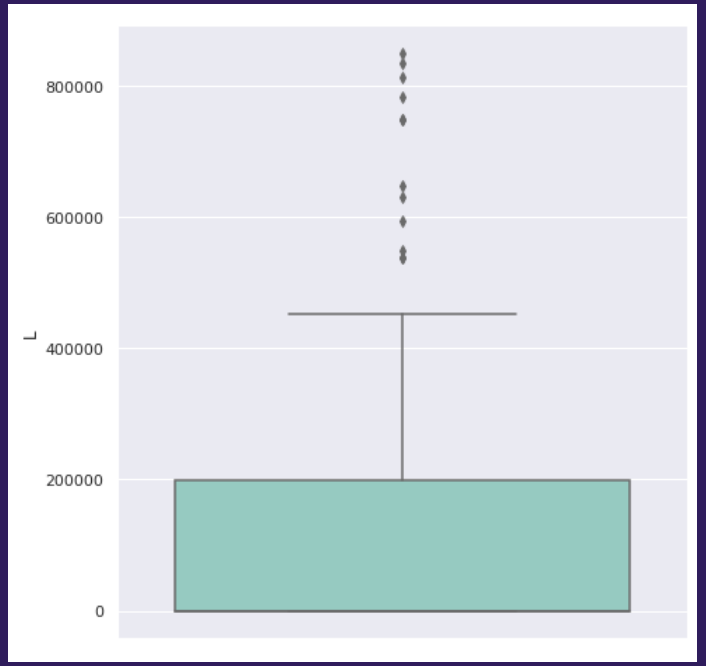
Density plots





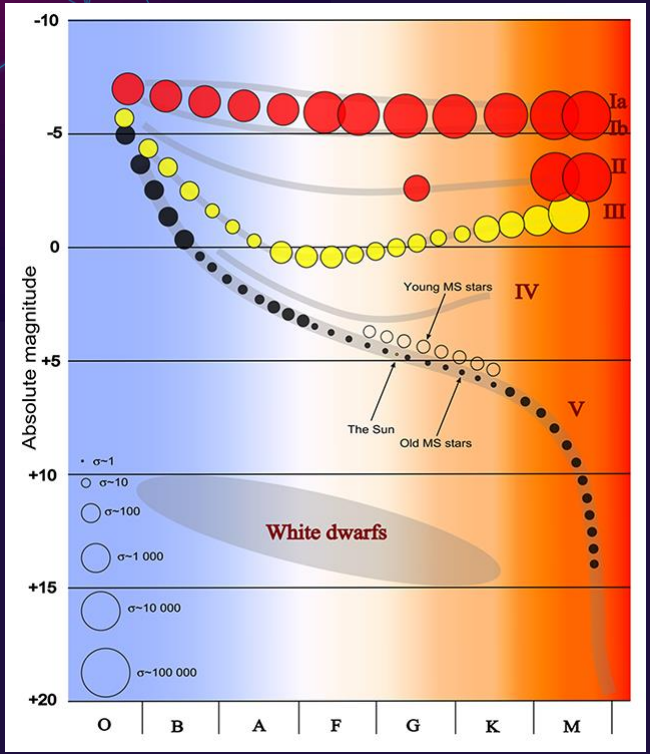
Density plots

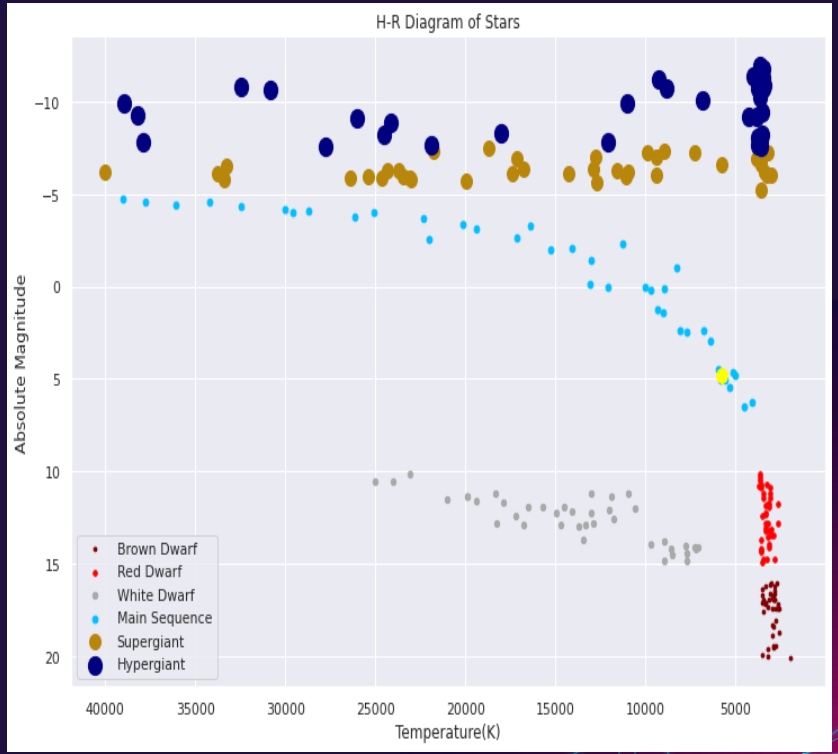




03 H-R Diagram

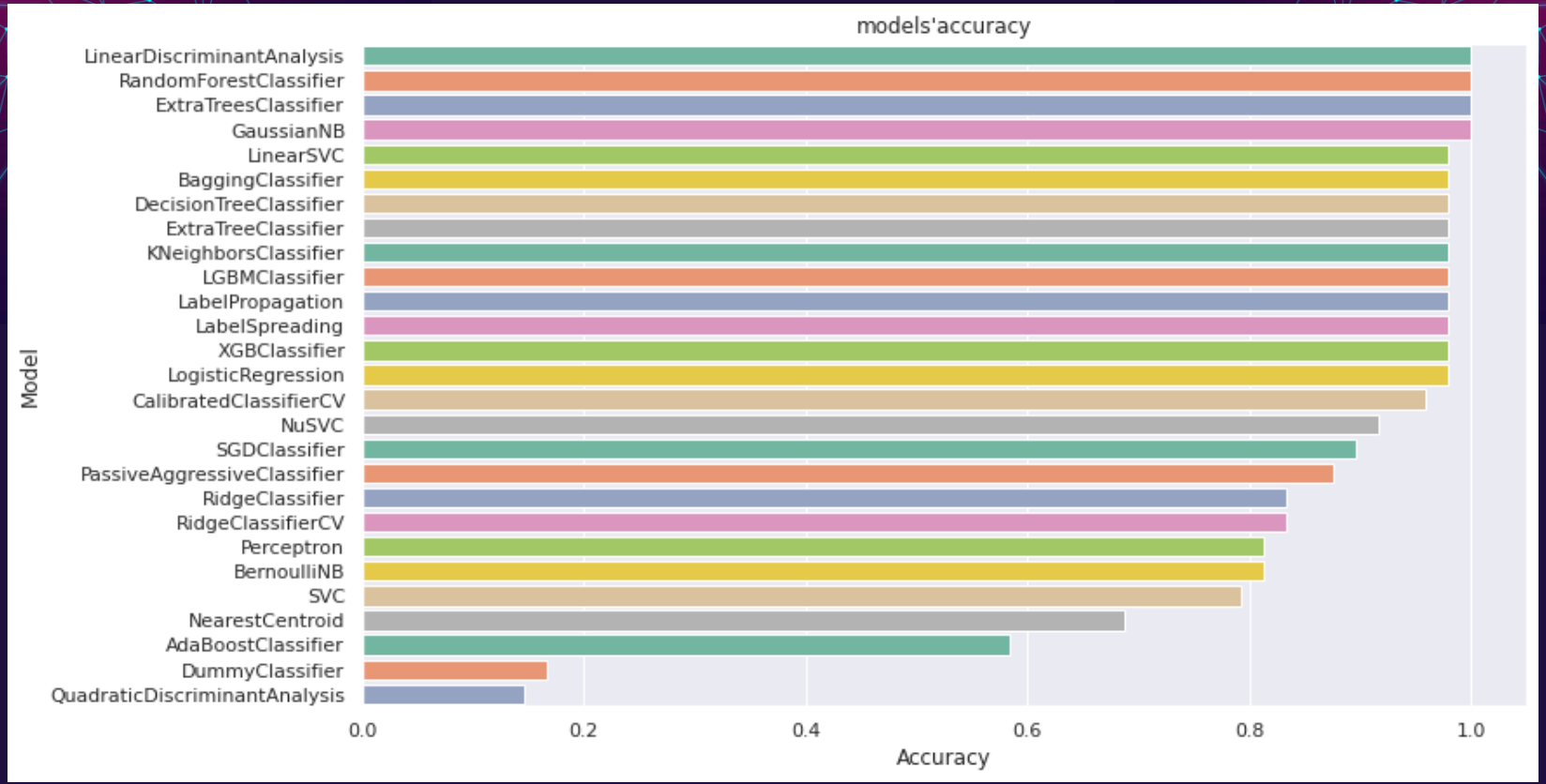
in this part we Proved that stars follow the H-R diagram, so that we can classify stars by plotting their absolute magnitude based on the luminosity.





04 ML Tools

Models' comparison



Thanks for your attention!