Data Visualizations

Why do we need visualizations?

Before

```
array([ 22.2545198 ,   9.46306667,  12.06767132,  18.59783811,
        11.86490354,  14.68040278,  20.30153772,  25.24777714,
        34.3022338 ,  34.12490434,  44.33391473,  44.38379237,
        40.00574845,  42.57340636,  36.10801652,  36.80541831,
        40.04538794,  43.69025546,  53.46028177,  52.50945039,
        59.19988263,  65.21990689,  59.65118444,  58.65185448,
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        60.93714419,  67.40567495,  69.26647731,  72.62978286,
        76.95759959,  80.0000368 ,  79.51964481,  81.56353416,
        87.97679347,  88.05404069,  83.47695913,  80.17622344,
        81.63942456,  83.11399608,  74.75389511,  75.35131548,
        85.5736879 ,  93.56250189, 104.63174345, 104.31686973,
       108.96186346, 114.64848866])
```
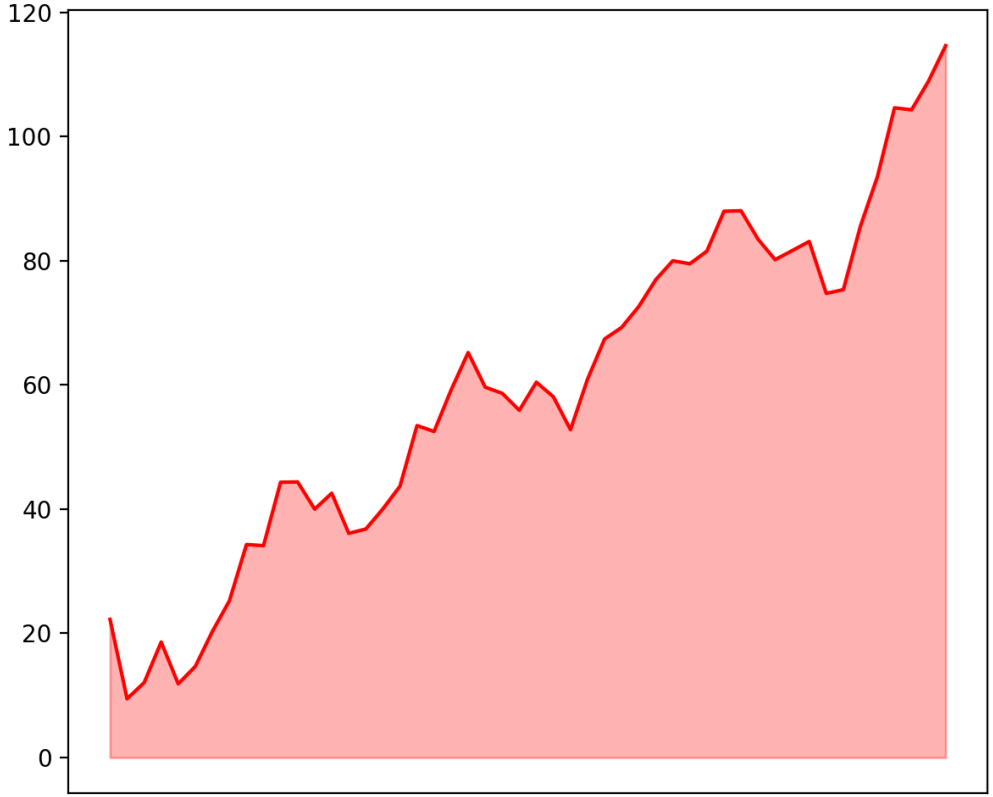
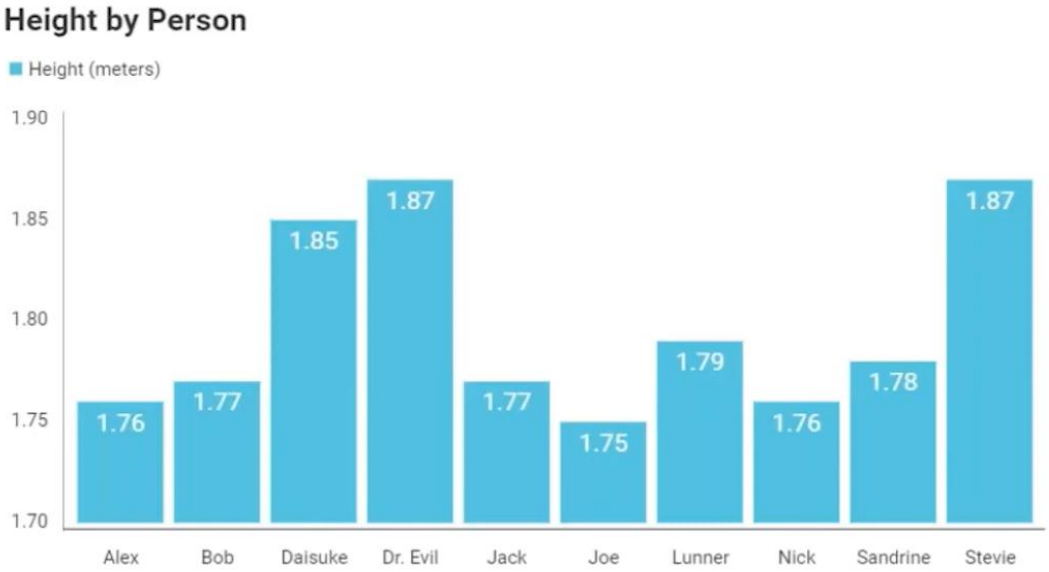

After



Person	Height (meters)
Stevie	1.87
Sandrine	1.78
Nick	1.76
Lunner	1.79
Joe	1.75
Jack	1.77
Dr. Evil	1.87
Daisuke	1.85
Bob	1.77
Alex	1.76

Person	Height (meters)
Stevie	1.87
Sandrine	1.78
Nick	1.76
Lunner	1.79
Joe	1.75
Jack	1.77
Dr. Evil	1.87
Daisuke	1.85
Bob	1.77
Alex	1.76



Person	Height (meters)
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Dr. Evil	1.87
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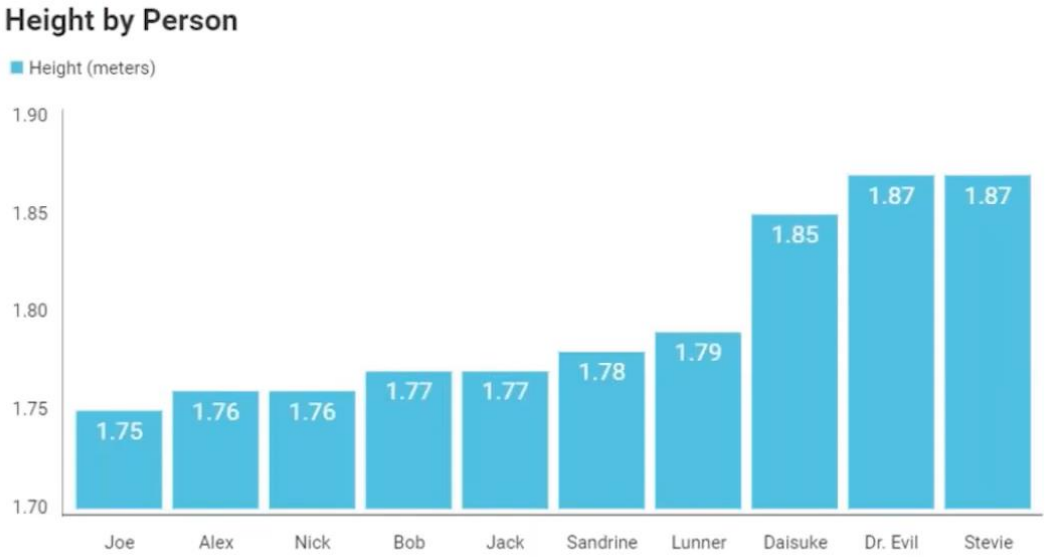


Global warming of 1.5°C

An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty

1 / 630

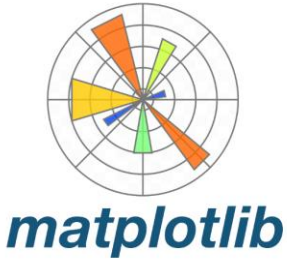
Global warming of 1.5°C

An IPCC Special Report on the impacts of global warming of 1.5°C
above pre-industrial levels and related global greenhouse gas emission pathways,
in the context of strengthening the global response to the threat of climate change,
sustainable development, and efforts to eradicate poverty

Main libraries

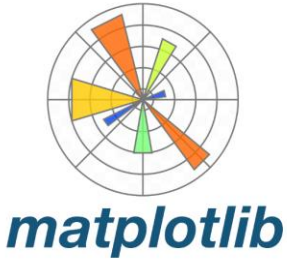
Main libraries

Fundamental



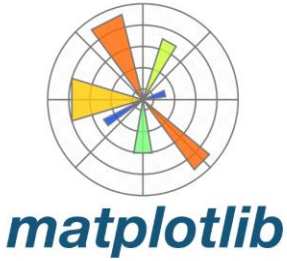
Main libraries

Fundamental



Main libraries

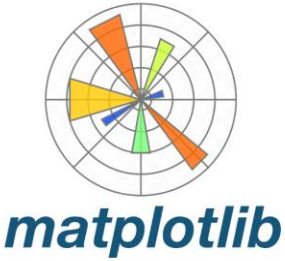
Fundamental



Interactive

Main libraries

Fundamental

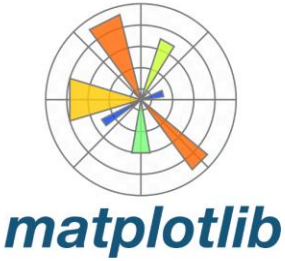


Interactive

Geospatial

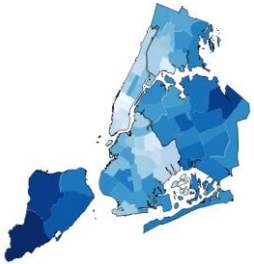
Main libraries

Fundamental



Interactive

Geospatial



Geoplot

Folium

Other visualization apps

Other visualization apps

How to visualize data distribution

Titanic dataset

Gender submission and test file merged

Data Card | Code (394) | Discussion (2) | Suggestions (1)

About Dataset

Usability
10.00

License
CC0: Public Domain

Expected update frequency
Never

Tags

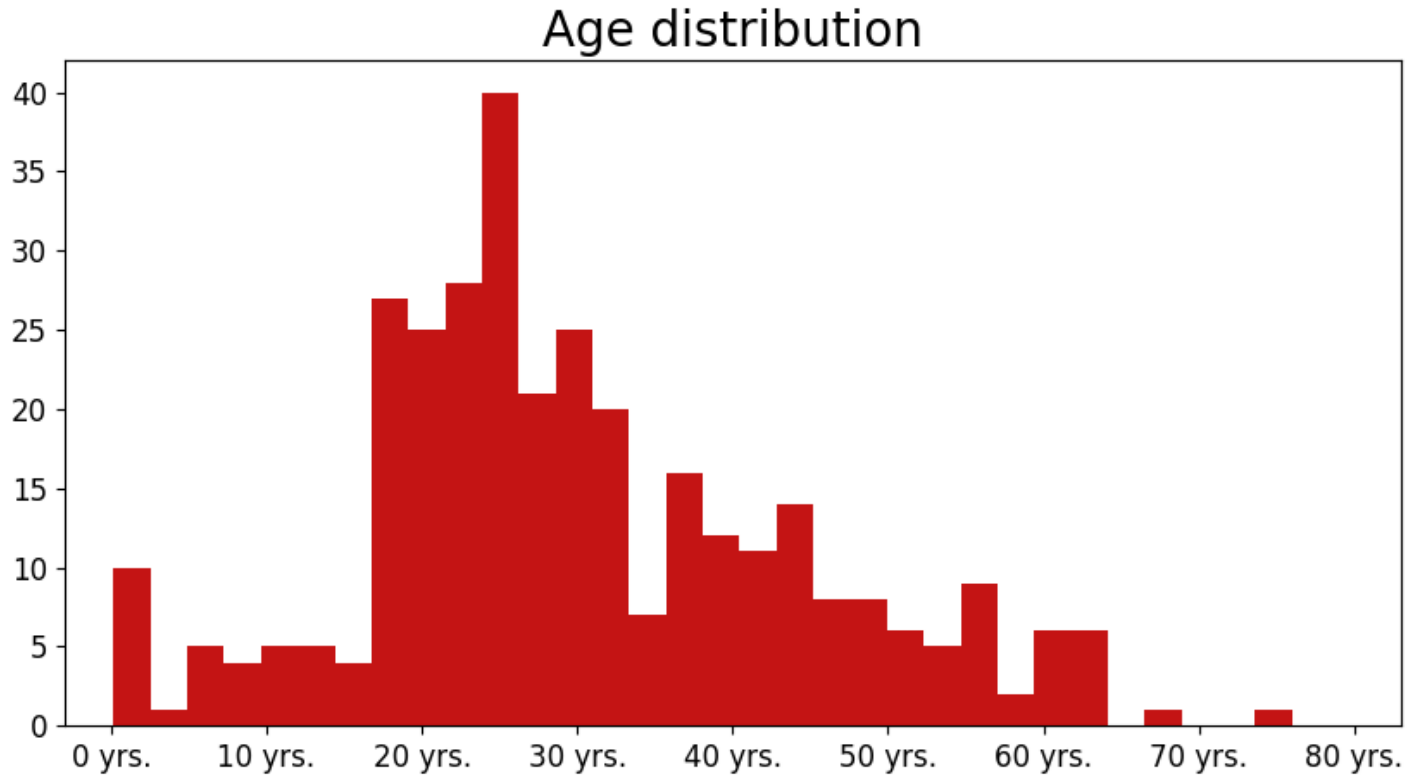
Beginner

Data Visualization

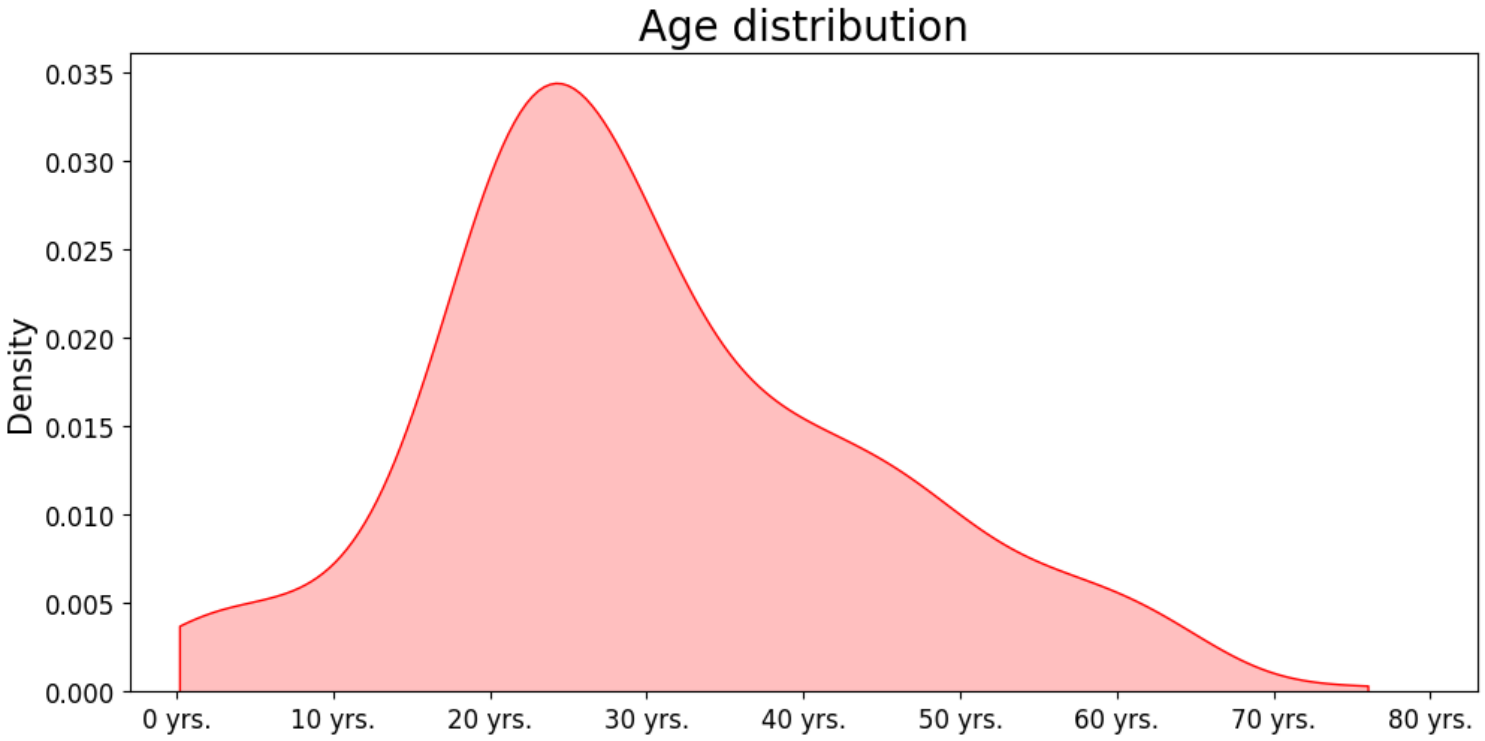
HISTORICAL ACCURACY
KAGGLE COMPETITORS
imgflip.com

	PassengerId	Survived	Pclass	Name	Sex	Age	SibSp	Parch	Ticket	Fare	Cabin	Embarked
0	892	0	Third	Kelly, Mr. James	male	34.5	0	0	330911	7.8292	NaN	Q
1	893	1	Third	Wilkes, Mrs. James (Ellen Needs)	female	47.0	1	0	363272	7.0000	NaN	S
2	894	0	Second	Myles, Mr. Thomas Francis	male	62.0	0	0	240276	9.6875	NaN	Q
3	895	0	Third	Wirz, Mr. Albert	male	27.0	0	0	315154	8.6625	NaN	S
4	896	1	Third	Hirvonen, Mrs. Alexander (Helga E Lindqvist)	female	22.0	1	1	3101298	12.2875	NaN	S
5	897	0	Third	Svensson, Mr. Johan Cervin	male	14.0	0	0	7538	9.2250	NaN	S
6	898	1	Third	Connolly, Miss. Kate	female	30.0	0	0	330972	7.6292	NaN	Q
7	899	0	Second	Caldwell, Mr. Albert Francis	male	26.0	1	1	248738	29.0000	NaN	S
8	900	1	Third	Abrahim, Mrs. Joseph (Sophie Halaut Easu)	female	18.0	0	0	2657	7.2292	NaN	C
9	901	0	Third	Davies, Mr. John Samuel	male	21.0	2	0	A/4 48871	24.1500	NaN	S

Histogram


Age distribution
40
35
30
25
20
15
10
5
0
0 yrs.
10 yrs.
20 yrs.
30 yrs.
40 yrs.
50 yrs.
60 yrs.
70 yrs.
80 yrs.

Density plot

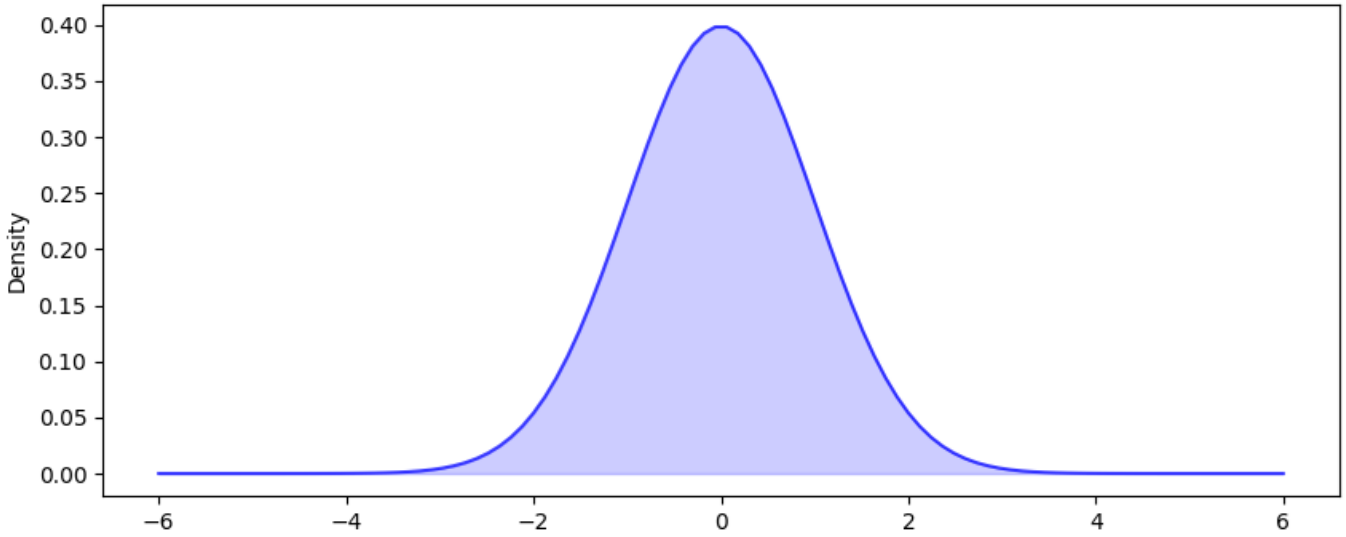


KDE

KDE - Kernel Density Estimator

Density plot

$$K(x) = \frac{1}{\sqrt{2\pi}} \exp\left[-\frac{x^2}{2}\right]$$



Density plot

$$K(x - x_i)$$

Density plot

$$K(x - x_i)$$

$$K\left(\frac{x - x_i}{h}\right)$$

Density plot

h - kernel bandwidth

$$K(x - x_i)$$

$$K\left(\frac{x - x_i}{h}\right)$$

Density plot

h - kernel bandwidth

$$K(x - x_i)$$

$$K\left(\frac{x - x_i}{h}\right)$$

$$\frac{1}{h}K\left(\frac{x - x_i}{h}\right)$$

Density plot

$$X = \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

Density plot

$$X = \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

$$\frac{1}{h} K\left(\frac{x - x_1}{h}\right)$$

Density plot

$$X = \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

$$\frac{1}{h} K\left(\frac{x - x_1}{h}\right) + \frac{1}{h} K\left(\frac{x - x_2}{h}\right)$$

Density plot

$$f(x) = \frac{1}{2}\left[\frac{1}{h}K\left(\frac{x-x_1}{h}\right) + \frac{1}{h}K\left(\frac{x-x_2}{h}\right)\right]$$

Density plot

$$f(x) = \frac{1}{2}\left[\frac{1}{h}K\left(\frac{x-x_1}{h}\right) + \frac{1}{h}K\left(\frac{x-x_2}{h}\right)\right] =$$

$$= \frac{1}{2h}\left[K\left(\frac{x-x_1}{h}\right) + K\left(\frac{x-x_2}{h}\right)\right]$$

Density plot

$$f(x) = \frac{1}{2}\left[\frac{1}{h}K\left(\frac{x-x_1}{h}\right) + \frac{1}{h}K\left(\frac{x-x_2}{h}\right)\right] =$$

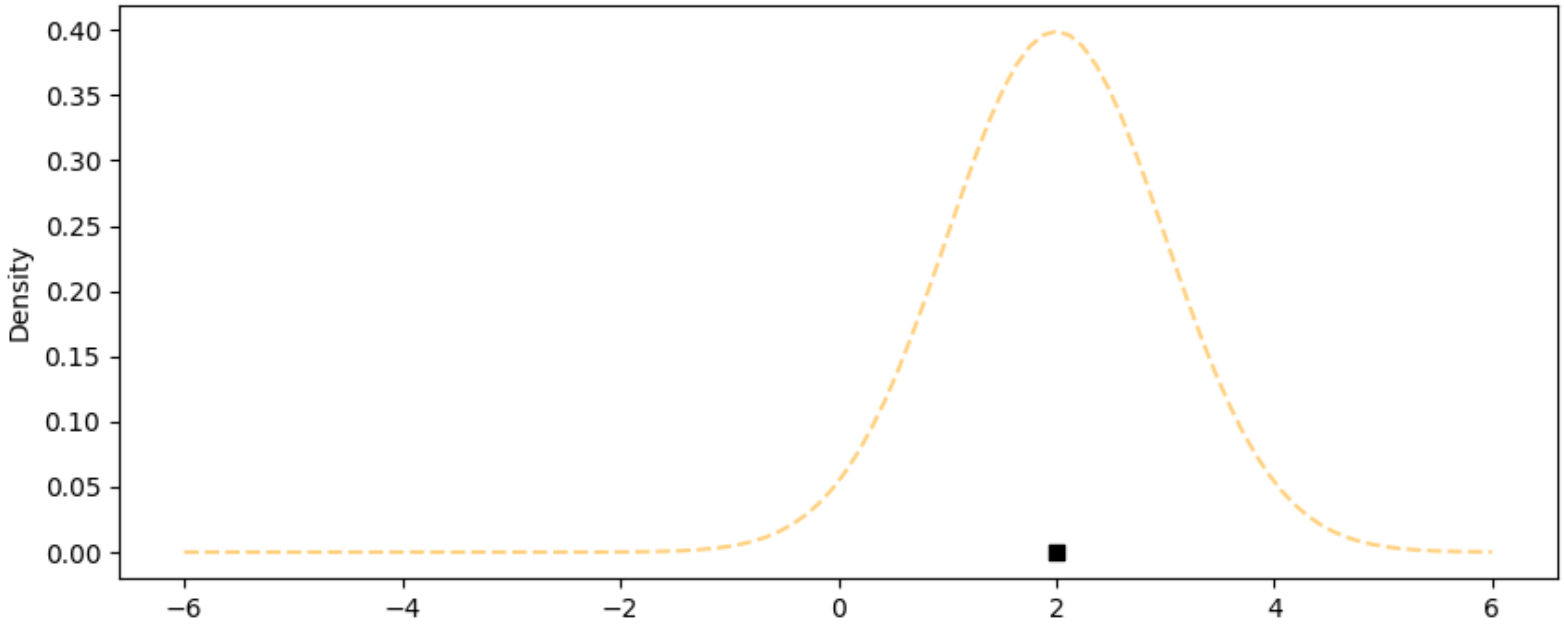
$$= \frac{1}{2h}\left[K\left(\frac{x-x_1}{h}\right) + K\left(\frac{x-x_2}{h}\right)\right] =$$

$$= \frac{1}{2h}\sum_{i=1}^{2} K\left(\frac{x-x_i}{h}\right)$$

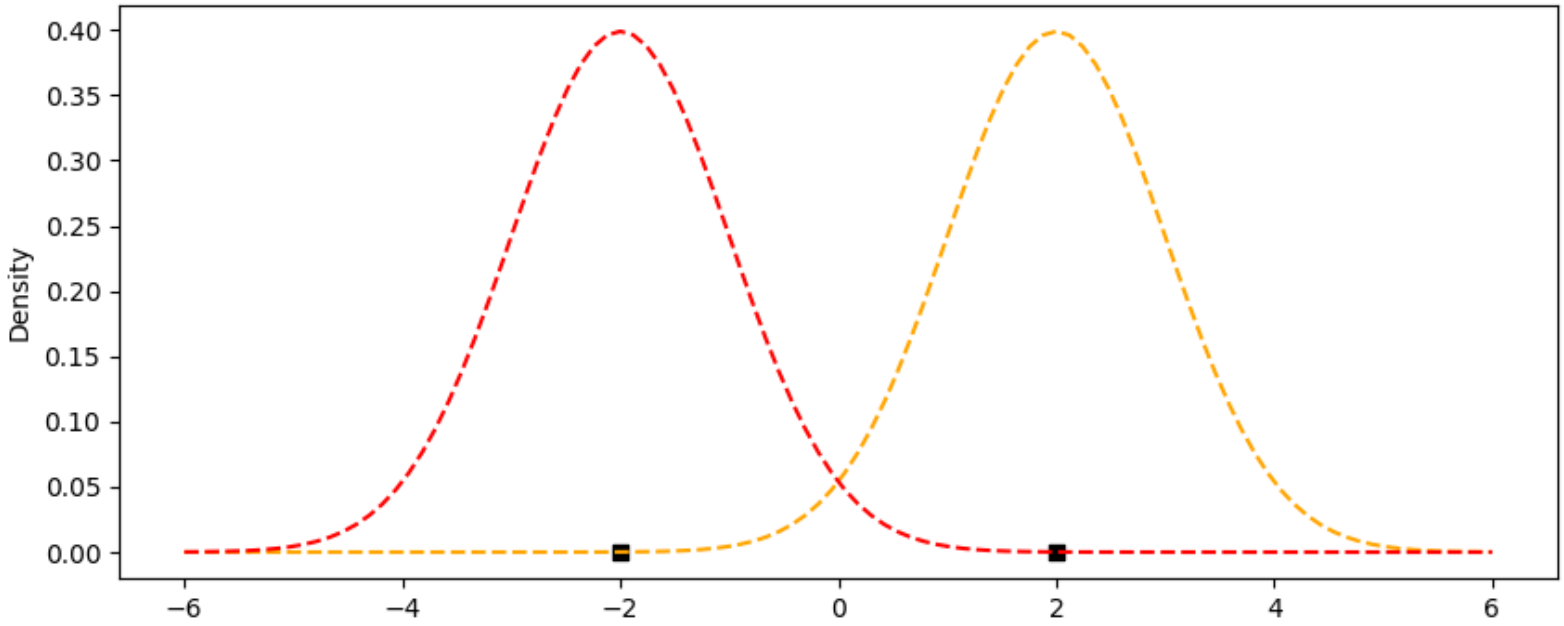
Density plot

$$f(x) = \frac{1}{nh} \sum_{i=1}^{n} K\left(\frac{x - x_i}{h}\right)$$

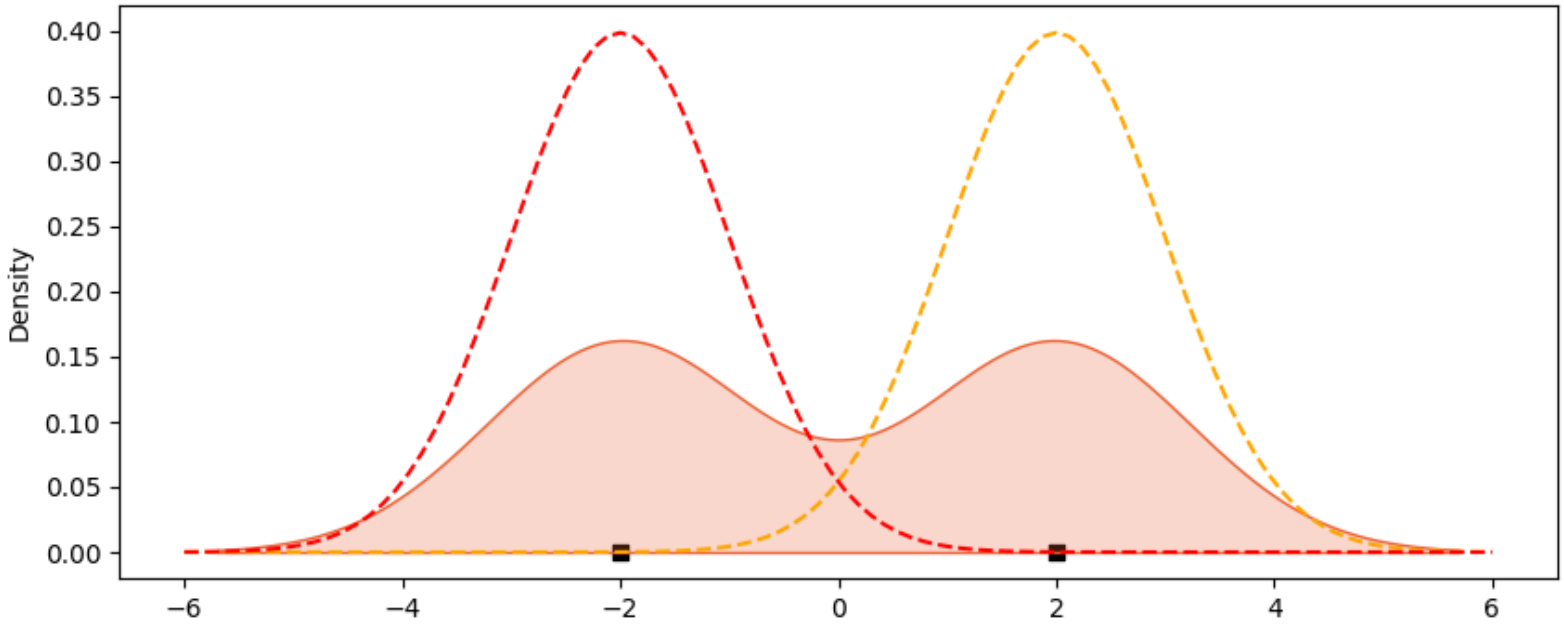
Density plot



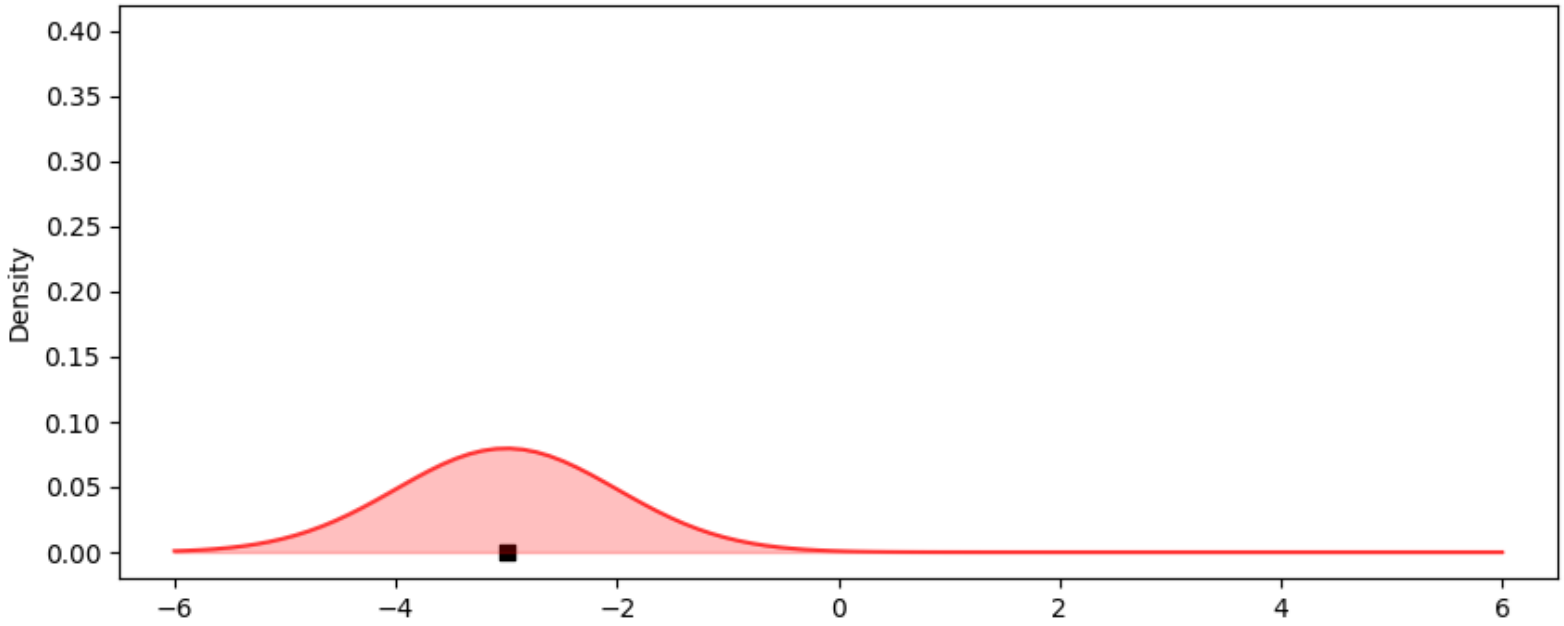
Density plot



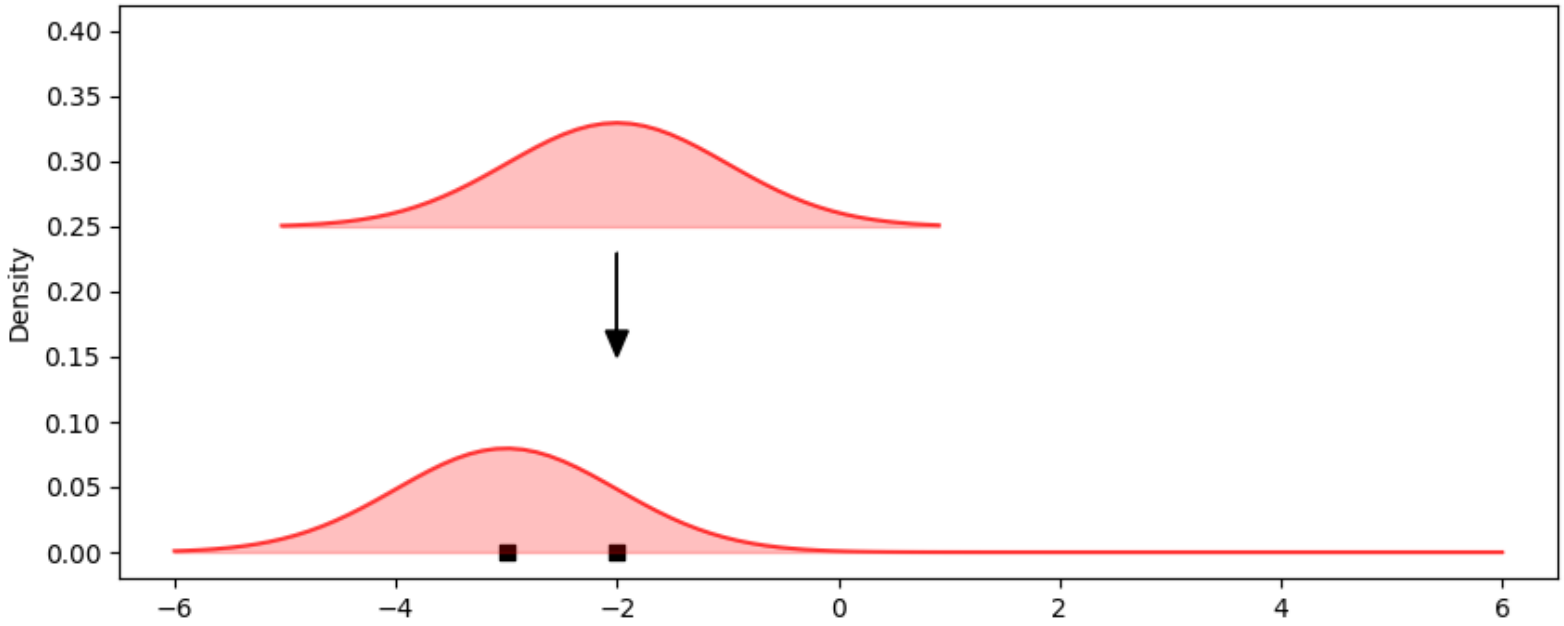
Density plot



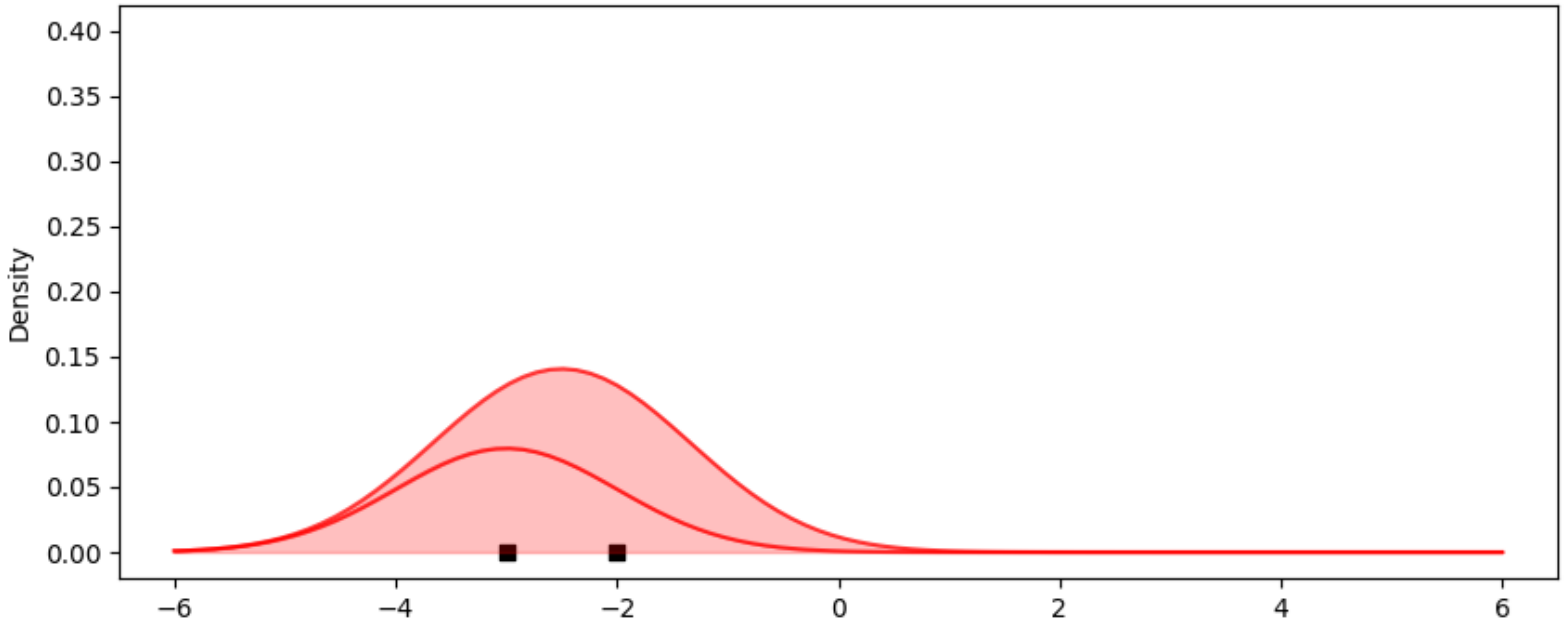
Density plot



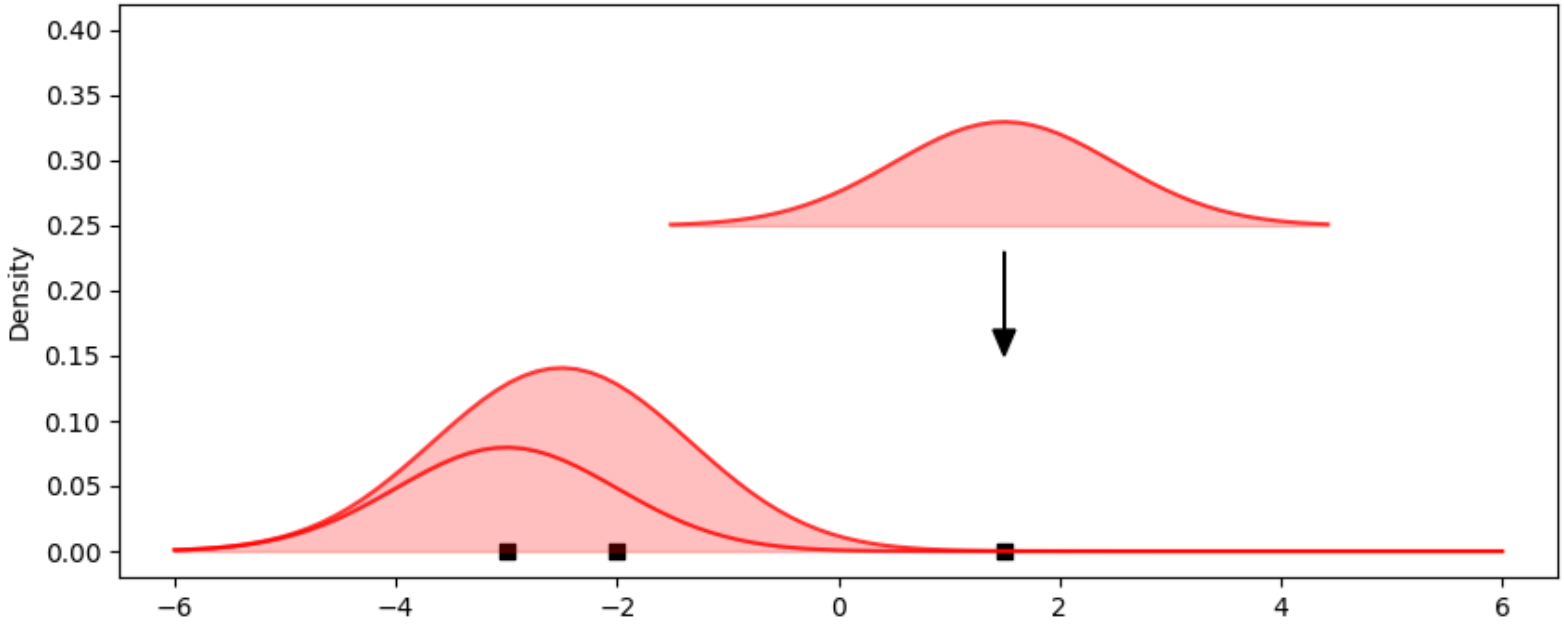
Density plot



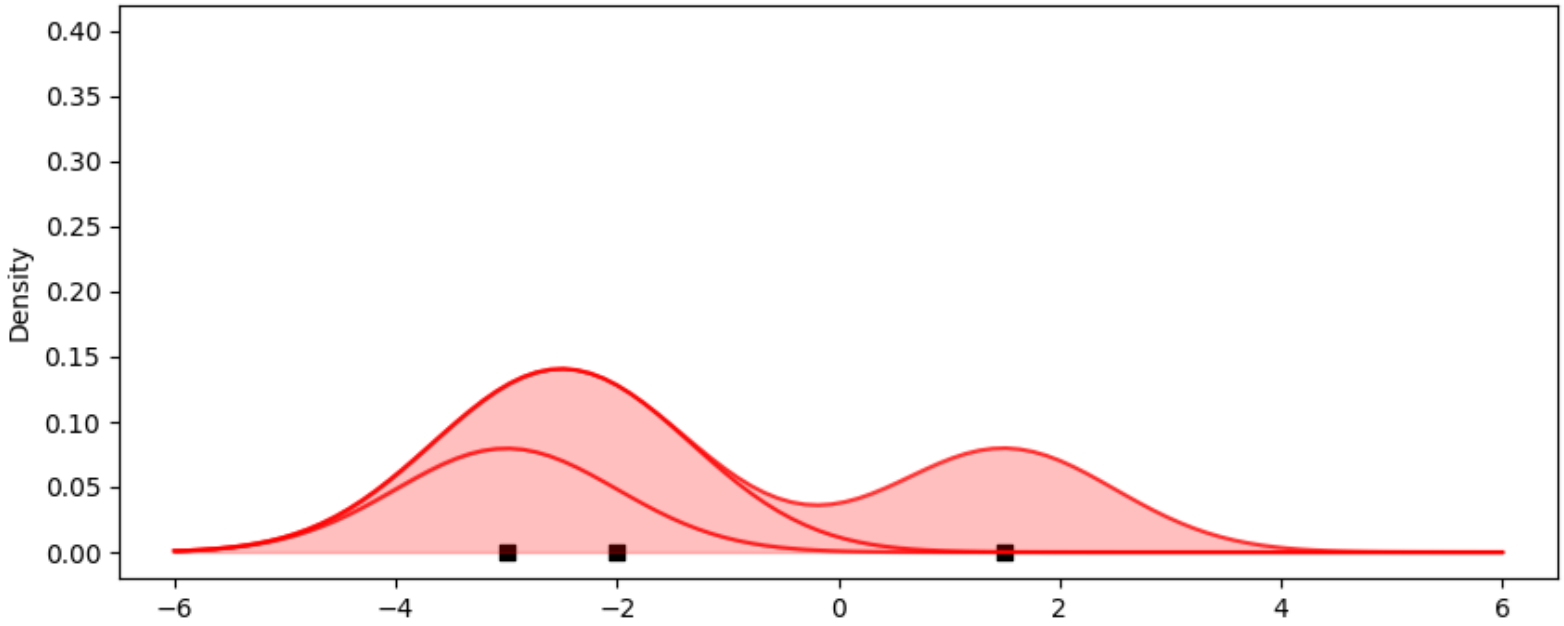
Density plot



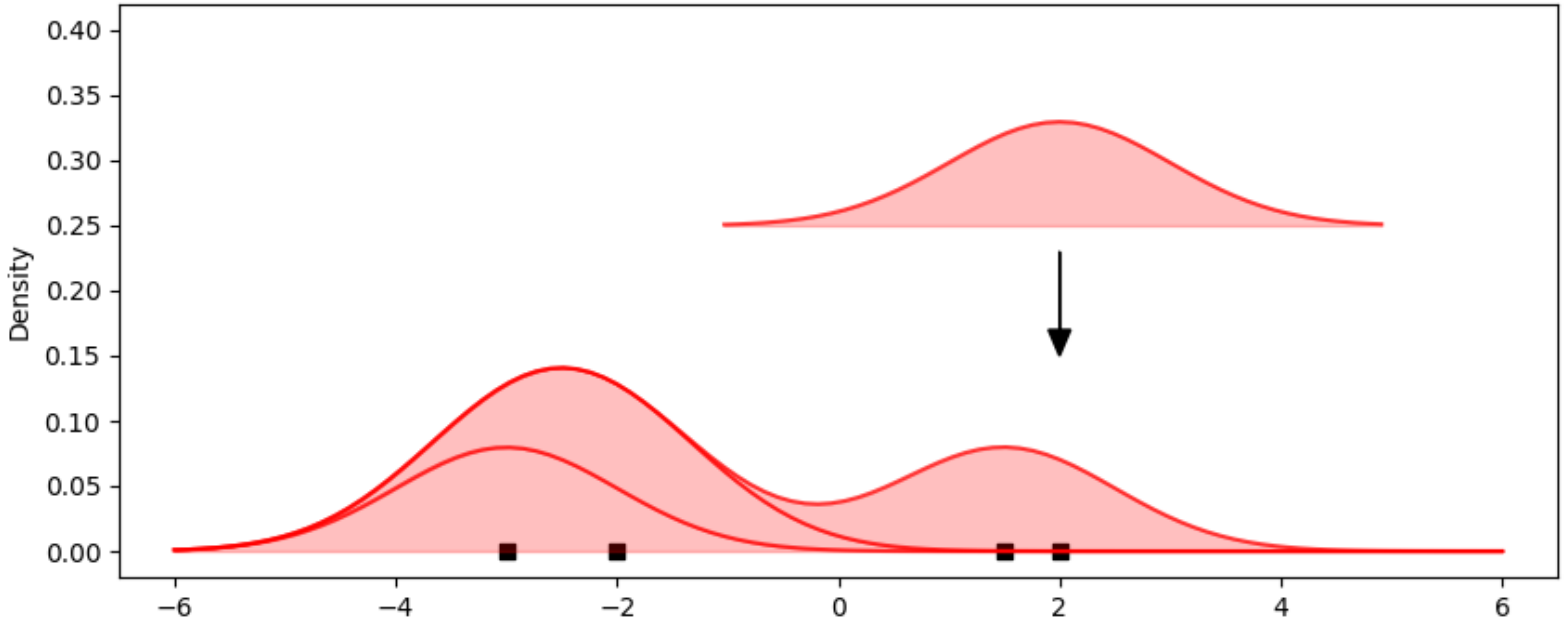
Density plot



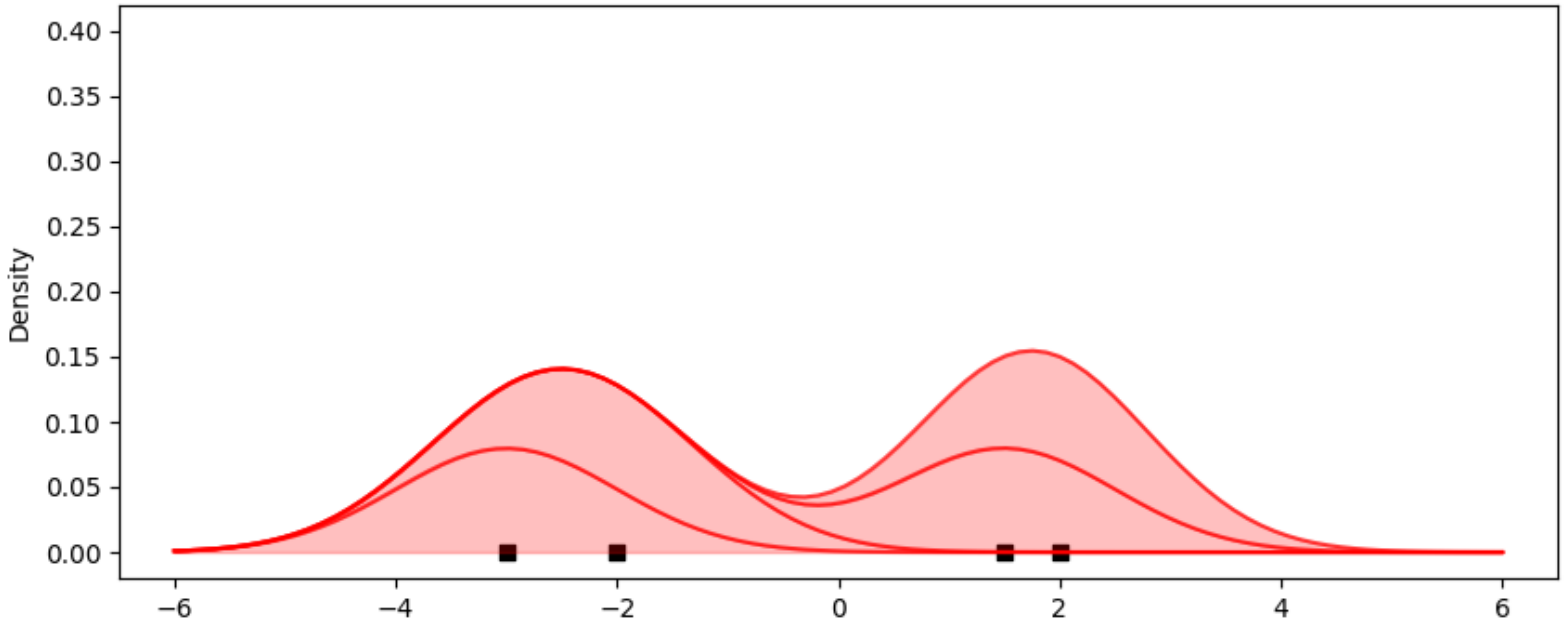
Density plot



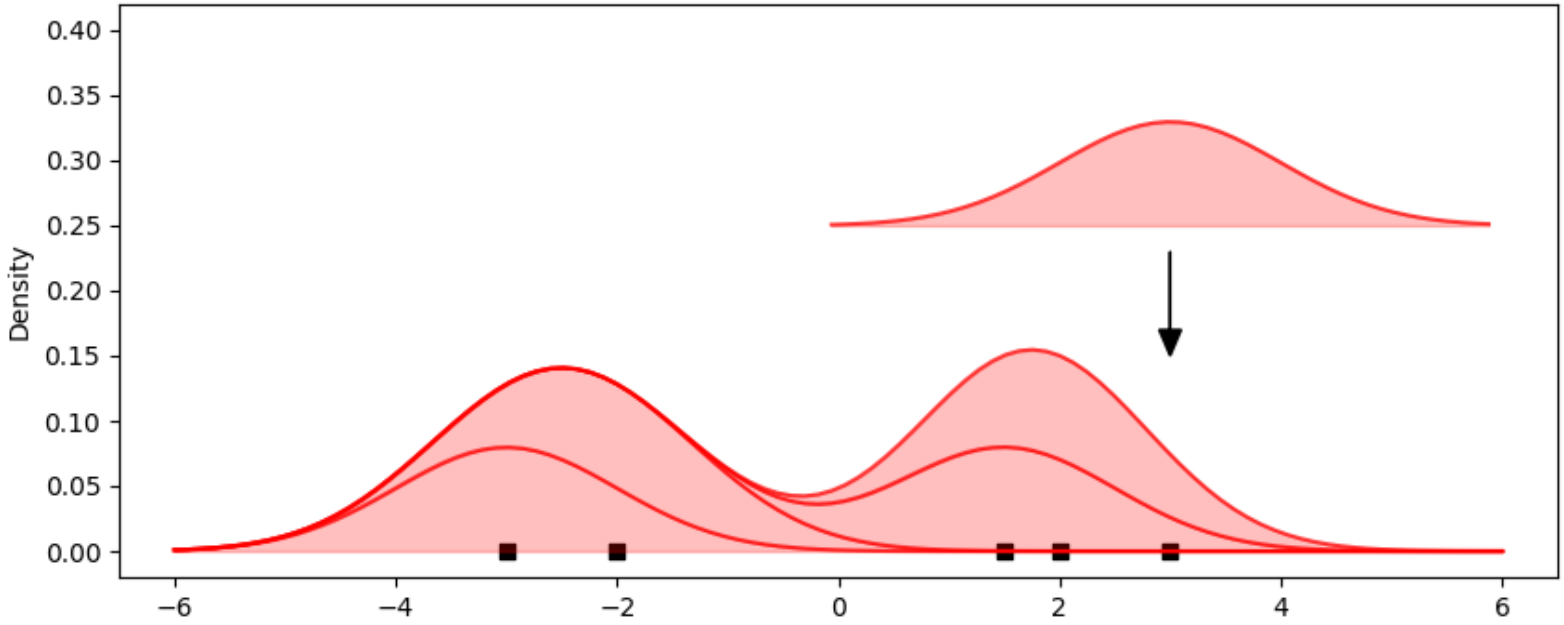
Density plot



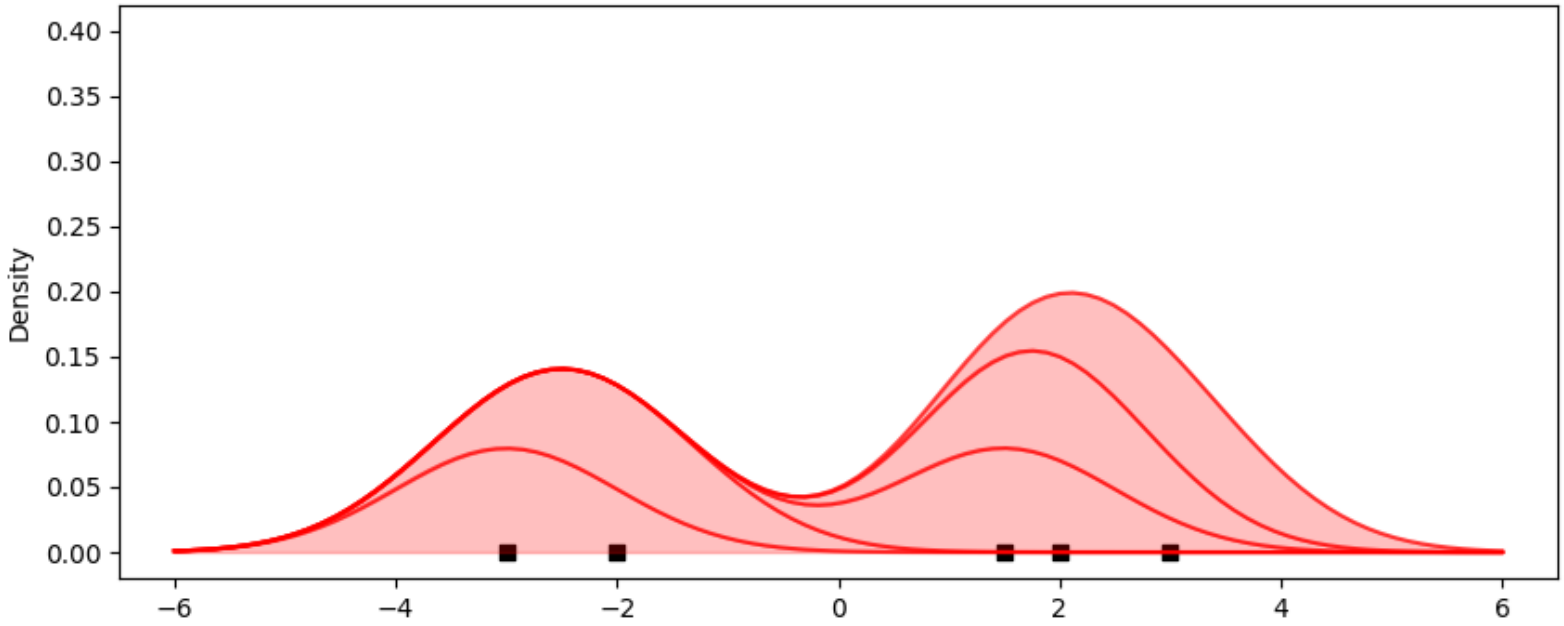
Density plot



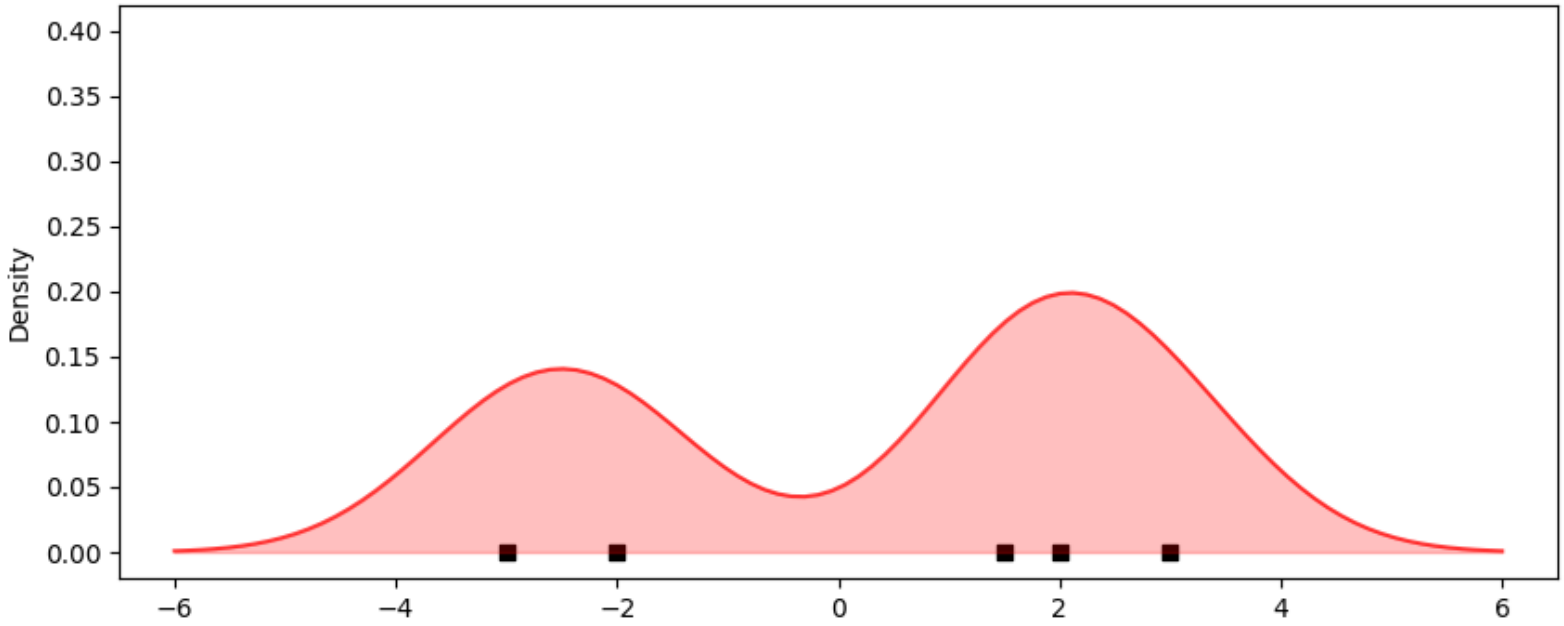
Density plot



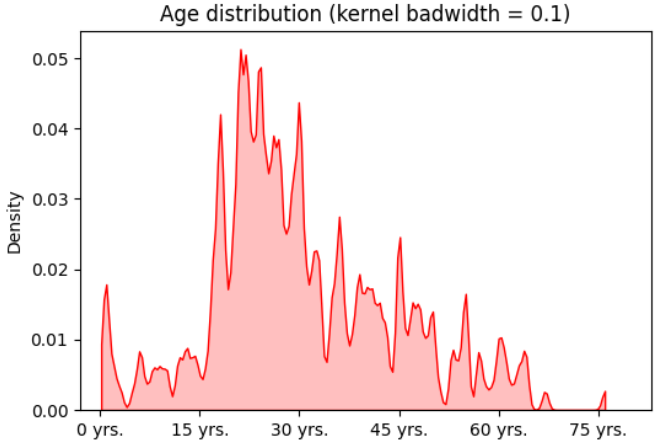
Density plot

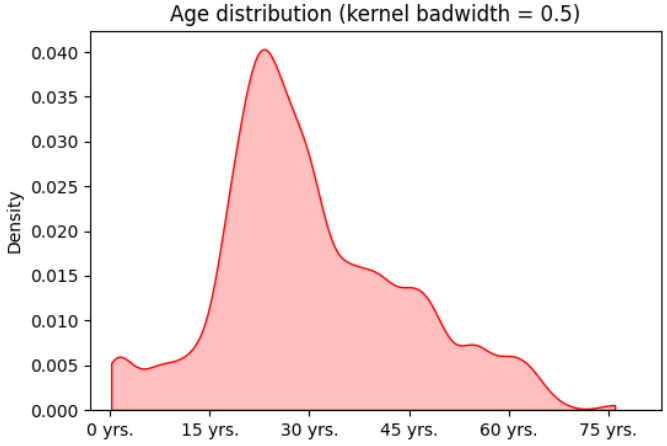


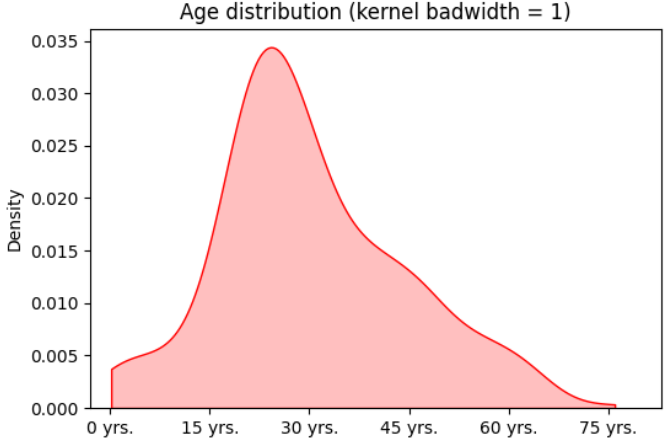
Density plot

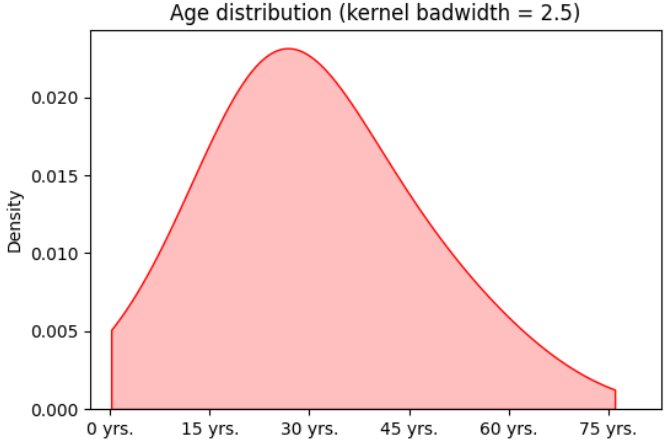


Kernel Bandwidth


Age distribution (kernel badwidth = 0.1)
Density
0.05
0.04
0.03
0.02
0.01
0.00
0 yrs.
15 yrs.
30 yrs.
45 yrs.
60 yrs.
75 yrs.

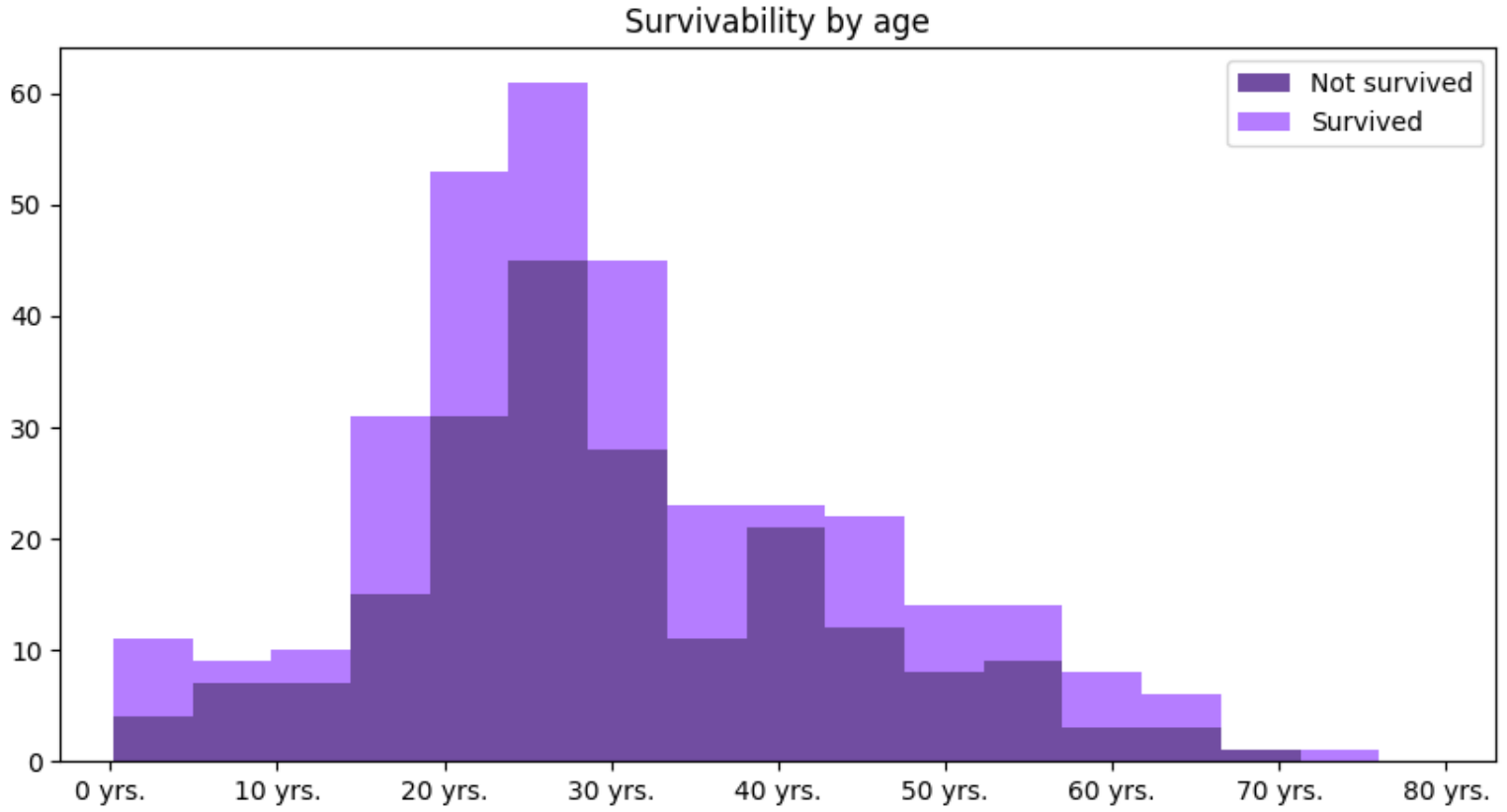

Age distribution (kernel badwidth = 0.5)
Density
0.040
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
0 yrs.
15 yrs.
30 yrs.
45 yrs.
60 yrs.
75 yrs.


Age distribution (kernel badwidth = 1)
Density
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
0 yrs.
15 yrs.
30 yrs.
45 yrs.
60 yrs.
75 yrs.

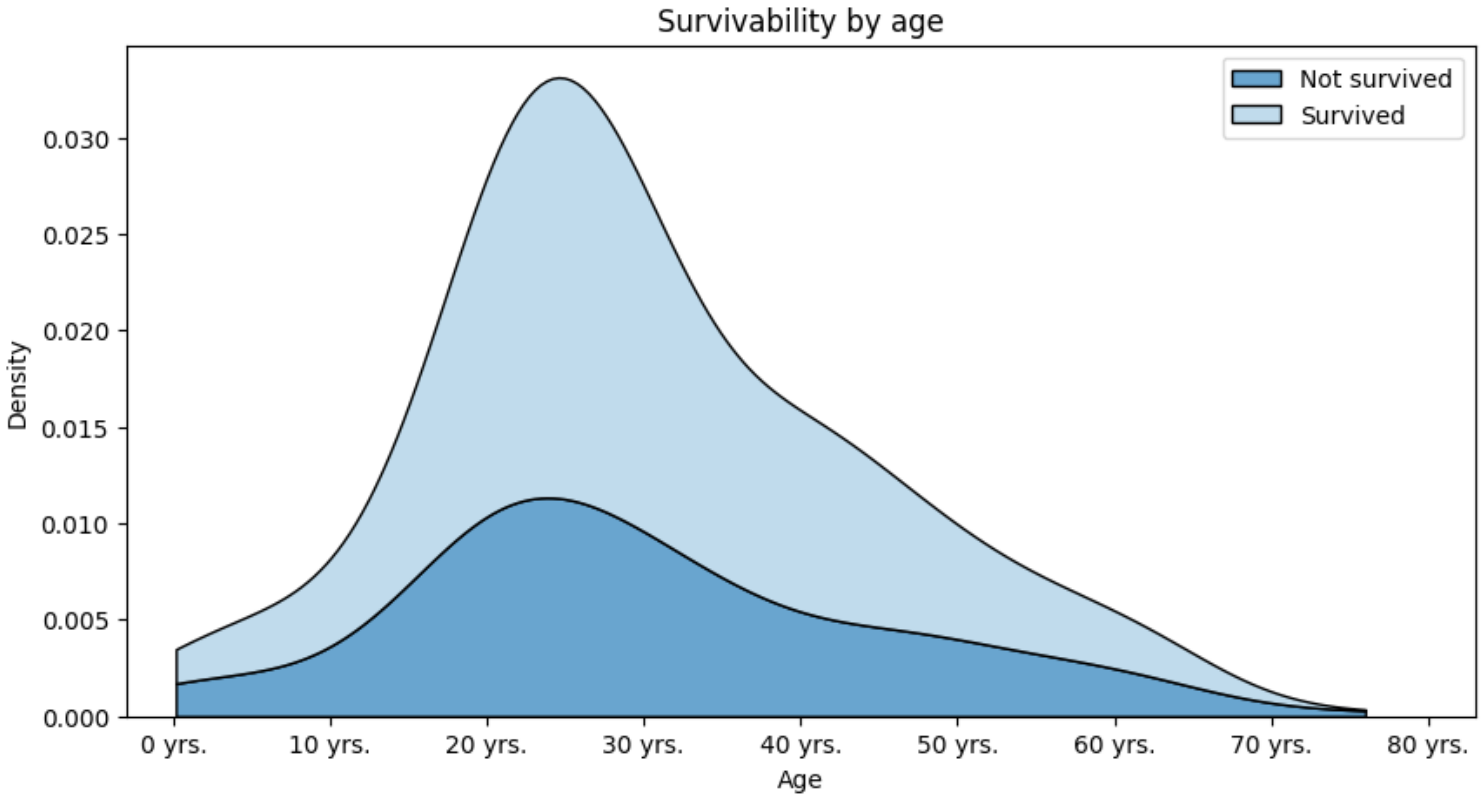

Age distribution (kernel badwidth = 2.5)
Density
0.020
0.015
0.010
0.005
0.000
0 yrs.
15 yrs.
30 yrs.
45 yrs.
60 yrs.
75 yrs.

Comparing multiple distributions

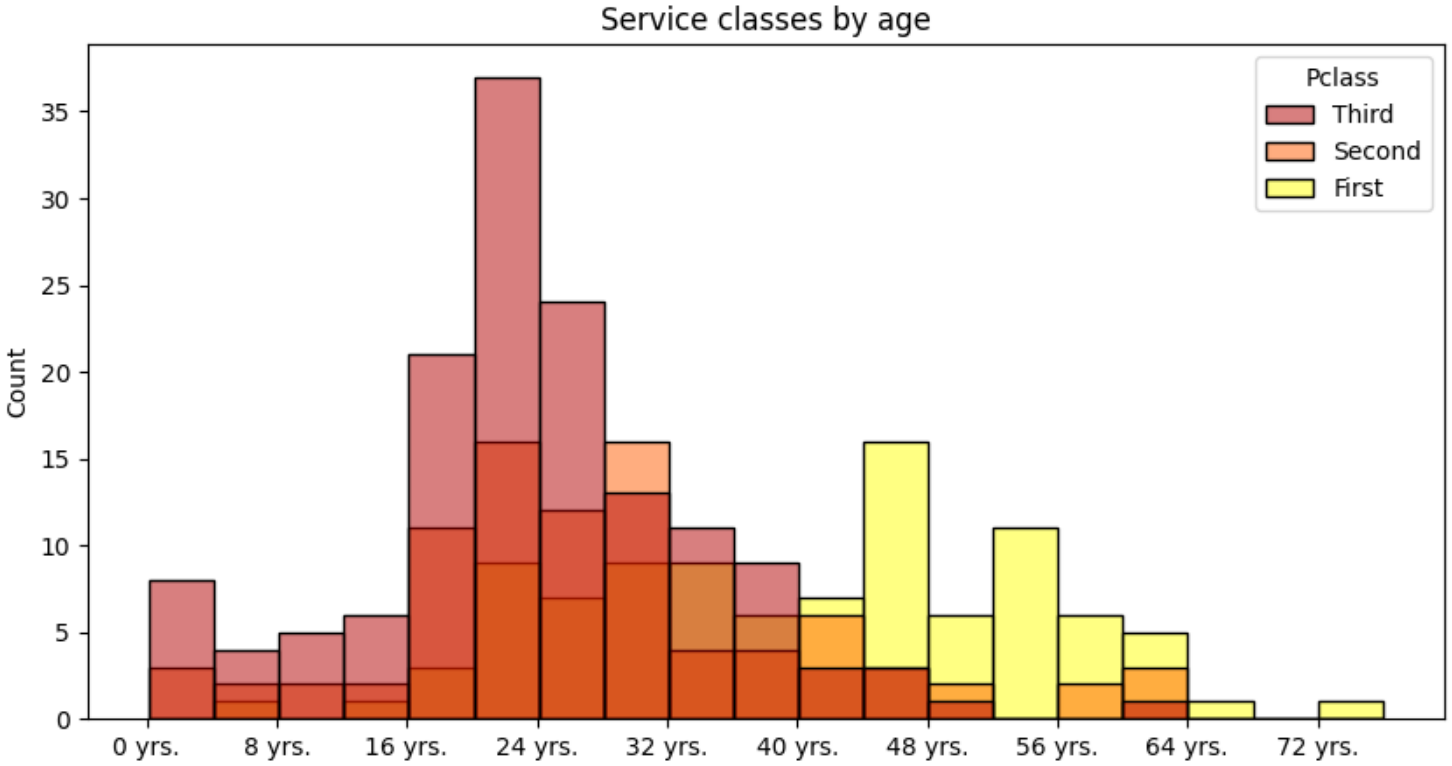
Stacked histogram



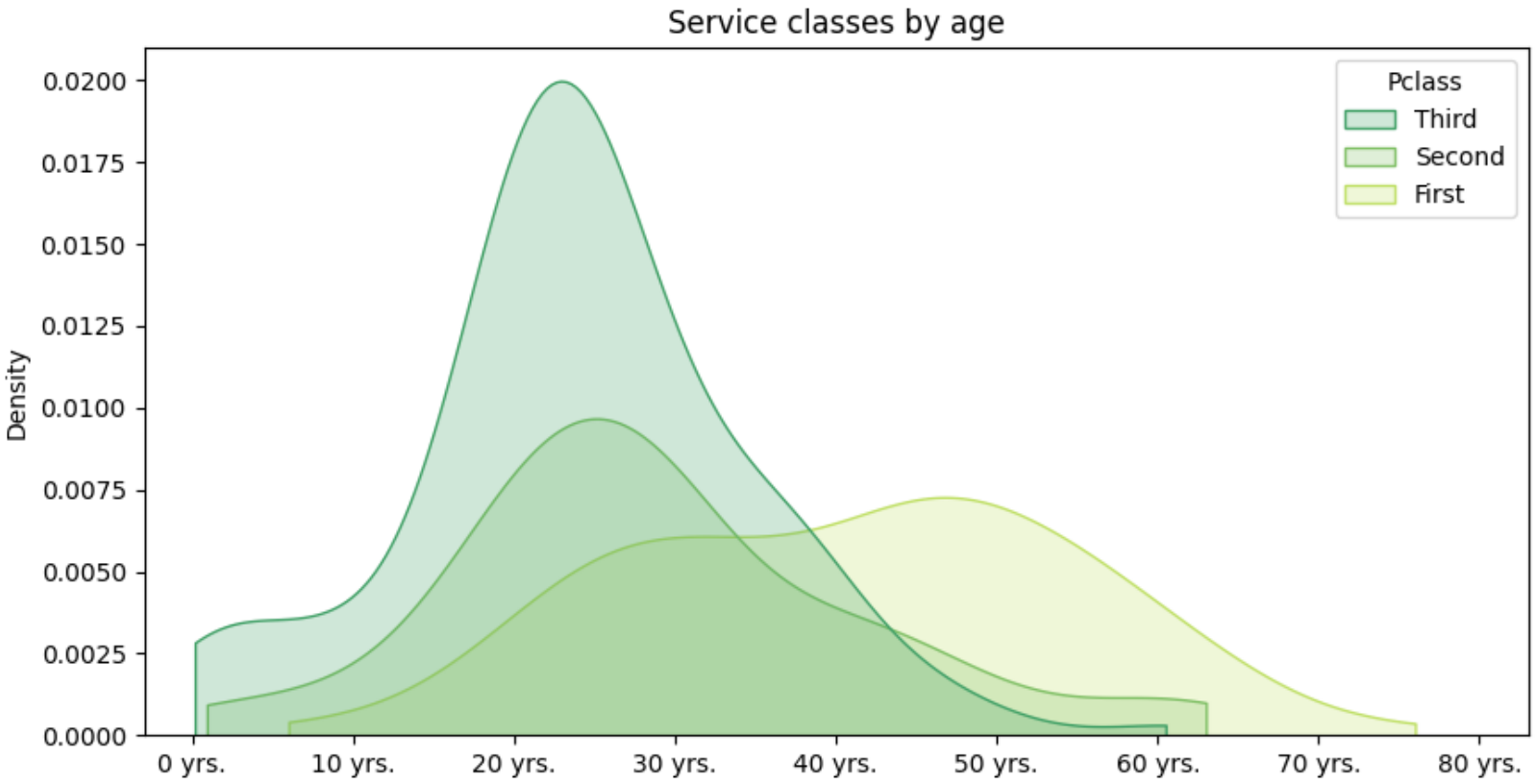
Stacked density plot



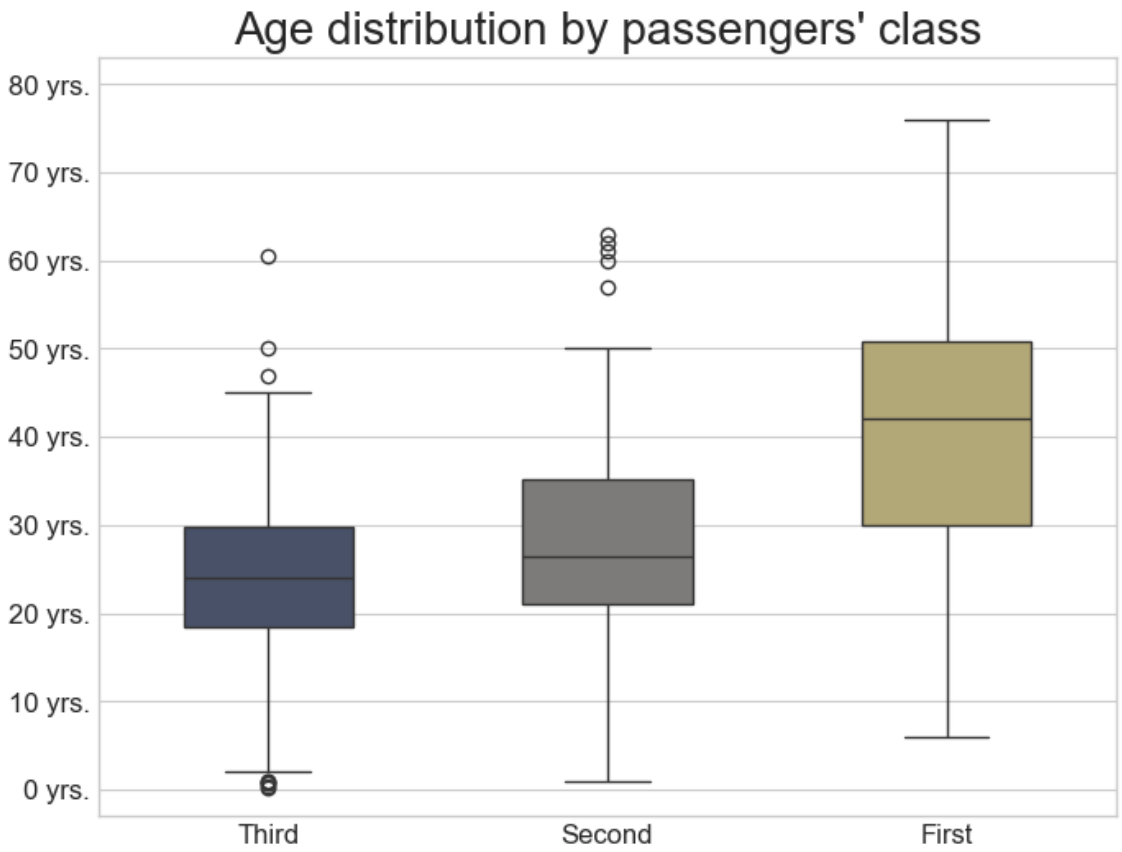
Overlapping density plot



Overlapping density plot



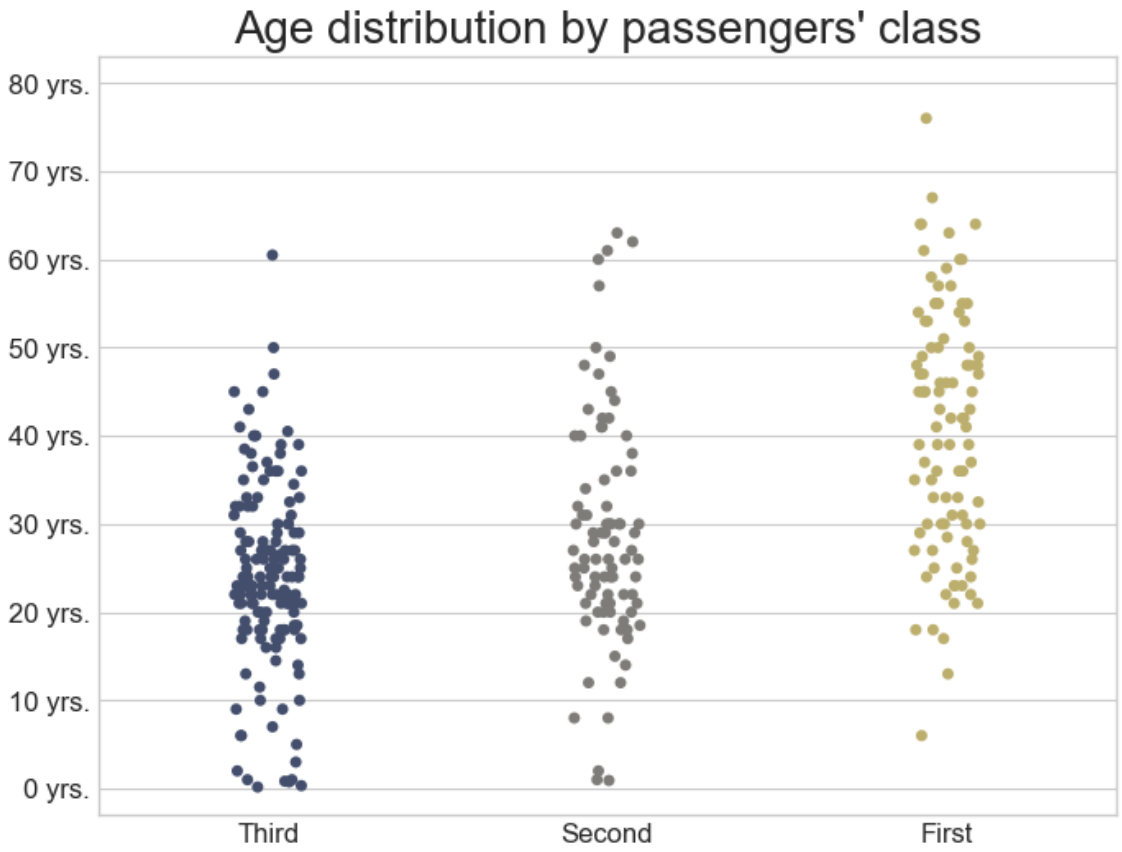
Box plots


Age distribution by passengers' class
80 yrs.
70 yrs.
60 yrs.
50 yrs.
40 yrs.
30 yrs.
20 yrs.
10 yrs.
0 yrs.
Third
Second
First

Violin plot

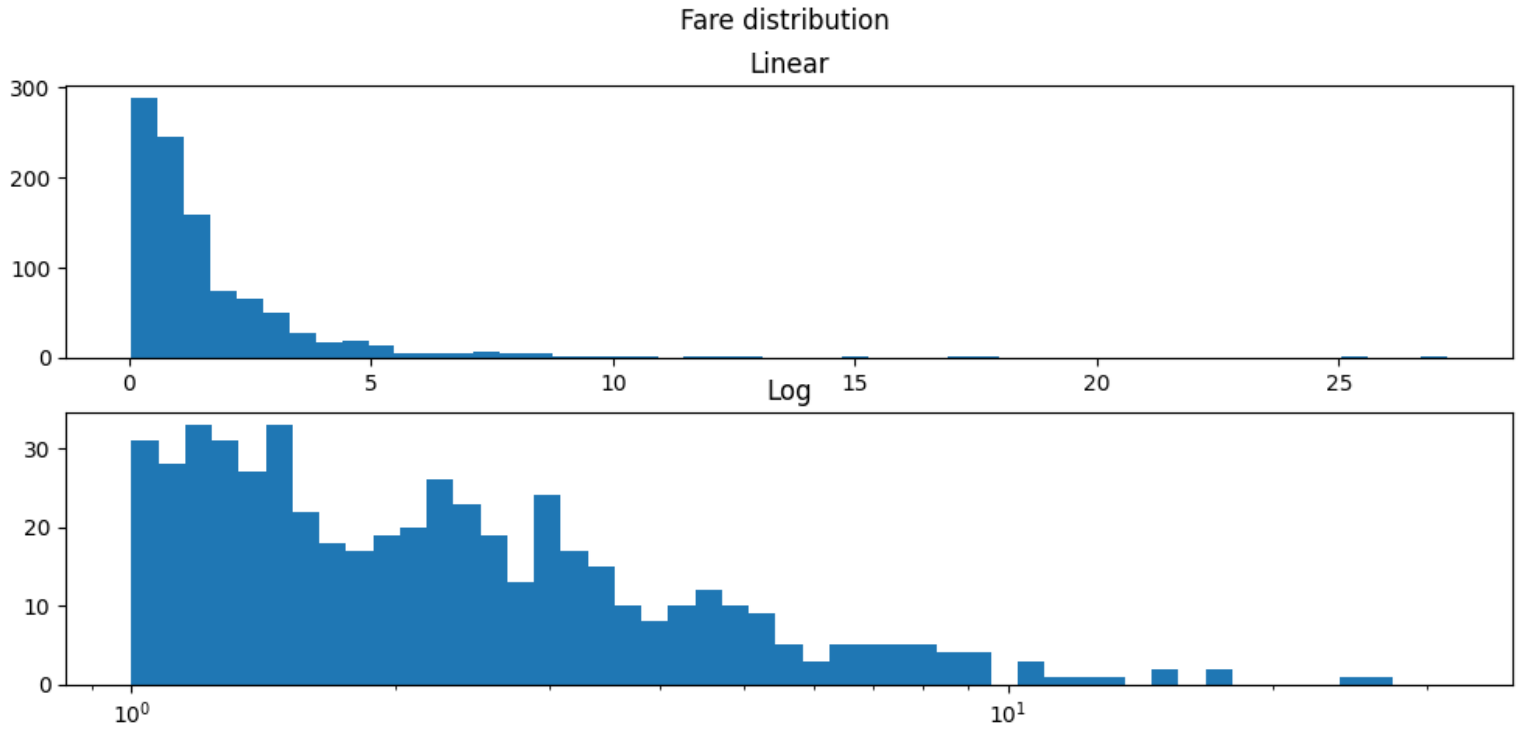
Age distribution by passengers' class
80 yrs.
70 yrs.
60 yrs.
50 yrs.
40 yrs.
30 yrs.
20 yrs.
10 yrs.
0 yrs.
Third
Second
First

Strip plot


Age distribution by passengers' class
80 yrs.
70 yrs.
60 yrs.
50 yrs.
40 yrs.
30 yrs.
20 yrs.
10 yrs.
0 yrs.
Third
Second
First

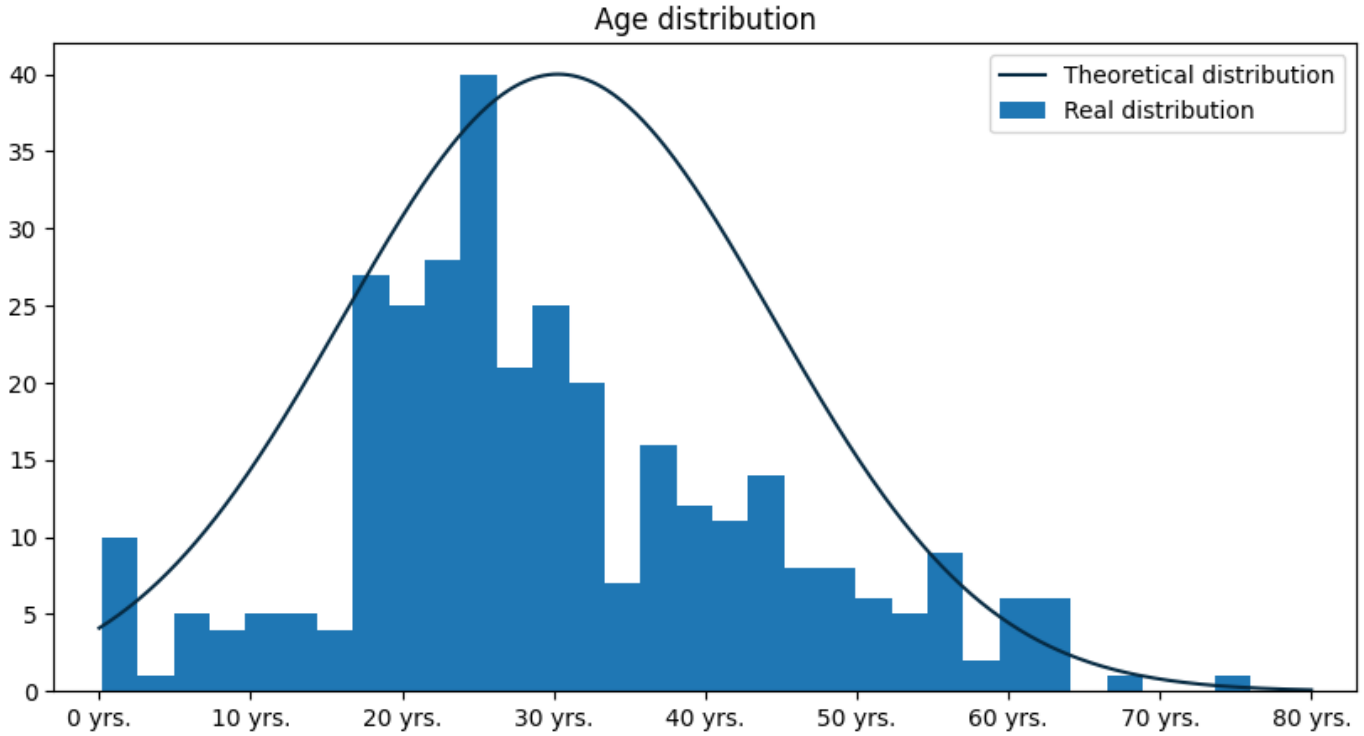
Logarithmic scale

Logarithmic scale

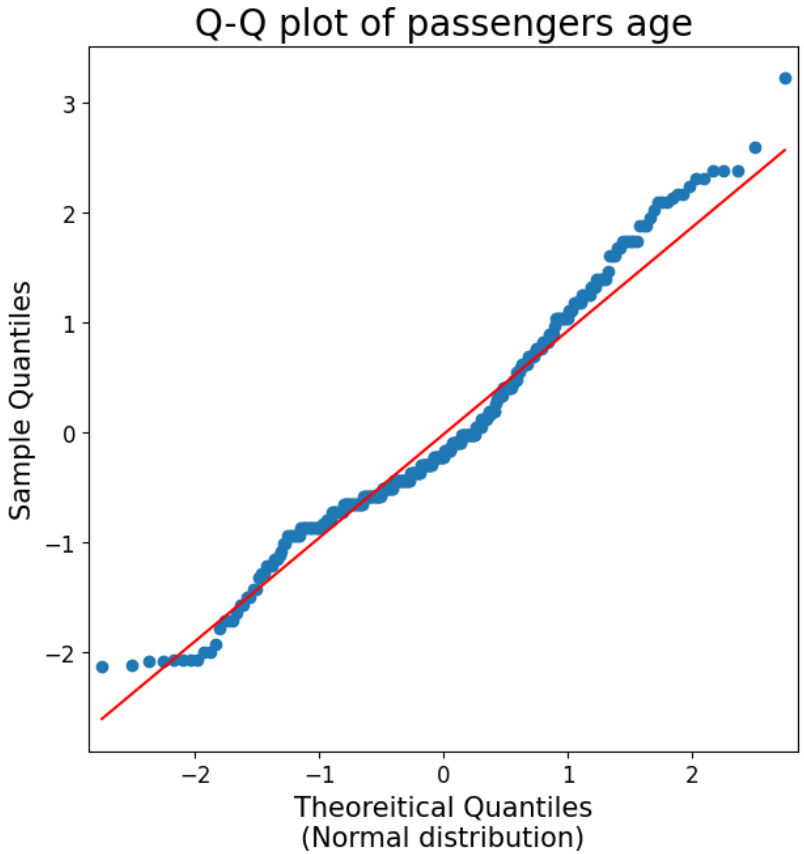


Real vs theoretical distribution

Real vs theoretical distribution

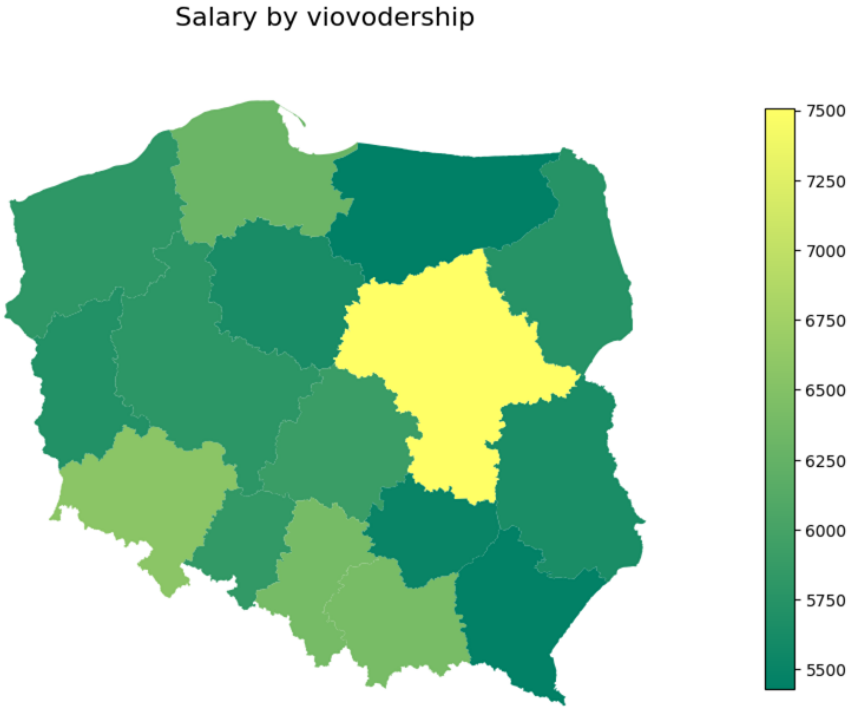


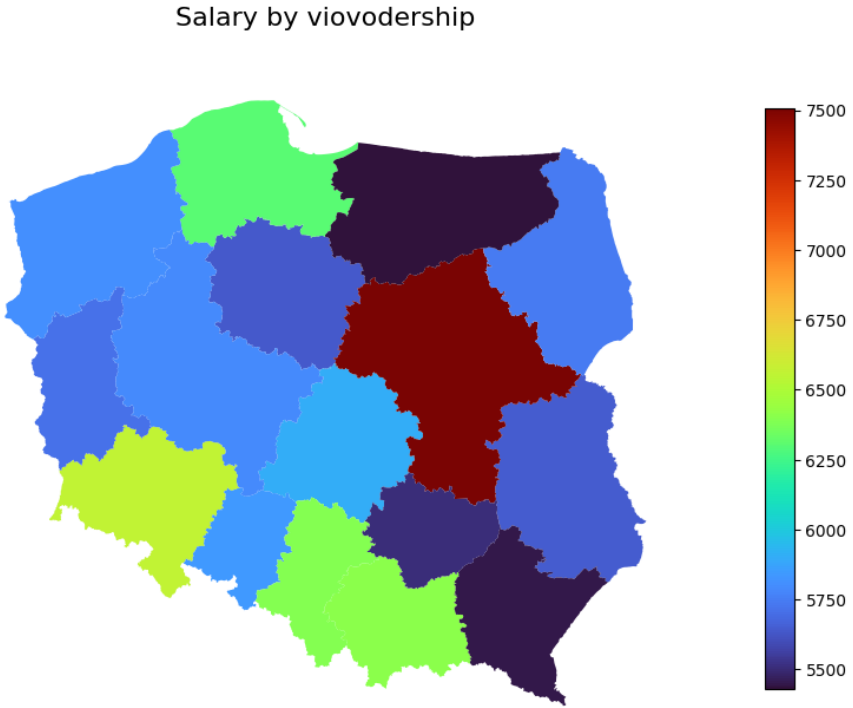
Real vs theoretical distribution



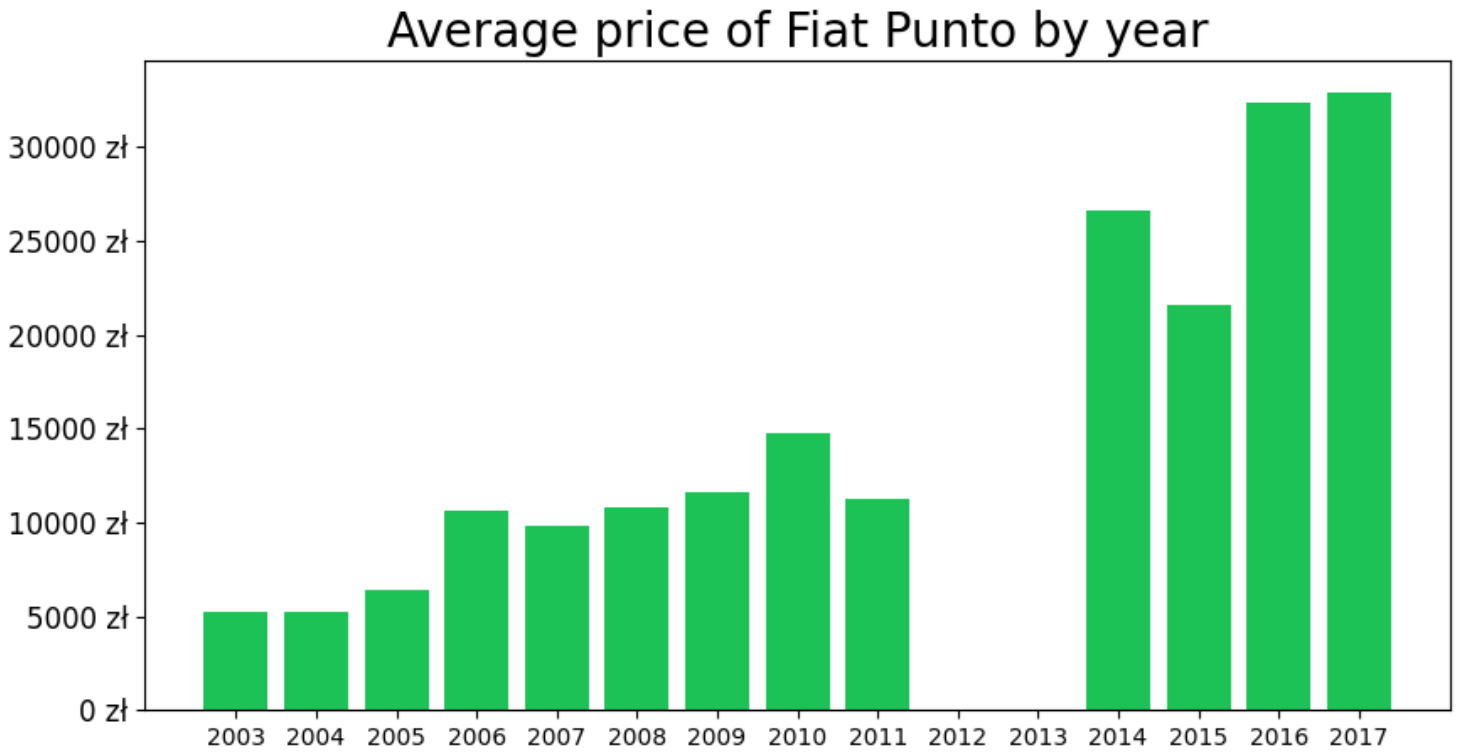
Frequently made mistakes

Incorrect color scale





Informing about missing data



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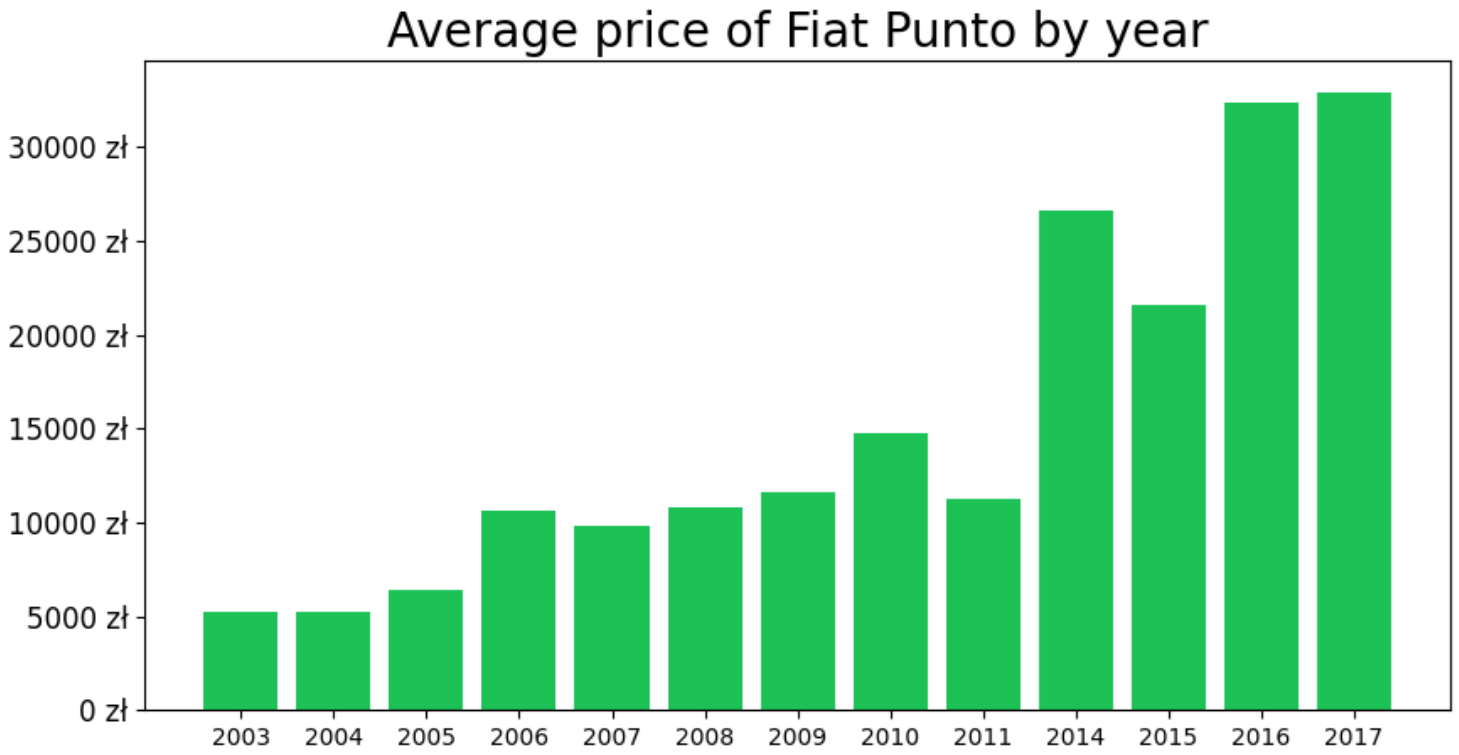
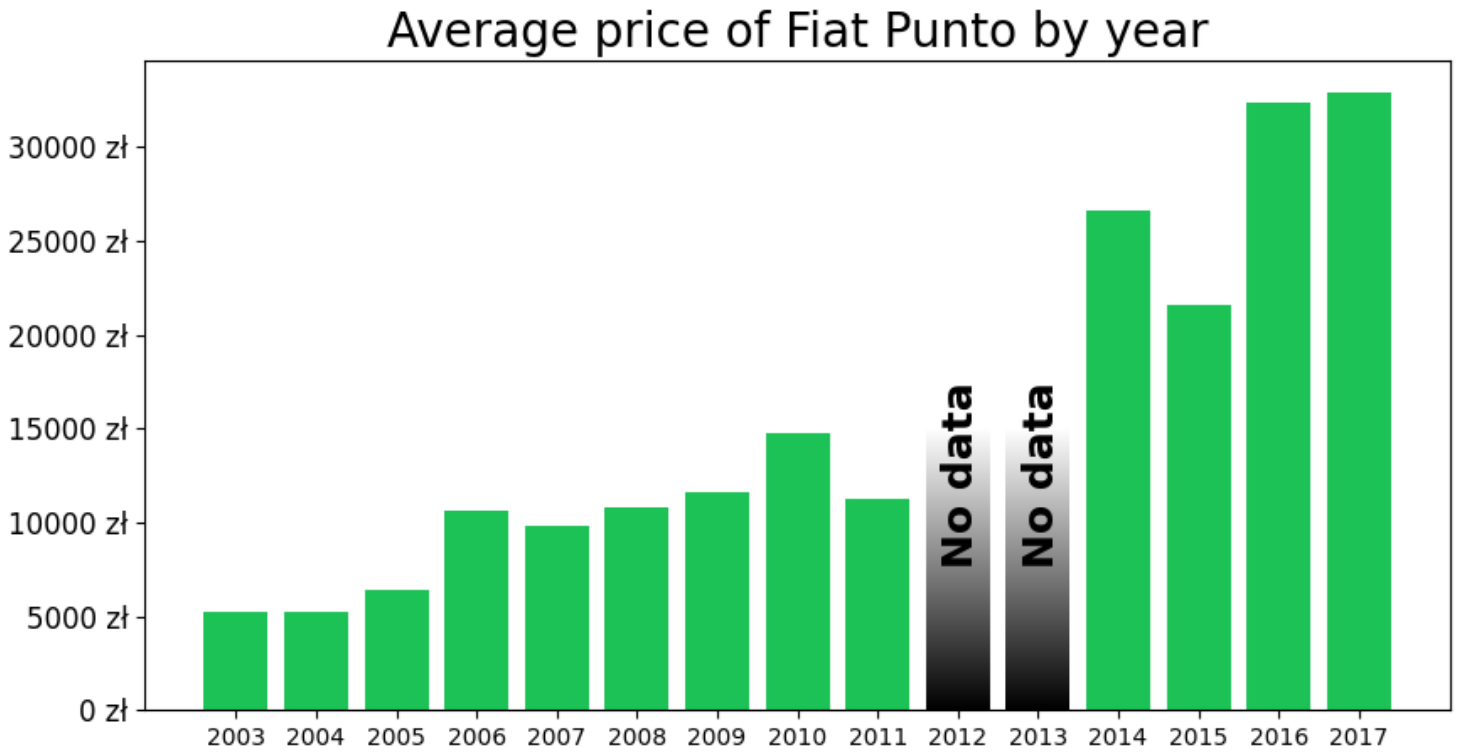
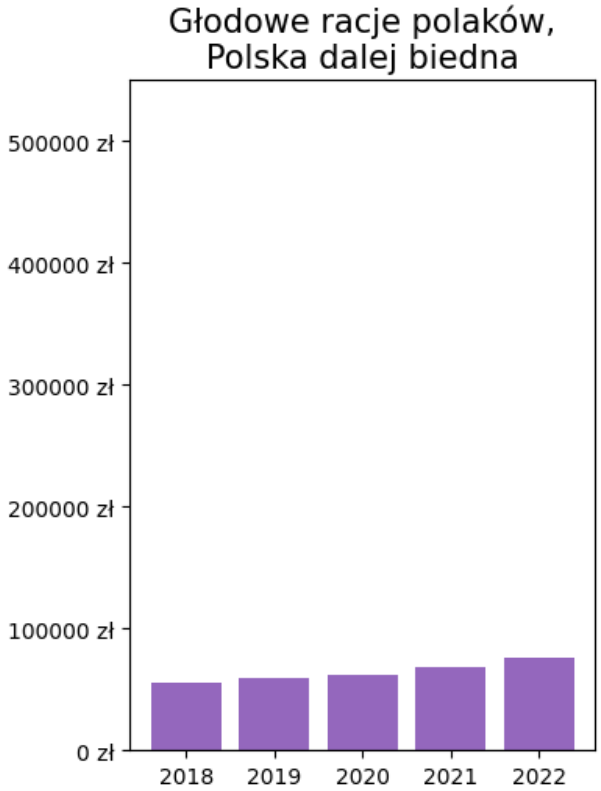
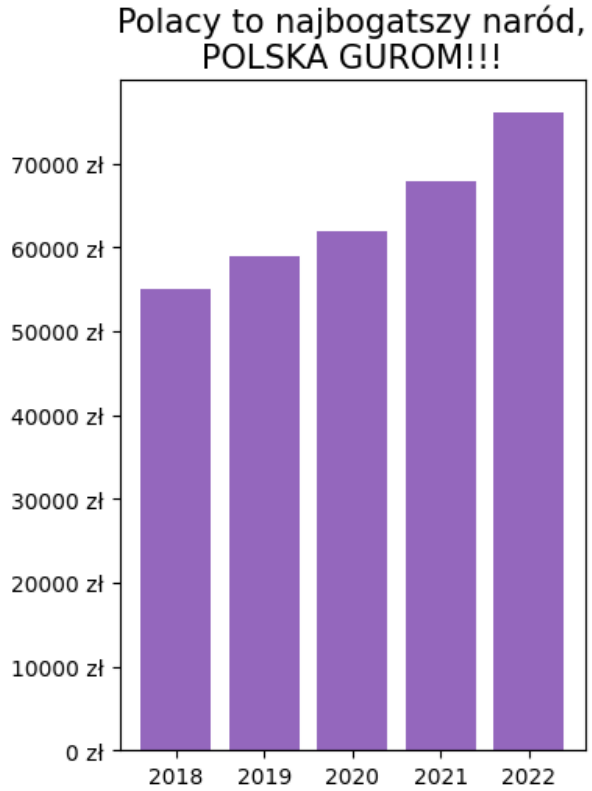


Informing about missing data



Manipulating scale





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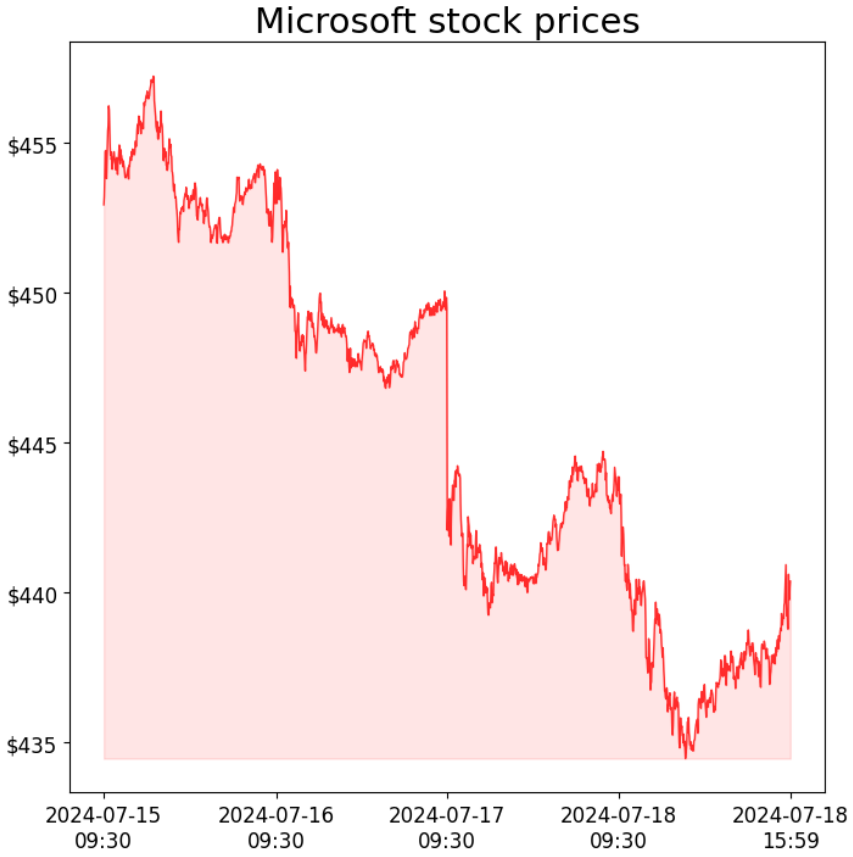

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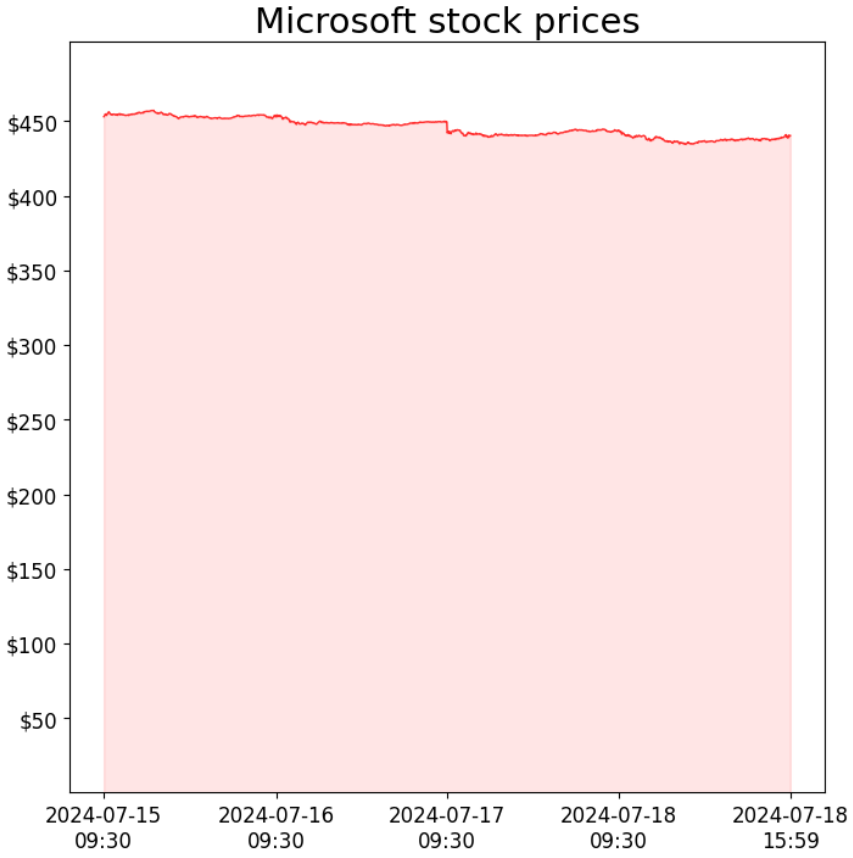

Manipulating scale

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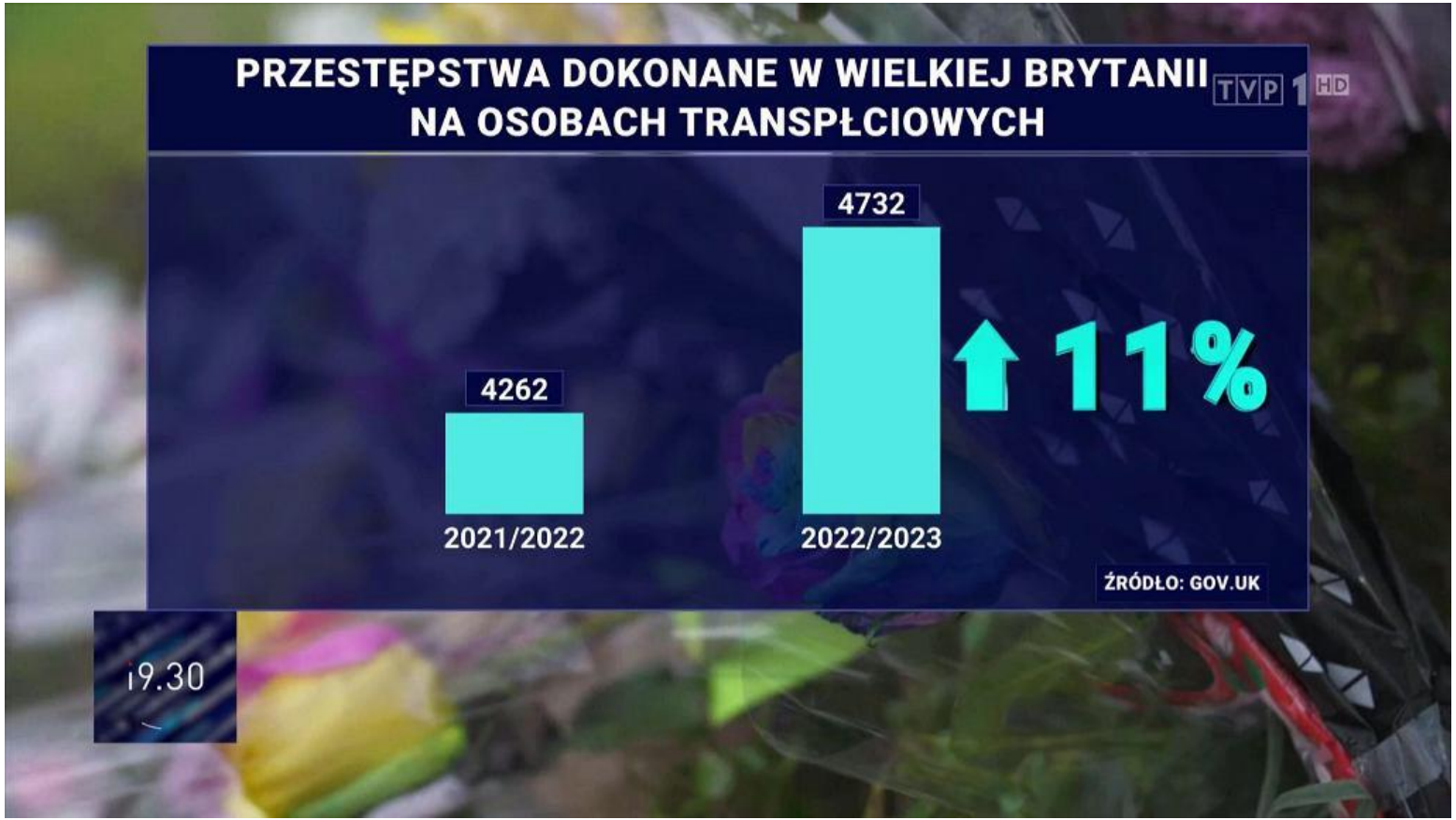
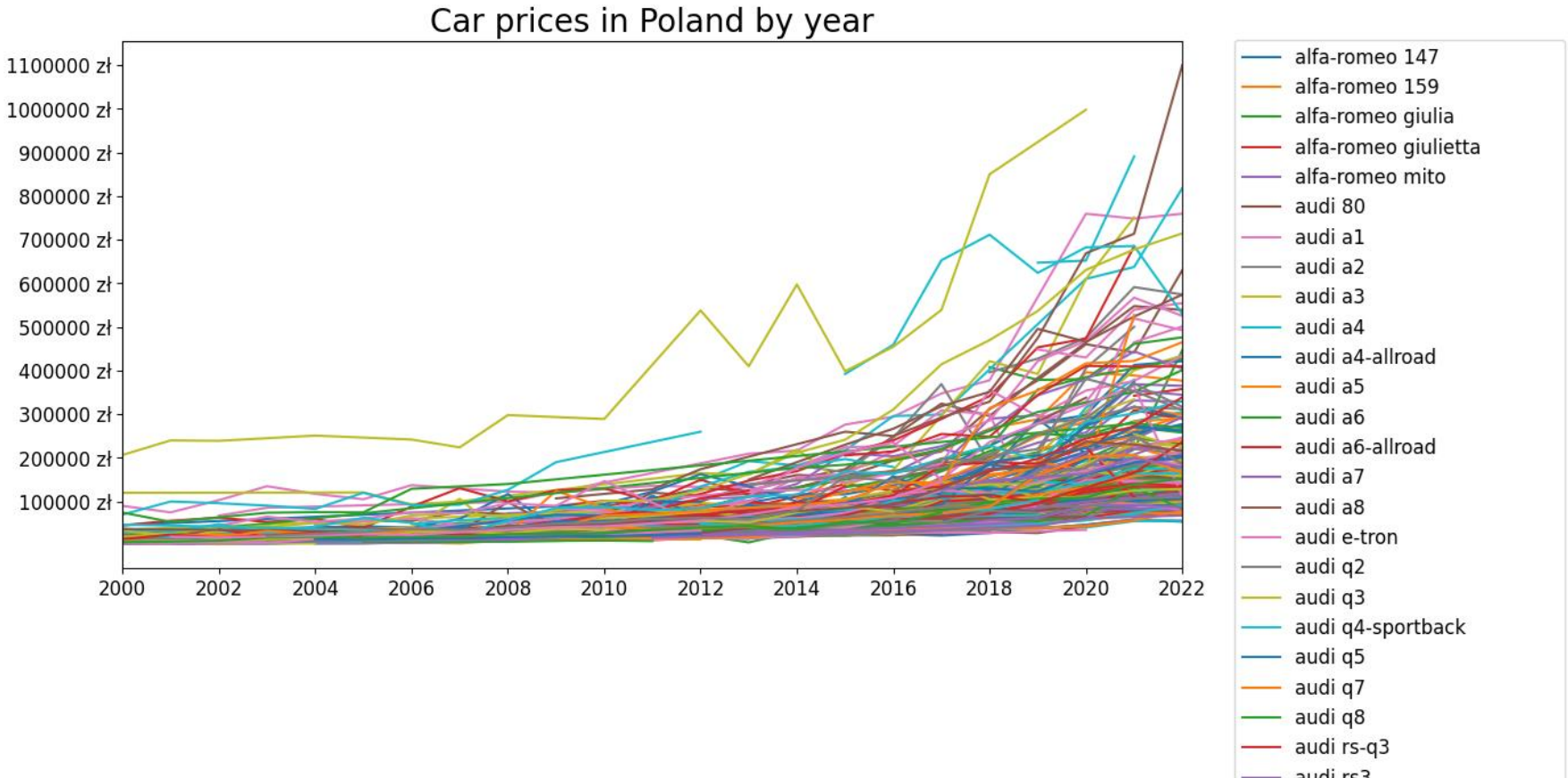
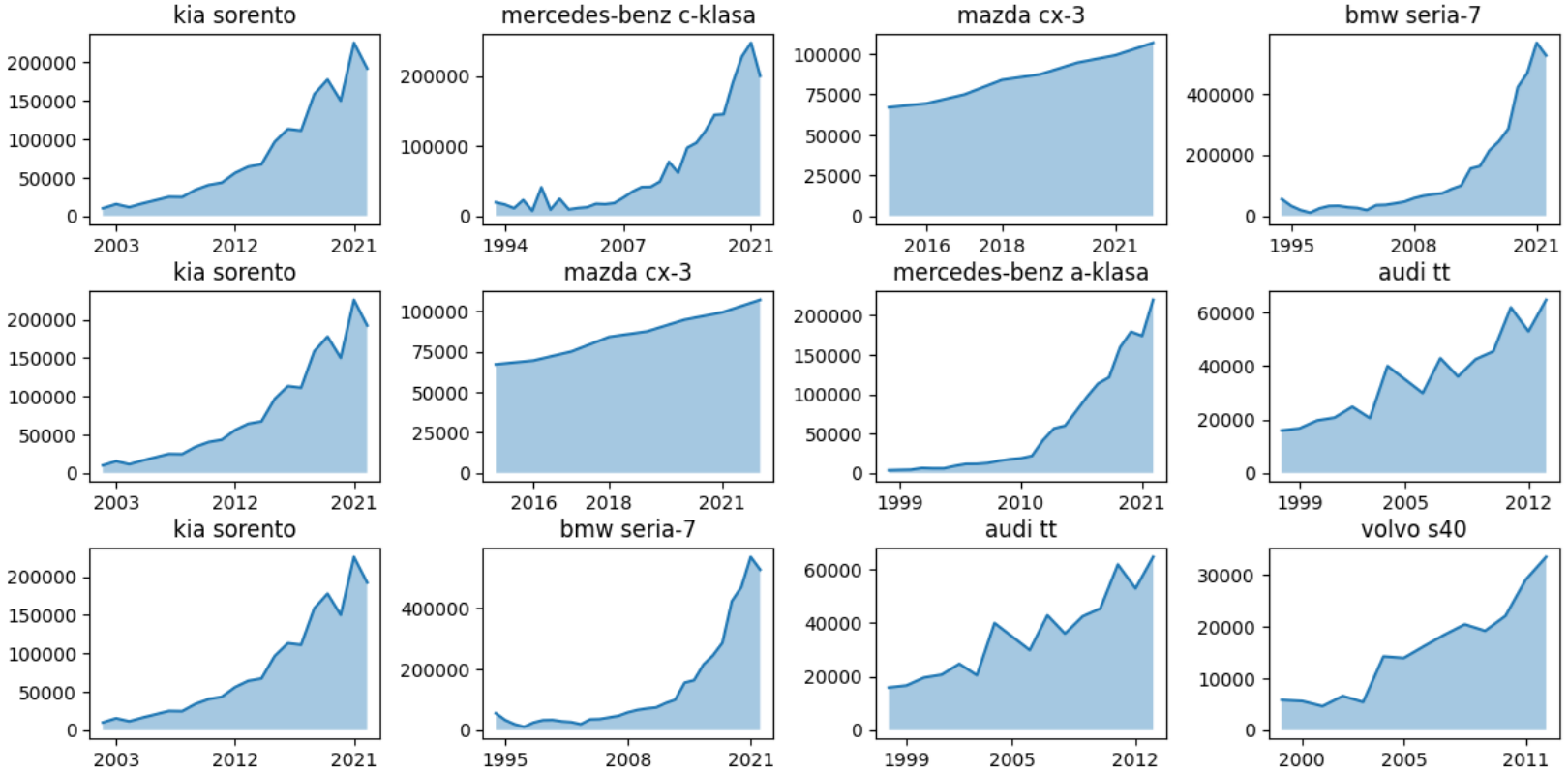


Too many informations



Too many informations



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[7] Aleksandr Glotov, Car Prices Poland (2021), Kaggle

Other:
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