Applied Data Analytics

Statistics — Basics & location

Measures of Central Tendency: Cardinal data

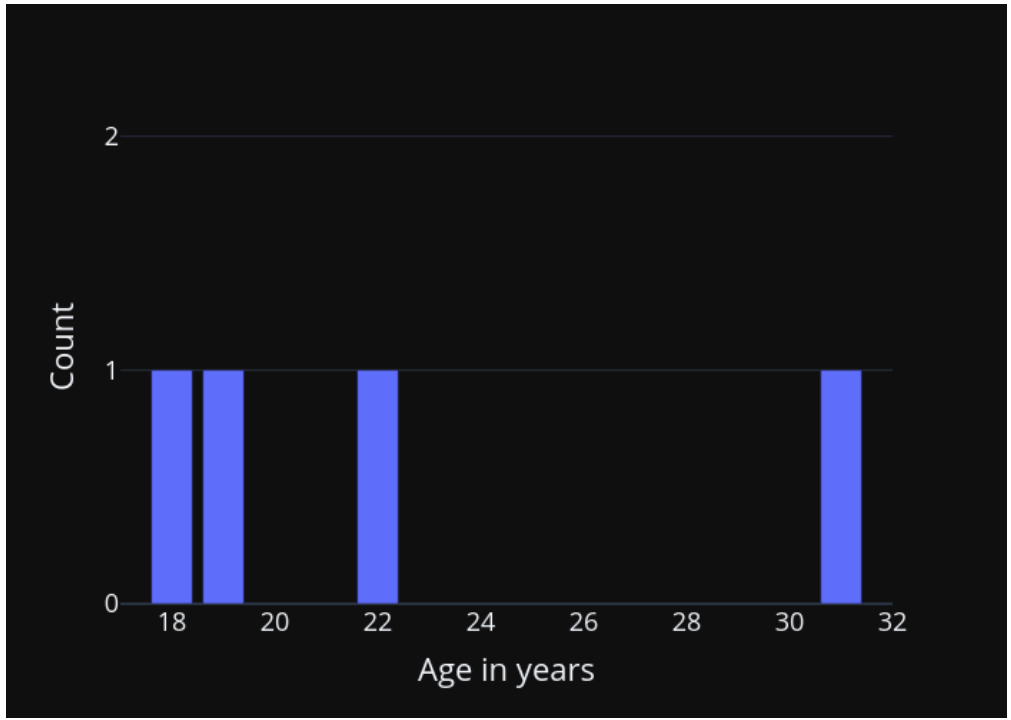
Hans-Martin von Gaudecker and Aapo Stenhammar

Cardinal data

Example:

- Variable: Age in years
- Possible values: 0, 1, 2, ...
- Observed values: 18, 22, 19, 31

Distribution



Median: Definition

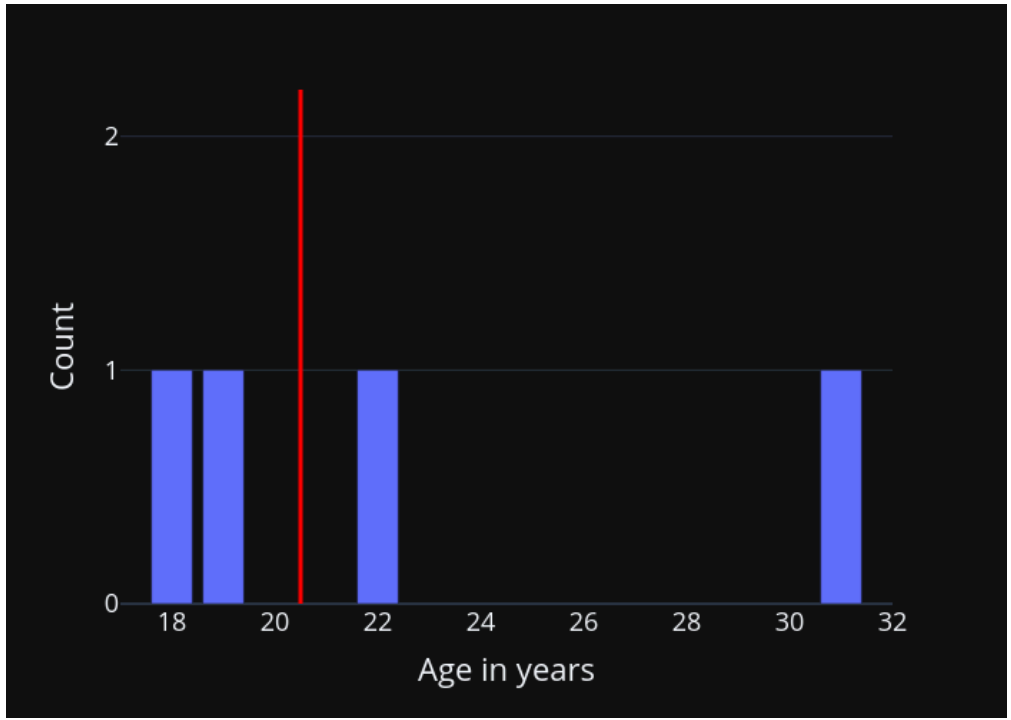
A value such that:

- at least half of the observations are higher or equal than the value
- at least half of the observations are lower or equal than the value

Median: in practice

- Sort the data and find the *middle value*
- Even N and distinct values at $N/2$ and $N/2+1$: Any value between the two, typically the average.
- Can be computed for any type of *ordered* data (ordinal and cardinal).

Distribution with median



Mean: Definition

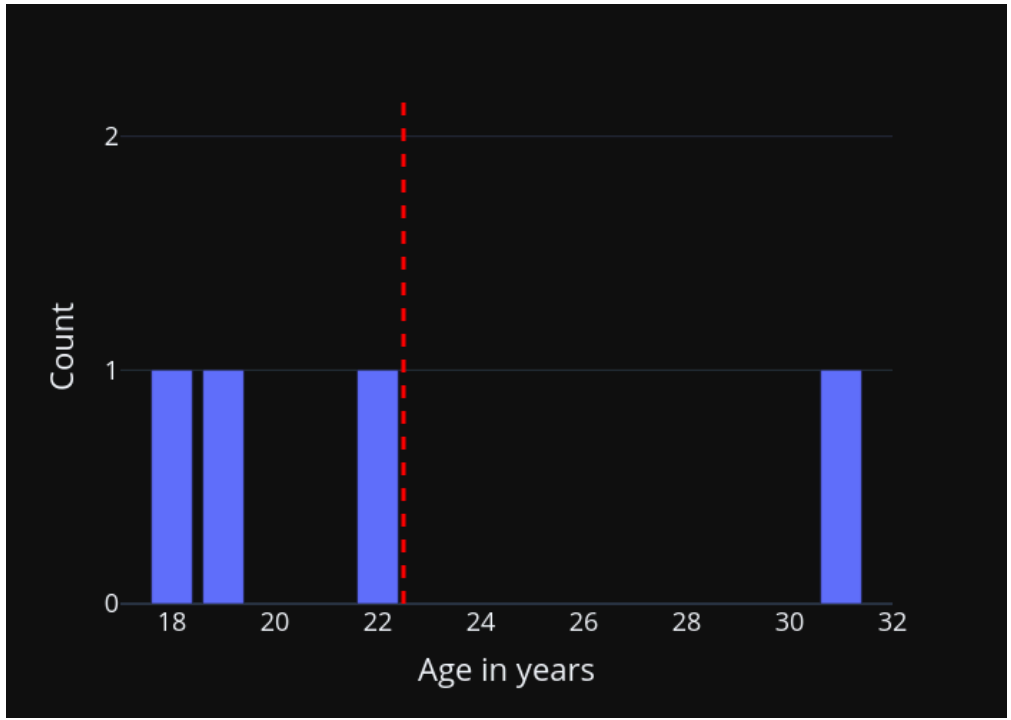
The mean is *the sum of all the values in the sample divided by the total number of values*

$$\bar{x} = \frac{1}{N} \sum_{i=1}^{N} x_i$$

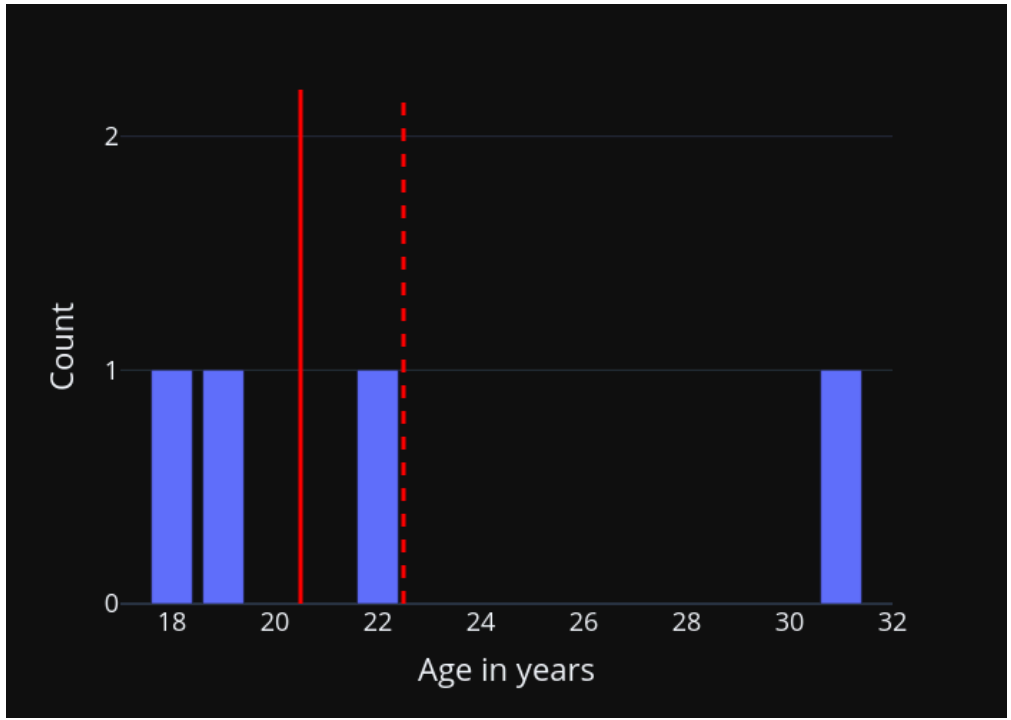
Mean: in practice

- Sum up all values and divide by the number of observations
- Is influenced by all observations, median only by the middle one(s)

Distribution with mean



Distribution with median and mean



Median and mean in pandas

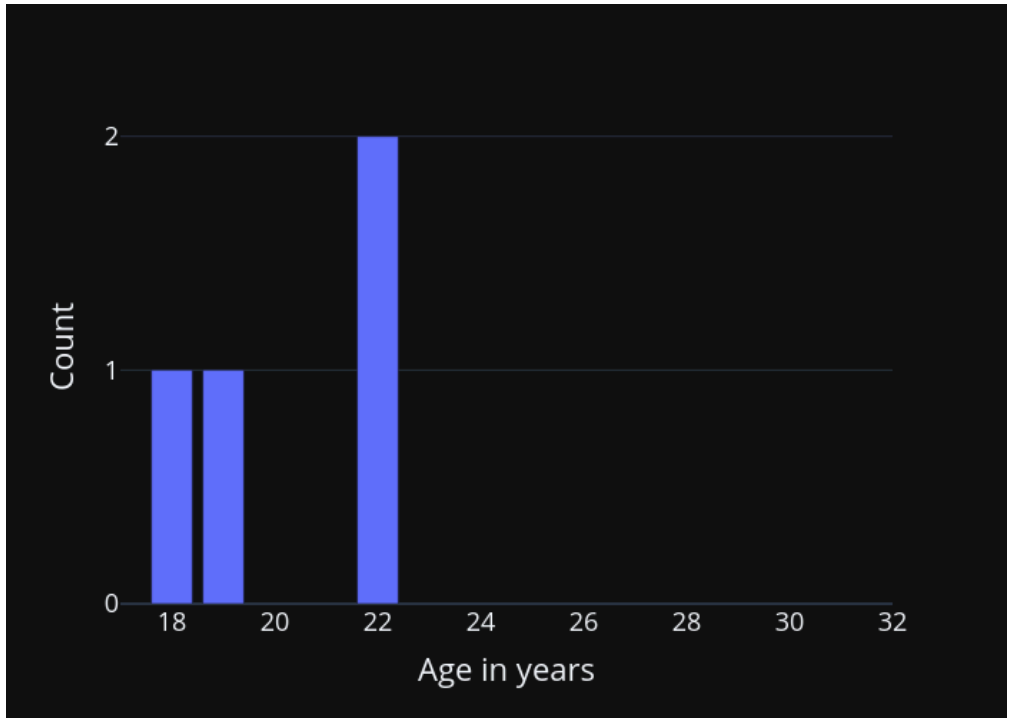
```
[1] age.median()
[1] np.float64(20.5)

[2] age.mean()
[2] np.float64(22.5)
```

- Just call methods with the respective name
- Median gives the average of the two middle values for even N

Median vs Median: sensitivity to outliers.

- The median is less sensitive to outliers than the mean.
- Reason is that it is influenced by all observations, while the median only by the middle one(s).
- Example: Observed values: 18, 22, 19, 22

Distribution



Distribution with median and mean