Session 06

Outliers (finishing up) and privacy in action

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Outliers

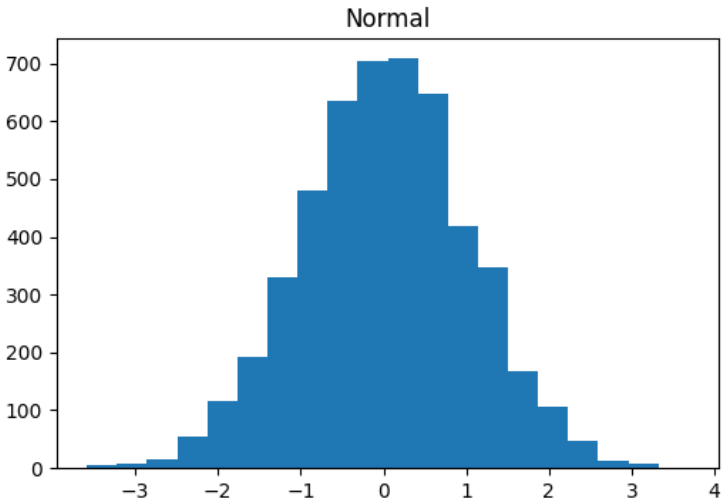
- We’ll be looking at outliers in the bysykkel data.
- We’ll be looking for a appropriate distribution to model trip duration
- We’ll do clustering on the trip data (mainly to use more of Sklearn)

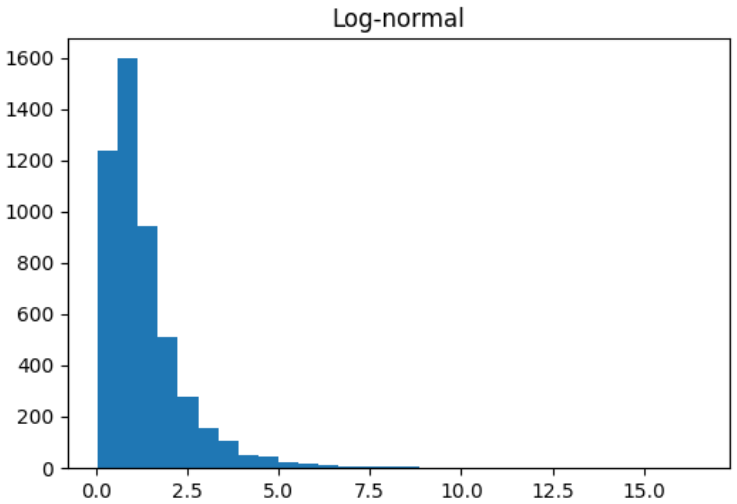
Log-normal distribution

Reminder: If X is log-normal distributed, then

$$Y = \ln(X)$$

is normal distributed.





Chi-square distribution

Reminder: If $Z_i, i = 1, \ldots, k$ are normal distributed, then

$$Y = \sum_i X_i^2$$

is χ^2 distributed.
Not normally used to model observations, but for hypothesis testing and confidence intervals.

Privacy: Randomization

ϵ-differential privacy

Let ϵ be positive, real, and $\mathcal{A}$ be a randomized algorithm. $\mathcal{A}$ provides ϵ-differential privacy if for all D_1, D_2 that differ by one element, and all subsets S of $\operatorname{im} \mathcal{A}$

$$\Pr[\mathcal{A}(D_1) \in S] \leq \exp(\epsilon) \cdot \Pr[\mathcal{A}(D_2) \in S]$$

ϵ-differential privacy gives strong guarantees regarding strength and robustness.

Intuition

Give each individual roughly the same privacy that would result from having their data removed from the set.

Randomization

Given a sensitive (binary) variable and a person queried about that variable,

1. Toss a coin.
2. If heads up, answer honestly.
3. Else, answer randomly by coin toss.

This mechanism provides ϵ-differential privacy, excluding micro-data releases.