Study of recharging stations placement for electric car sharing systems

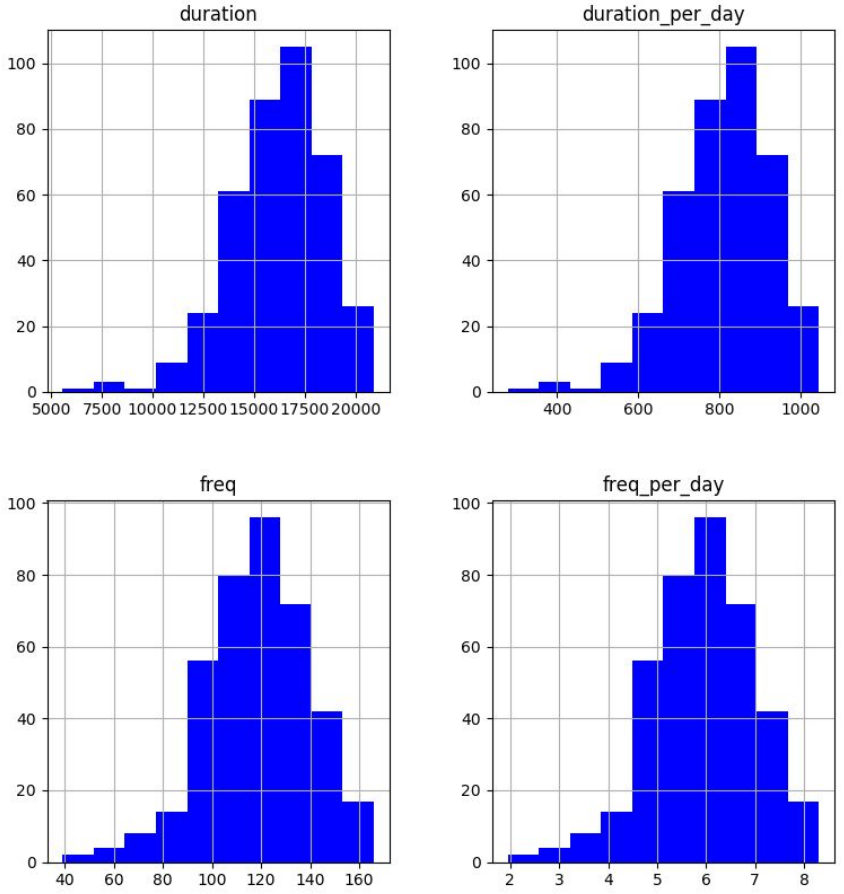
Report 2

Previous Results I

Car2go:

- The (0,0) plot represents the PDF of parkings duration on all the period
- The (1,0) plot is the parkings frequence PDF on all the fleet on all period
- The (0,1) and (1,1) plots are obtained from the (0,0) and (1,0) dividing by the number of days with valid entries

- Median duration per day per car = 820 min
- Median booking freq. per day per car = 5.95

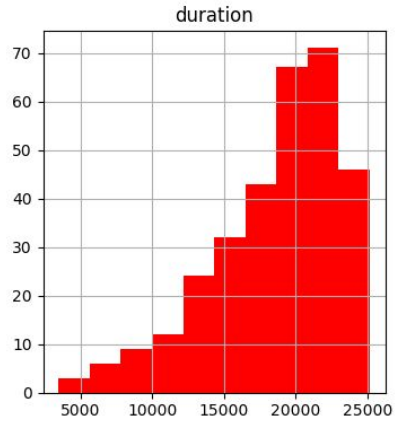


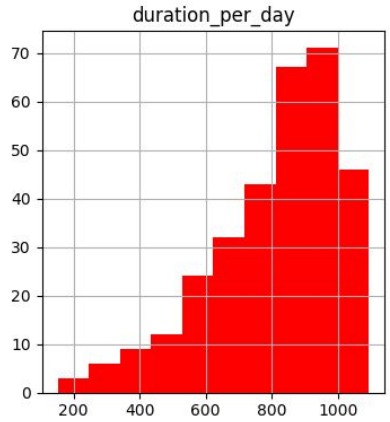
Previous Results II

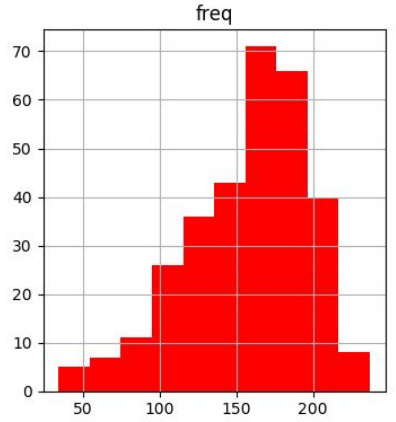
Enjoy:

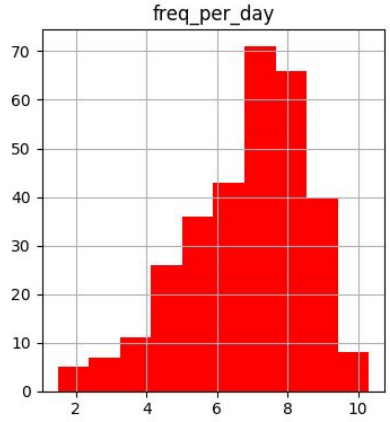
- The (0,0) plot represents the PDF of parkings duration on all period
- The (1,0) plot is the parking frequencies PDF on all the fleet on all period
- The (0,1) and (1,1) plots are obtained from the (0,0) and (1,0) dividing by the number of days with valid entries

- Median duration per day per car = 850 min
- Median parking freq. per day per car = 7.17









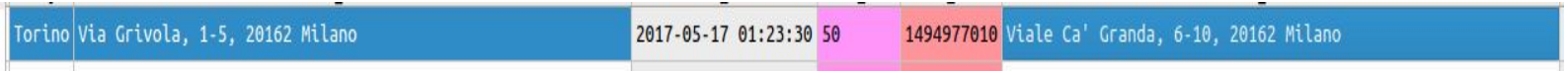
Analysis of car exchange among cities

- Analysis period: from 17th May 2017 to 17th June 2017
- By querying all bookings, half cars had booked one times for few minutes
  - Phenomenon visible only for Enjoy
- (*)Took all the cars which have a cumulative distance lower than 30 km (in Torino)
- Querying those car per plate
- Saved in format
  - Key (plate, city) - Value: number of bookings for those car in those city (unplottable)
  - Sum all the bookings, for the cars in (1), for each city
    - Is possible to notice that 547 cars are re-injeceted in Torino or are “jolly cars”
- Any of those cars is in the Active Bookings collections

Details of disappeared cars

Index	ookings_per_ca	log
Catania	309	2.49
Firenze	815	2.91
Milano	49481	4.69
Roma	1506	3.18
Torino	547	2.74

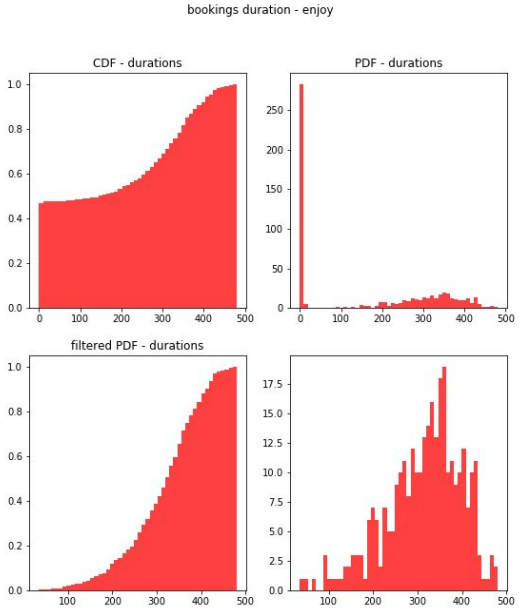
Improvements I

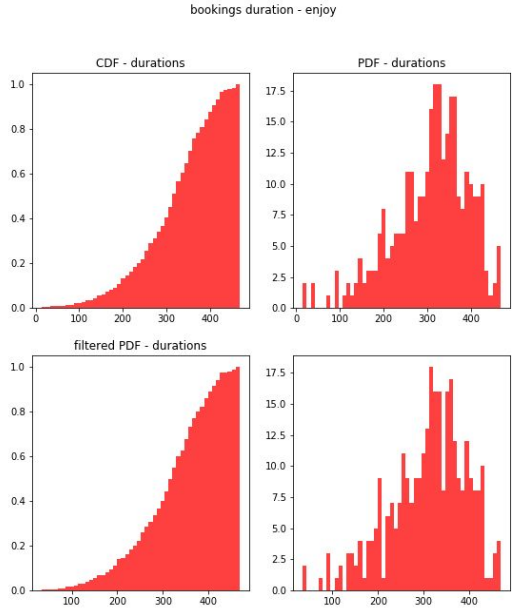
- The previous data come from a scraping error
- 

- In the Database proxy is added a constraint on the init and final address: a regex expression decide which entries to take and which not
  - (nn… city) where: nn first two digit of CAP, ‘…ì means each number from 0 to 9, and city the city passed as parameter
- Not scalable on other cities of both Enjoy and Car2go (not yet analyzed)
  - It is possible check also the coordinates of booking

Improvements II - Enjoy

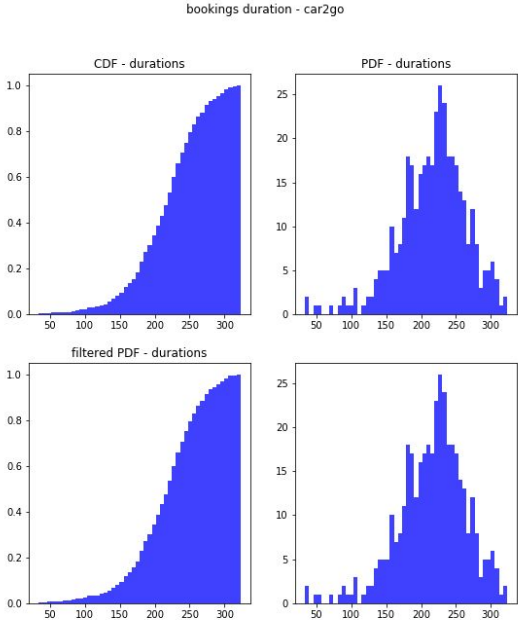
- In all the previous analysis the outliers are discarded
  - on the left, biased data, on the right unbiased

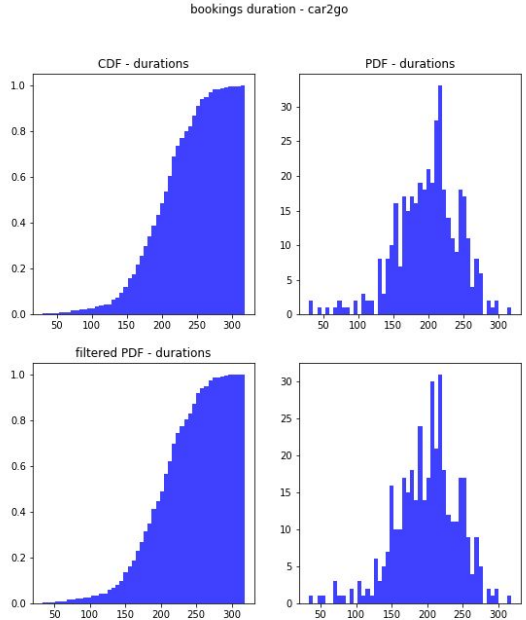




Improvements II - Car2go

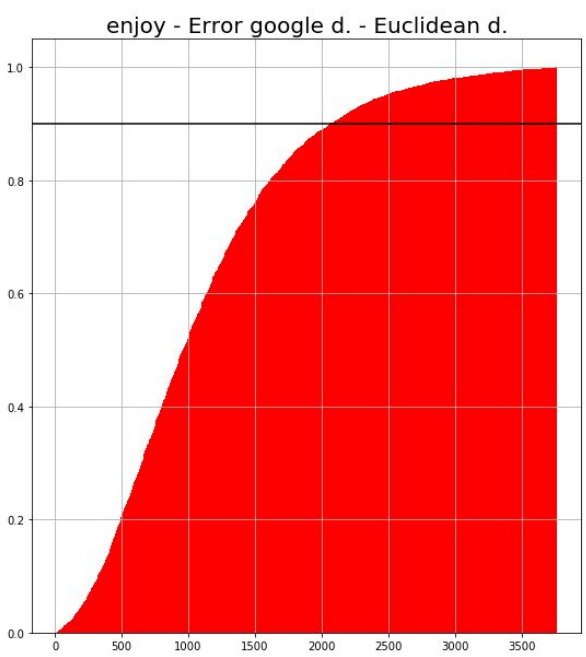
- The phenomenon has less influence on Car2go

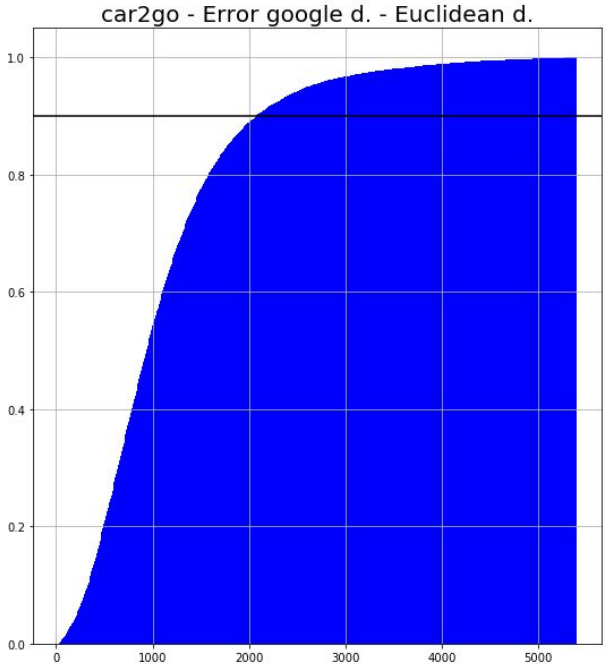




Google distances(g.d.) vs Euclidean distance (e.d.)

- Took all the cars with at least 20m of e.d. and a g.d. different from -1
  - Enjoy losses 36698 on a total of 50165 (73%): the scraper could have some problems
  - Cargo losses 11923 on a total of 46437 (25%)
- CDF of g.d. and e.d. in order to obtain a corrective factor to apply to e.d.



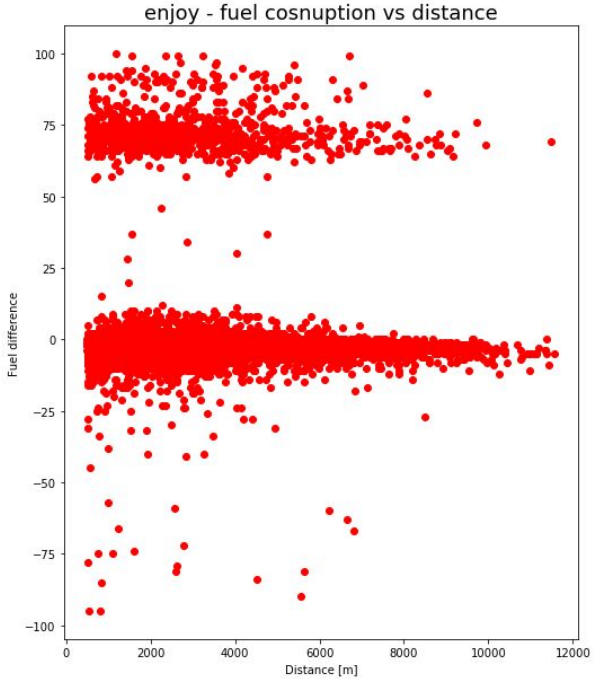


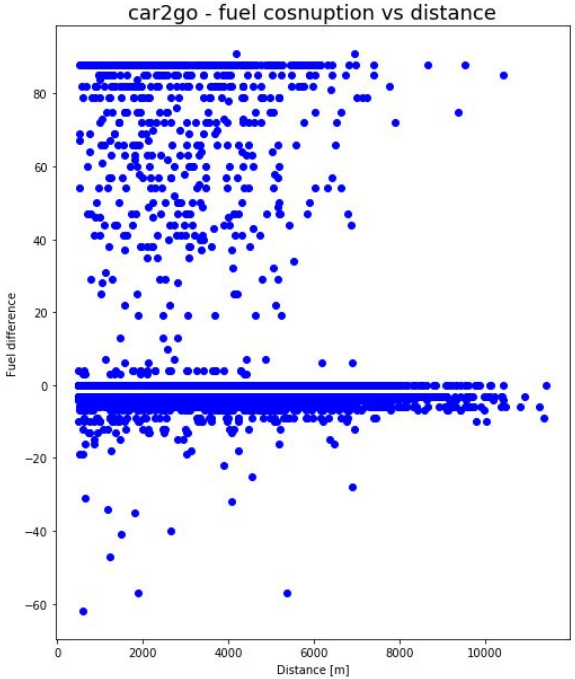
Google distances(g.d.) vs Euclidean distance(e.d.) II

- Google distances - Euclidean distances
  - Car2go:
    - mean: 1114 m, median: 941 m, 0.9-quantile: 2079 m
  - Enjoy
    - mean: 1098 m, median: 963 m, 0.9-quantile: 2071 m

Fuel consumption analysis

- On a clean dataset
- Y: fuel difference
- X: euclidean distance
- Distance > 500m
- Fuel difference
  - Refill >0
  - Cosuption <0





Parking time per zone

- Took parkings, and are counted how many parkings per zone
- Took parkings and summed all the duration per each zone
- Multiplied the sum of the zonal parking duration per the number of parking in the zone
  - Callec *factor*
- Factor divided per:
  - 60: obtaining the hour
  - Valid days: hour per zone per car
  - fleet : hour per zone per day per car

Parking time per zone