

## The Battle of Neighborhoods: Just Eat Belfast Bikes scheme

**Introduction.** Belfast is the capital and largest city of Northern Ireland (UK). Recently voted the best place to visit in 2018 by Lonely Planet, Belfast has been quietly evolving into one of the most exciting cities to explore in the United Kingdom. The modern style of the city, as well as the beautiful green areas and countryside, hills, rivers and parks make the city a very easy place to fall in love with. The city offers the Just Eat Belfast Bikes scheme providing a low cost, convenient and sustainable way to travel in the city. More specifically, there are 47 docking stations: in this project, we analyse the rentals and return statistics for six docking stations (Belfast City Hall, Waterfront, Queen's University Belfast/Botanic Gardens, St. Malachy's Church, Writer's Square, Odyssey) from 2015 to 2017. The purpose of the project is to understand how the different docking stations are used and if some of them are not offering a high amount of rentals.

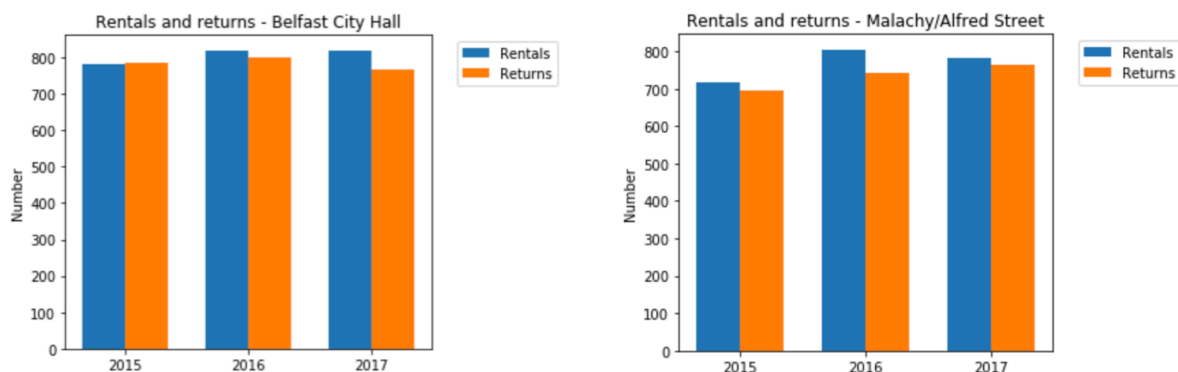
**Open Data.** The Belfast City Council website furnishes a bunch of .csv files which can be used for the purpose. Data downloaded have been carefully cleaned. In the project, we make use of the following:

- i) BelfastBikesRH\_APR15JUL17.csv which is a (985x13) dataset containing 'Place Name', 'Month', 'Year', 'Rentals' and 'Returns' for each docking station (from 2015 to 2017);
- ii) bikestations\_belfast.csv which is a (38x8) dataset containing 'Station Number', 'Location', 'BNG\_X', 'BNG\_Y', 'Latitude', 'Longitude', 'IG\_EASTING', 'IG\_NORTHING';
- iii) parksdata\_belfast.csv which is a (44x5) dataset containing 'Name', 'Address', 'Postcode', 'Latitude', and 'Longitude' of Belfast parks (which can stimulate bike activities and sharing).

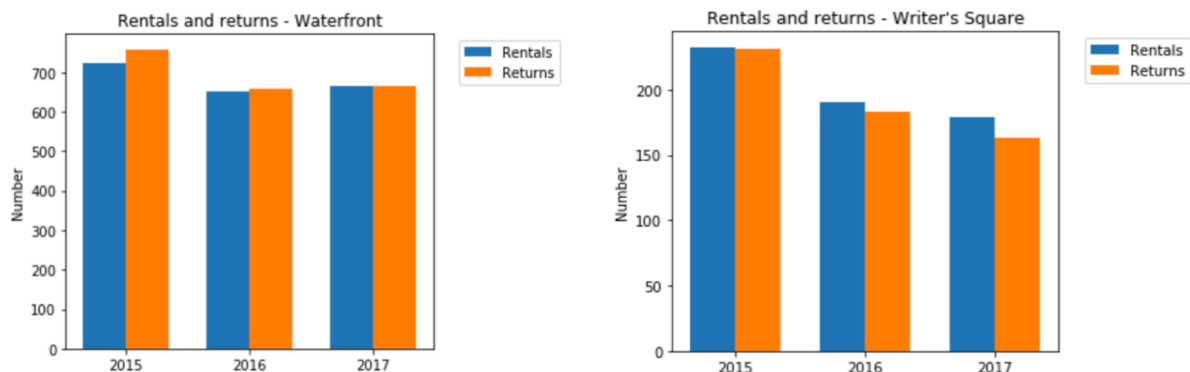
We will use i) to understand how the monthly average number of rentals/returns has changed from 2015 to 2017. Since no information on Latitude and Longitude is contained in BelfastBikesRH\_APR15JUL17.csv, we will make use of the ii) dataset to extract the coordinates of the docking stations. The iii) dataset is used to visualise the parks of the city in the Belfast map.

**Methodology.** Data has been used to evaluate the monthly average of rentals/returns for the analysed docking stations from 2017 to 2019. In the first step of the analysis, we have built some histograms showing the dispersion of rentals/returns average numbers for each station vs year (i.e. 2015, 2016, 2017). This step is crucial since it allows to extract informations on the 'usefulness' of a docking station with respect to another one: the more the rentals/returns, the more the station usage. This analysis can help in understanding if a docking station can be removed due to its 'inefficiency'. As a second point, we have built some histograms to compare the average number of rentals/returns in the whole analysed docking stations for each year. This step is important to understand what is the most used docking station, and if there is a clear growing trend for one of them. The data have been merged to link the geographical coordinates to each of the docking stations with the final aim to obtain a Belfast map with a purple spot (less used docking station), orange spot (more used docking station), red spots (the other analysed docking stations), and green spots (Belfast parks).

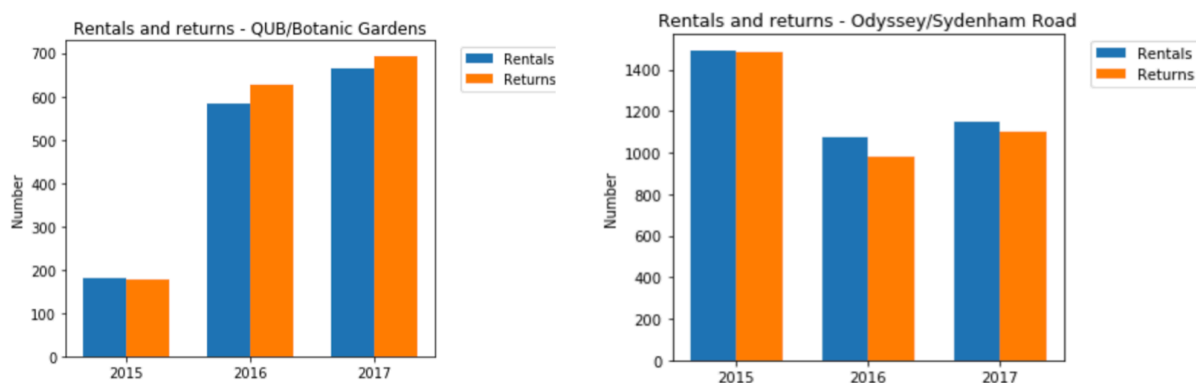
**Results.** In what follows, we show different sets of histograms representing the output of the data analysis.



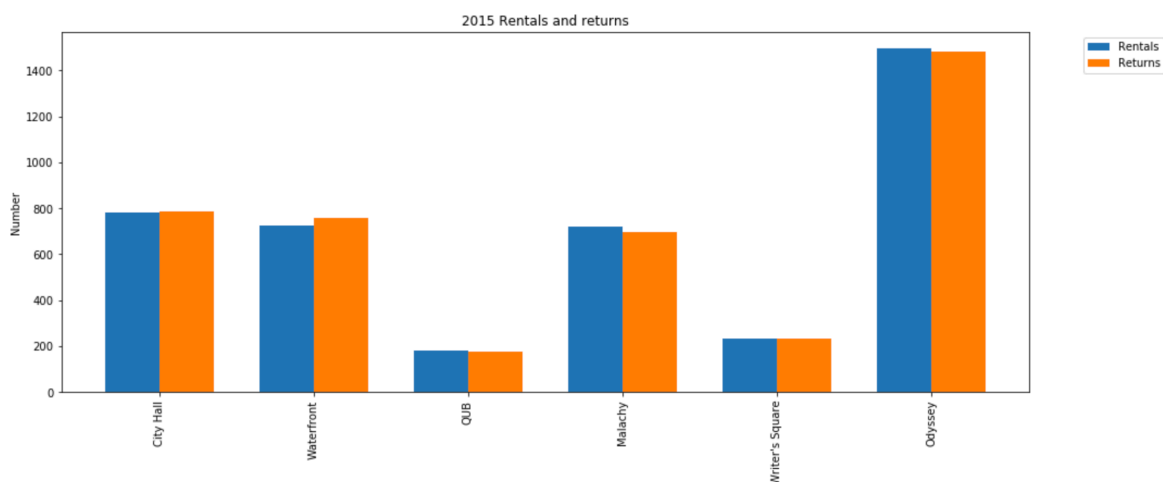
Plot 1 - Left panel: Rentals/returns for the 'Belfast City Hall' docking station, Right Panel: Rentals/returns for the 'Malachy's Church' docking station



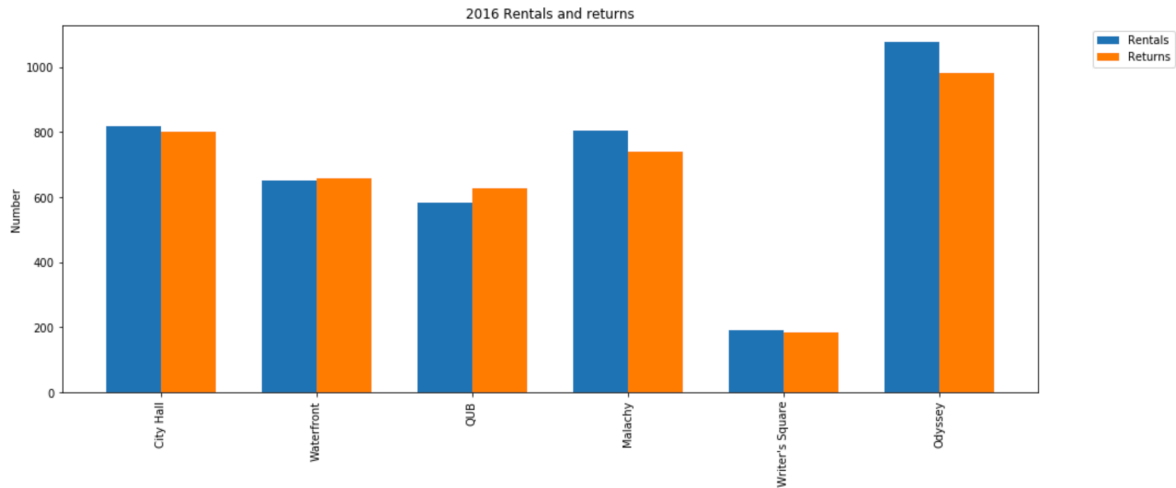
Plot 2 - Left panel: Rentals/returns for the 'Waterfront' docking station, Right Panel: Rentals/returns for the 'Writer's Square' docking station



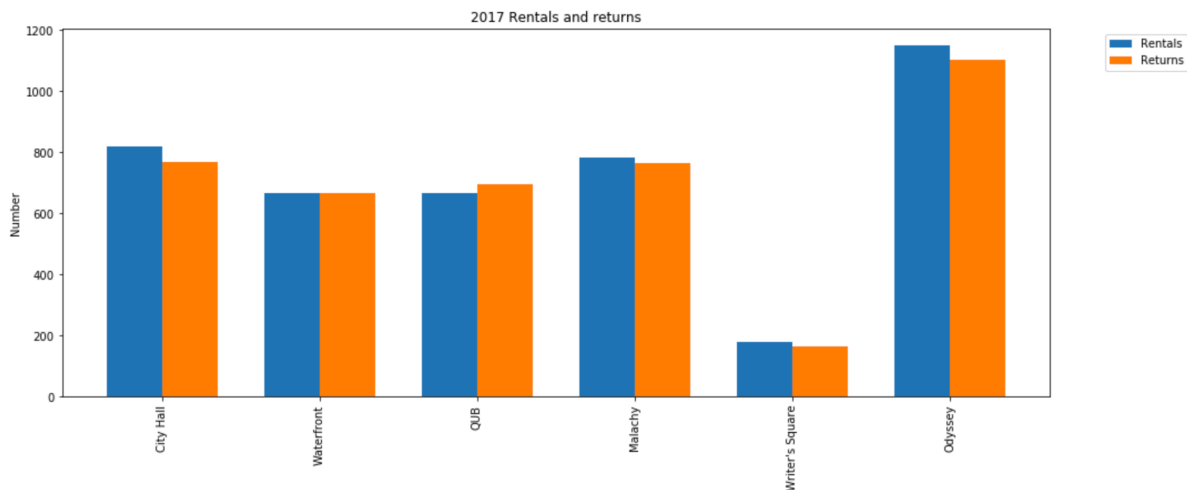
Plot 3 - Left panel: Rentals/returns for the 'Queen's University Belfast/Botanic Gardens' docking station, Right Panel: Rentals/returns for the 'Odyssey/Sydenham Road' docking station



Plot 4 - Rentals/returns in 2015 for the analysed docking stations



Plot 4 - Rentals/returns in 2016 for the analysed docking stations



Plot 5 - Rentals/returns in 2017 for the analysed docking stations

**Discussion.** The histograms showed in the 'Result' sections permit to extract useful informations for the 'Just Eat Belfast Bike' company. The first three plots helps in visualising how differently each docking station has been used from 2015 to 2017. For this analysis, we can conclude that i) the rentals/returns at the 'Belfast City Hall' docking station are more or less constant during the 3-year period analysed (the monthly average value is approximately 800); ii) a slightly increase of rentals/returns is observed in the 'Alfred Street' docking station; iii) the Waterfront point shows a faint decrease in 2016 and 2017 with respect to 2015; iv) the 'Writer's Square' has an ongoing reduction in rentals/returns while the 'Queen's University Belfast/Botanic Gardens' docking station seems to be more and more used (i.e. rentals/returns numbers increase from 2015 to 2017); v) the 'Odyssey' docking station in 2016 and 2017 has been less used than 2015. The other plots help In comparing the whole analysed docking stations for each year: the 'Queen's University Belfast/Botanic Gardens' docking station registered a very low number of rentals/returns in 2015 and users made more use of the 'Writer's Square' docking station. With the new year, the situation changed and such a trend has been confirmed in 2017: the 'Queen's University Belfast/Botanic Garden' docking station is preferred than the one in 'Writer's Square', which registers the lowest number of rentals/returns. The 'Odyssey' point, however, remains the mostly used one.

**Conclusions.** The project has analysed how the number of rentals/returns have been registered in some of the docking stations available in the Belfast city. Having more data, e.g. from 2015 to 2020, would help in thinking at machine learning techniques to predict the number of rentals/returns in time and think at more suitable positions in case of station inactivity. As a conclusion of the project, we show here a reduced Belfast map with some markers: i) the purple spot represents the 'Writer's Square' docking station position, ii) the orange spot represents the 'Odyssey' docking station position, iii) the red spots show the positions of the other docking stations which have been analysed, and iv) the green spots represents the coordinates of the Belfast parks. Being the 'Odyssey' docking station far from green spots, we can also conclude that the presence of parks do not have immediate consequences on the number of rentals/returns.

