Spatial influence in Basque Country's hotel prices

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BACKGROUND

Despite being a small territory, there is a huge variety of places people could visit at the Basque Country. Starting from Donostia's beaches, passing through Bilbo with the Guggenheim or the mythic San Mames and finishing with Gasteiz, the Green Capital. That is why we thought that it would be interesting to analyze if those differences are shown in the tourism and, thus, in those place's hotel's prices.

In order to achieve that, the data was collected from two main sources. The Basque Country's hotel's prices were collected thanks to a personalized web scraping technique developed by the Basque Statistics Office, Eustat. Moreover, complementary information was collected from the Directory of Tourist Establishments of Eustat. This complementary information varies from the category of the establishments to the specific coordinates, passing through the occupation or the size of the hotels.

OBJECTIVES

This project had 2 main objectives: to study the influence of the location in the hotel prices using spatial correlation indices and to develop an intuitive and accessible interactive chart which shows the prices and their evolution over the time.

OUTLIER DETECTION

As the prices were automatically taken from Booking with a web scraping technique, and, though some previous pre-process was done, some outliers were present in our data. Once an early study was done, some points were discovered which, despite they seemed to be outliers, they were not. Those prices were related to the different festivities or events of the different territories and cities.

Taking those points into account and before starting to find the real outliers, the data was scaled to remove the influence of their category and their location, making them comparable. With that objective, the series were transformed to show the price variation instead of the price, isolating the strange prices.

NA INPUTATION

The price of some establishments in some punctual days could not have been scraped either owing to a mistake in the scraping algorithm or because Booking did not allow booking a single night in those hotels in those days (sometimes it only allows booking more than one night).

The function na.seadec from the R package imputeTS was used in order to infer those lost values and the ones marked as outliers in the previous analysis.

SPATIAL CORRELATION ANALYSIS

Different correlation indexes were checked. In addition, the indexes were modified to take into account not only each hotel price but also the influence of the surrounding hotel prices. All studied indexes have the following structure:

\[ \Gamma = \sum_{i=1}^{n} \sum_{j=1}^{n} \gamma_{ij} \]

Here the element \( \gamma_{ij} \) reflect the spatial relation between the hotels \( i \) and \( j \) while the elements \( \gamma \) depends on the values of each hotel. In order to represent the spatial relation between the hotels \( i \) was decided to take \[ \gamma = \frac{1}{d} \]

\( d \)

is the distance between the hotels \( i \) and \( j \). The following indexes are the ones that had been tested:

Geary

\[ \gamma = \frac{1}{4 \rho_{i}} \sum_{j \neq i} \frac{(y_i - y_j)^2}{d_{ij}} - \frac{1}{\rho_{i}} \sum_{j = 1}^{n} \frac{(y_i - \bar{y})^2}{d_{ij}} \]

Lebart

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From all those indexes, the chosen one for the final testes has been the Geary correlation index.

REFERENCES


INTUITIVE CHART

In order to develop the interactive chart the software used has been R. This software, together with the integrated development environment Shiny and the packages leaflet and Shiny, has let us develop an intuitive interactive chart.

RESULTS

Analyzing the modified Geary's correlation index’s results, we noticed that despite in a general view it seemed that the Basque terrirories were very different; these dosimetrías were mainly caused by the high prices and price variety of Gipuzkoa’s establishments and, more specifically, Donostia’s establishments. Taking those hotels apart we saw that Bizkaia’s and Araba’s hotels were not so different in overall.

CONCLUSIONS

An interactive chart has been developed which allows following the Basque Country's hotel establishment's prices and watching the behavior of those. Moreover, thanks to the modified Geary's spatial index we noticed that the establishments of the Basque Country have a strong spatial relationship with the exception of the Gipuzcoa’s ones, more precisely, with de Donostia’s ones. This is a direct consequence of the high tourist influx that Donostia has.

A possible next step could be to make a continuous chart filling the empty places with estimated values via krigging for example. In addition, we could go a step further and make a model that infers the possible establishment number and prices on the towns without already existing hotels.