Sentiment Analysis of Reviews and Business-User Clustering on YelpDataset

Artificial Intelligence Project

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Overview

Introduction

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In this project we've worked with the **Yelp's academic datasets** available on their website. In particular we consider the following datasets:

- **Review** (5.89 GB)
- **Business** (145 MB)
- **User** (3.04 GB)

Datasets documentation source:
https://www.yelp.com/dataset/documentation/main

Goal

We have three different notebooks, each with a specific **goal**:

- Yelp review sentiment analysis
- Description-based business clustering
- Preferences-based user clustering that exploits the previously determined business' clusters

We developed in a **Colab environment** in order to exploit greater computational capabilities than a regular computer.
Nonetheless we had to work with smaller chunks of data due to RAM limits.

Models

Models

- Review Sentiment Analysis and performance evaluation
- Description-based Business Clustering model
- Preferences-based User Clustering model

Review sentiment analysis

Several models were built and evaluated in order to find the best one to **automatically classify reviews in positive and negative** ones based on the text' features.

Notebook link:
https://colab.research.google.com/drive/1BtYiHLLQ7iD5tB1KqXH5HnsXro9Le3Uj?usp=sharing

Approach

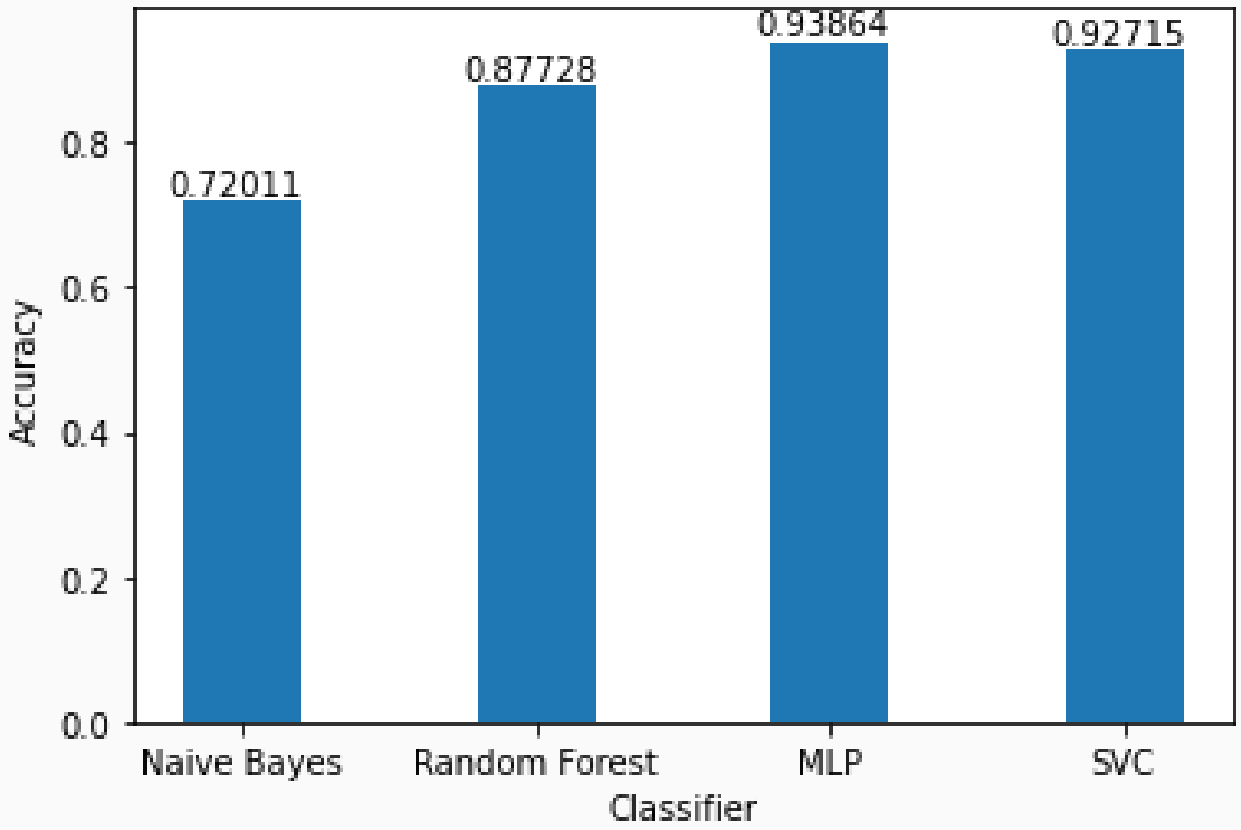
word2vec was used during the word-embedding phase.

Most famous classification models were used and evaluated:

- Naive Bayes
- Random Forest
- Multi-Layer Perceptron
- Support Vector Classifier

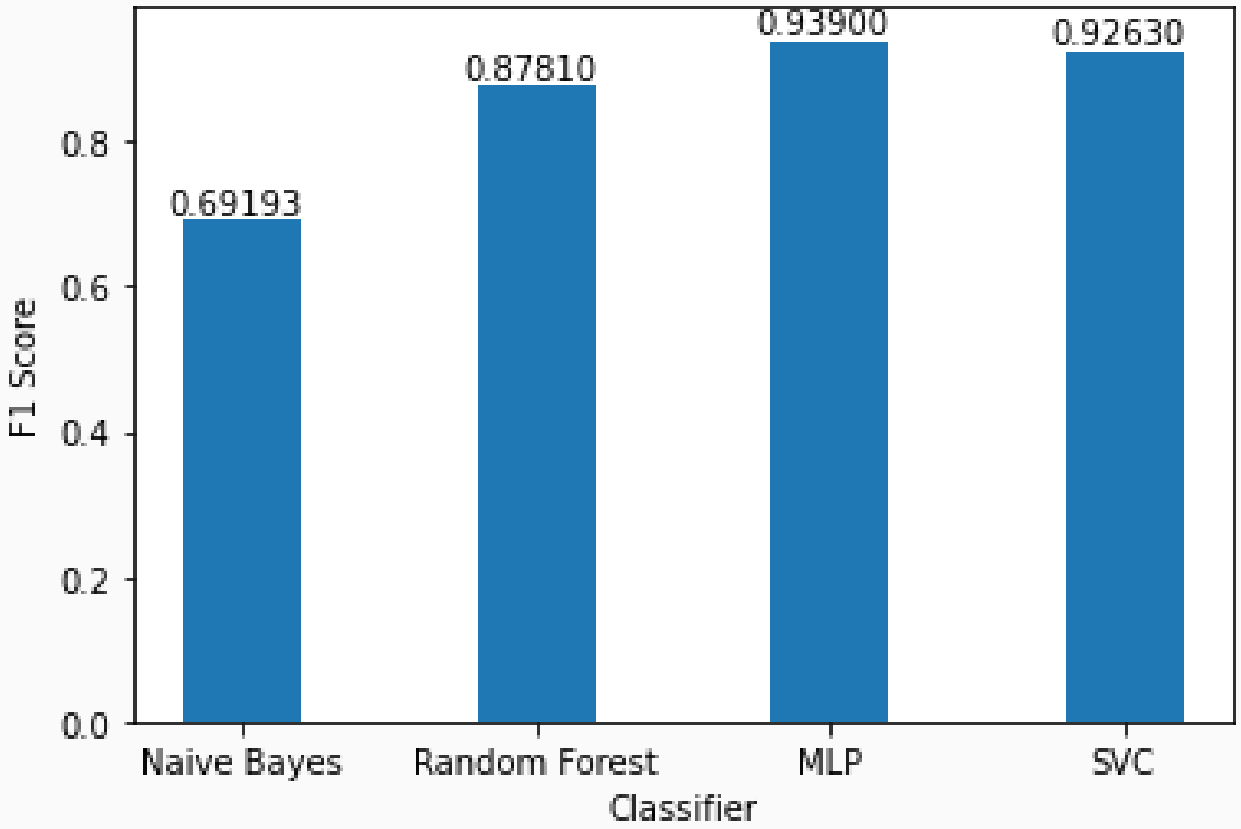
Evaluation 1/3

- Accuracy:



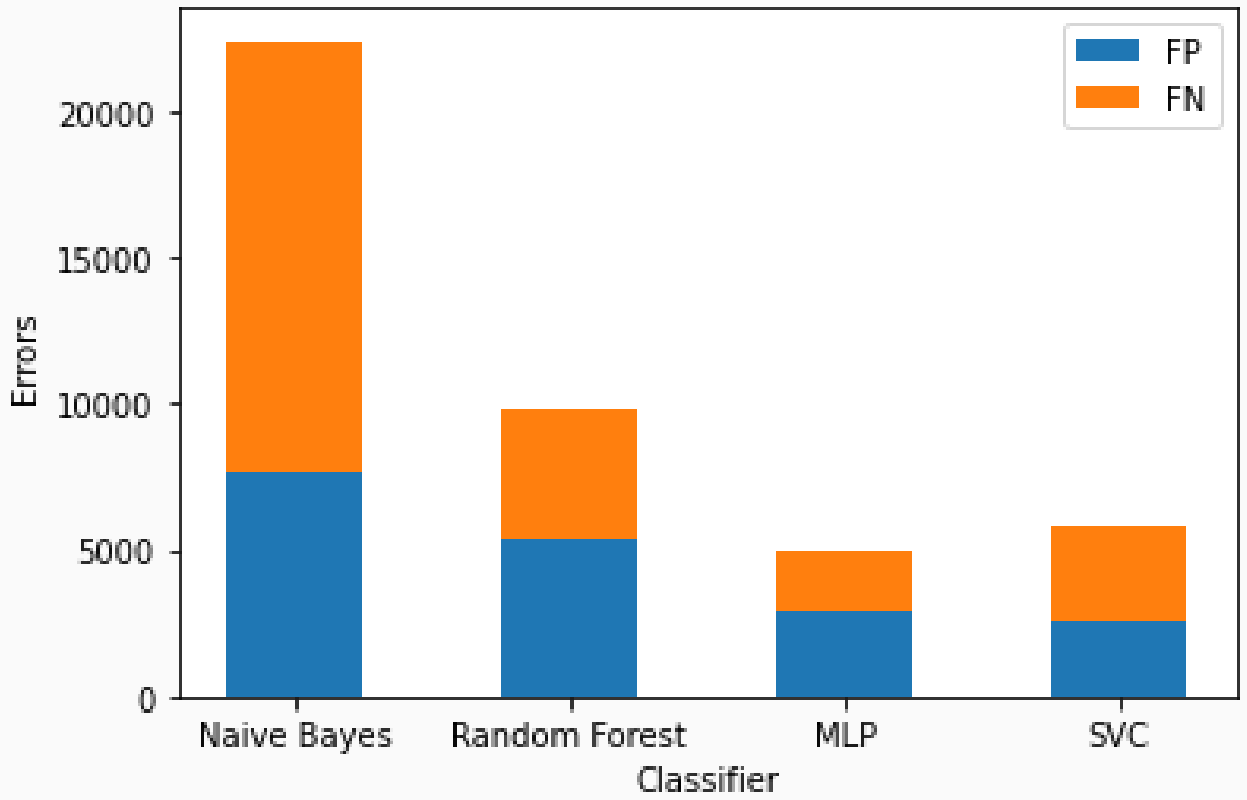
Evaluation 2/3

- F1 score:



Evaluation 3/3

- Errors:



Models

- Review Sentiment Analysis and performance evaluation
- Description-based Business Clustering model
- Preferences-based User Clustering model

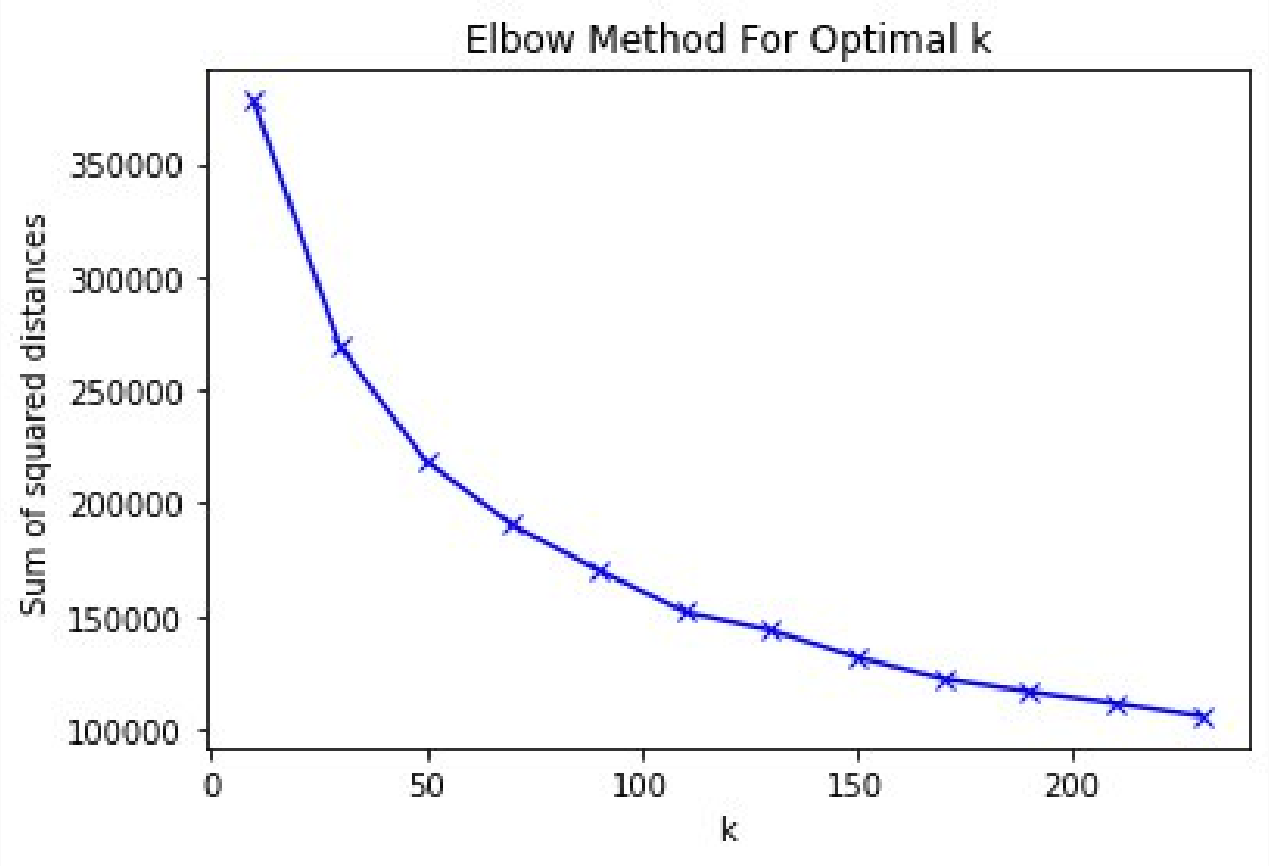
Description-based business clustering

In order to automatically group businesses according to their categories, **K-means clustering algorithm** was used.
A **city-based filter** is implemented and allows to filter clusters according to the chosen location.

Notebook link:
https://colab.research.google.com/drive/1rRFCmXHqfu337tBd7zBPmymyLStxDzJw?usp=sharing

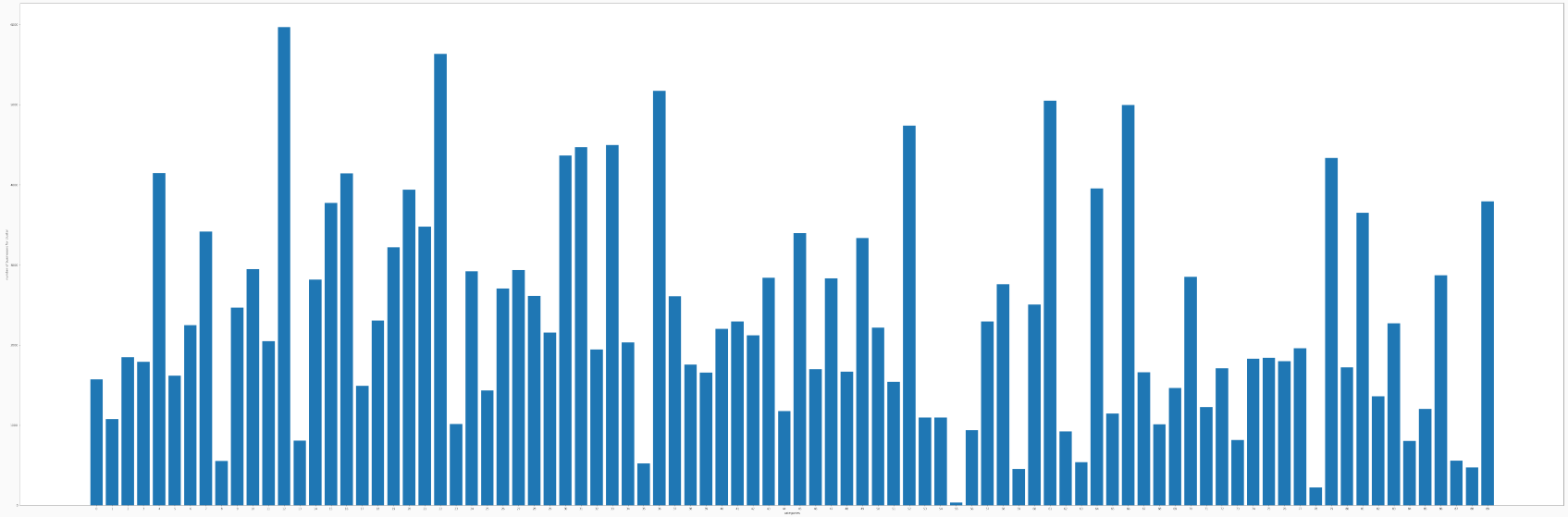
Elbow

- Elbow:


Elbow Method For Optimal k
Sum of squared distances
350000
300000
250000
200000
150000
100000
0
50
100
150
200
k

Distribution

- Businesses categories distribution:



x-axis: Clusters

y-axis: Businesses n.

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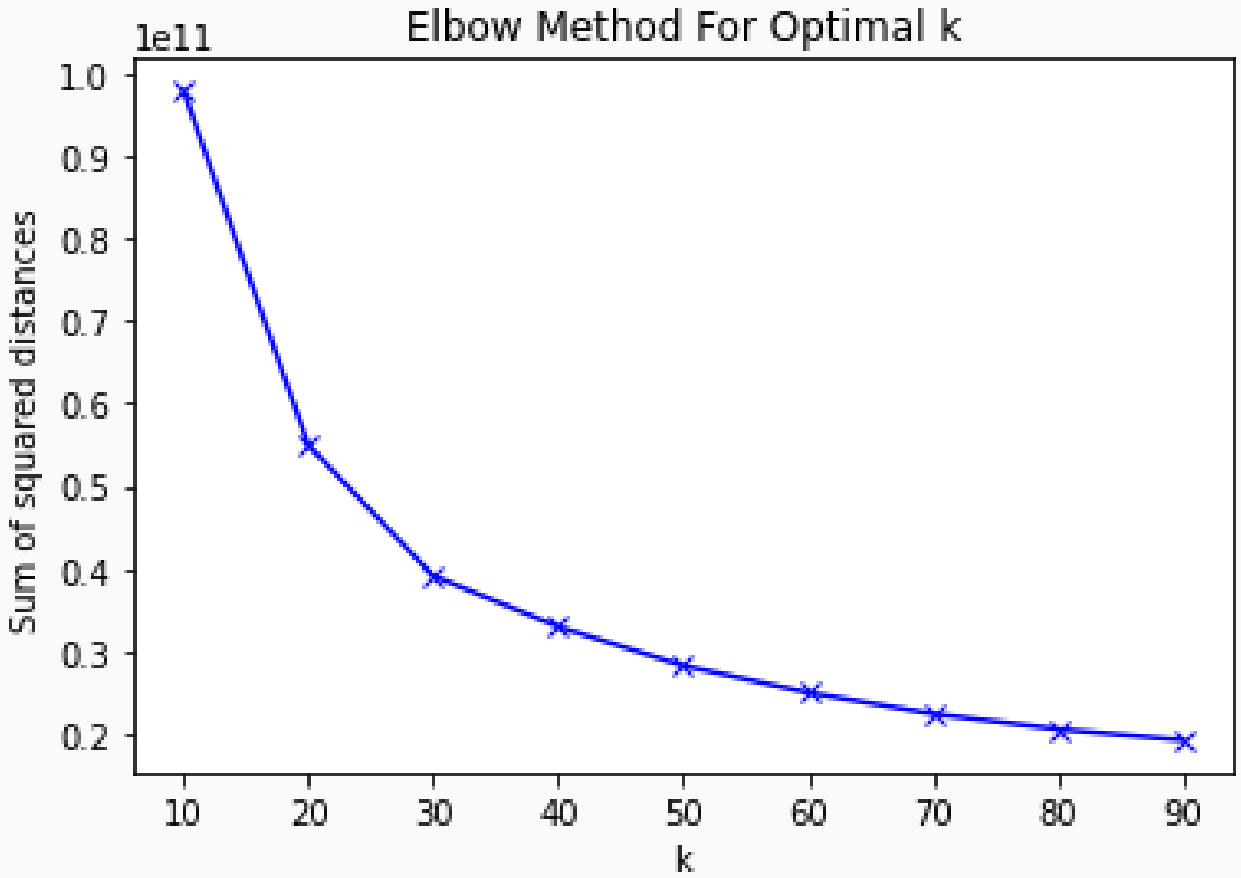
Preferences-based User Clustering

A further grouping was made on the user dataset.
Heavier pre-process operations were executed in order to define a new user dataset that includes for each user the **reviews' number** and **average stars** related to every business' cluster previously defined.
Afterwards a K-means algorithm was again performed to define users similarities according to their involvement in every business' group.

Notebook link:
https://colab.research.google.com/drive/1hNqLe7gWIb-3kH5axxNUGRlAeHjdPdQr?usp=sharing

Elbow

- Elbow:


Elbow Method For Optimal k
1e11
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
Sum of squared distances
10
20
30
40
50
60
70
80
90
k

Conclusion

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- The **accuracy and precision metrics** of the review sentiment analysis model are definetly satisfying;

- Grouping businesses according to their similar categories allows us to visualize their distribution in a specific location and may be fully **exploited in a spatial representation**;

- Joining multiple relevant datasets gave us an overall clear idea about the distribution of the users groups according to their **involvement** in different business categories.

Thanks for the attention!