International Cartographic Association
Association Cartographique Internationale

Modeling Salient Features as Directions for Place Recommender Systems

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Keywords: Place Recommendation, Textual Contents, Emotions, Salient Features.

Abstract:

With the increasing use of social media, knowledge bases that maintain information about places have become significantly important in different fields, including Geographic Information Science (GIS), geographic information retrieval (GIR), and sentiment analysis (Purves et al., 2019, Westerholt et al., 2018). Places are described by individuals through sharing their myriad experiences, narrated stories, and opinions on the web and social networks which provide a large, dynamic corpus of documents describing places (Ballator & Adams, 2015). People usually talk about places without well-known names or with only local significance, such as the museums, that are often identified by qualities (Winter, et al., 2021). A typical conversational context about places is location-aware services, which utilize recommender systems as their answering engine (Where can I go at this weekend?). Therefore, future methods need to refocus on the geographical concepts of place to shift from spatial towards place-based, sometimes called platial, information (Tuan, 1977; Goodchild & Li, 2011). Emotions play a significant role in recommending places for individuals who look for a joyful or fantastic place, and avoid from scary, sad, or even disgusting places. This paper aims to propose a novel method for place recommender systems based on user emotions expressed about places. There is an inherent trade-off between capturing similarity and modelling features as directions. To achieve this goal, we consider semantic spaces consisting of objects from some particular domain (e.g. TripAdvisor place reviews). Then, this semantic space could be used to suggest places in a recommender system. The proposed semantic space models salient features (e.g. how attractive a place is?) as directions. Finally, these directions are used to rank places according to corresponding features representing a salient feature. Our approach is fully unsupervised, requiring only a bag-of-words representation of the objects as input and contains three main steps. Figure 1 represents the general workflow of the proposed method.

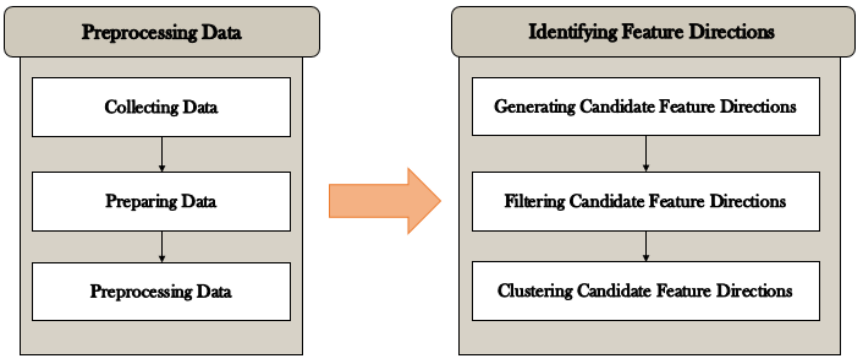

Figure 1. The general workflow of the proposed method.

In the first step of our work, we extracted tourism attractions of New York City (NYC) and their English reviews from TripAdvisor website. These data were collected on October 2020 by web scraping. To prepare these unstructured data, places without geographic coordinates, places out of the study area, duplicates or places whose type is unknown were removed. Then, for further analysis, these reviews should be pre-processed First, each review was converted to lower case and tokenized. Then punctuations and stop words were removed. Afterward, all tokens were stemmed and lemmatized. Finally, a bag-of-words was created.

In the next step, we are going to learn a semantic space from bag-of-words representations of the considered reviews, using a standard similarity-centric method. First, we will quantize the documents (reviews) by assigning an index vector (e.g. TF-IDF or PPMI) for the given word. The angles between the vectors are interpreted as their associated similarity. To construct the semantic space, TF-IDF values will be introduced to MDS technique. The output of the MDS would be the coordinates of the points in the semantic space. Each point in this space represents a review, where more similar points

https://doi.org/10.5194/ica-abs-5-54-2022

are located closer. Using the method from (Derrac and Schockaert, 2015), we will subsequently determine the most salient features in the considered domain, and their corresponding directions. We will classify the space by SVM into two classes: those points containing the given word in one class, and those lacking the word in another class. The result of the classification will put a hyper-plane in the space. The direction perpendicular to this hyper-plane is the direction towards the given attribute. After identifying meaningful directions, we are able to determine how much a review is leaning towards a desired attribute. For example, if we are going to find places that imply happiness for the users, we construct a semantic space in which some direction represents happiness.

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https://doi.org/10.5194/ica-abs-5-54-2022