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Capstone Title:
Spectral Clustering-based Approach for Delivery Job Matching

BSc (Hons) in Computing Science

Introduction and Problem Statements

In the logistics industry. delivery delays is often the most common challenge faced by Logistic Service Providers (LSPs) particularly during peak seasons, this is often due to shortages in delivery drivers and inefficiencies in delivery routings employed by LSPs.

To overcome these challenges, this research first proposes the concept of a Delivery Job Exchange (DJE) where LSPs are able to drop their less desirable jobs and take up jobs that are desirable to them from the DJE, that are dropped by other LSPs. Hence, the DJE will require two algorithm to work, an Inbound Job Recommender to recommend LSPs to drop outlier jobs, and an Outbound Job Recommender (OJR) to recommend LSPs to take up jobs suitable to them. This research focuses on the OJR algorithm.

Research Questions and Project Objectives

RESEARCH QUESTIONS

- How to efficiently and accurately LSPs with suitable delivery jobs from the DJE job pool?

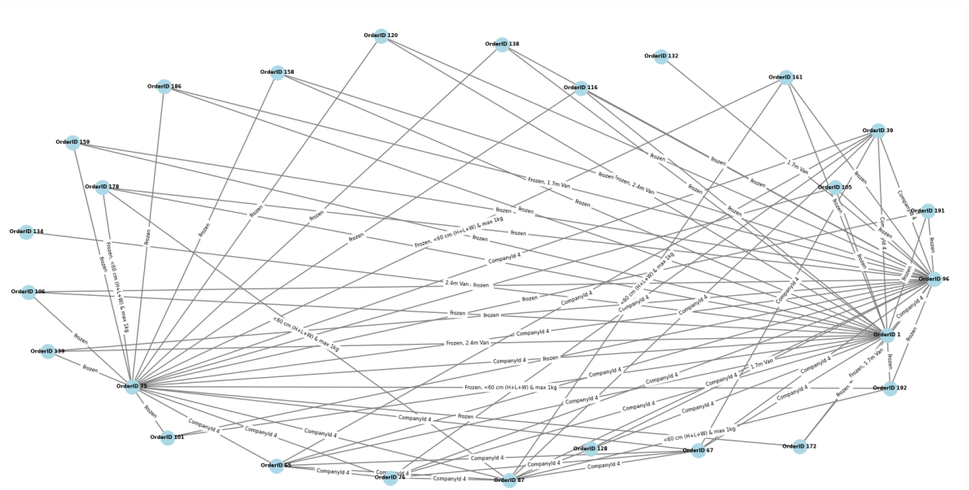
PROJECT OBJECTIVES

Develop an algorithm in the context of DJE, that fulfills the following requirements:

- Ensure LSPs retain their private job
- Able to handle multiple constraints and features
- Computationally efficient and scalable
- Prioritizes matching jobs based on similarity between the public jobs features and the LSP's private jobs features
- Does not require historical data

Methodology and Proposed Solutions

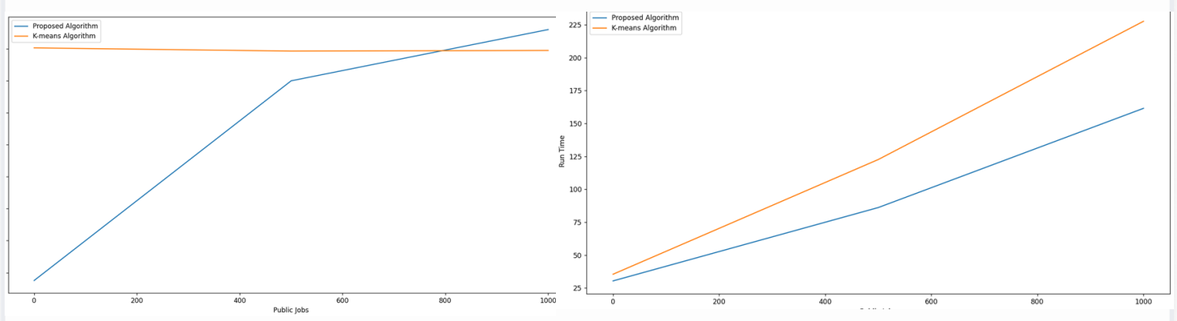
The methodology involves defining the assumptions and implementing the algorithm using a Spectral Clustering-based approach. Multiple adjacency matrices were constructed, with each matrix representing a specific feature considered in the algorithm. These adjacency matrices were then combined into a composite adjacency matrix by averaging them. The composite adjacency matrix was subsequently input into the Spectral Clustering algorithm, which produced the job assignment results for each LSP.



Experiments and Results Analysis

The results analysis involves comparing the OJR algorithm with K-means Clustering algorithm against metrics such as entropy to assess the quality of the clustering and run time to assess the performance and scalability.

The findings were OJR consistently outperforms K-means in terms of cluster quality and were also computationally more efficient and scalable, even when dealing with larger datasets.



Conclusion and Future Work

In conclusion, this research introduces the OJR algorithm, which aims to match LSP with suitable jobs from a shared job pool known as DJE. The algorithm demonstrates superior cluster quality compared to the traditional K-means algorithm, as evidenced by lower entropy values. Additionally, OJR exhibits faster runtime efficiency, providing a computationally efficient and scalable solution for the DJE context, even with larger datasets.

References and Acknowledgement

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