Enhancing E-commerce Recommendations with Multilingual Shopping Session

Team Member: Minwoo Sohn, Jiayu Shi

Executive Summary

The project aims to fill a significant gap in e-commerce personalization by addressing the challenge of session-based product recommendation in a multilingual and imbalanced dataset context. This initiative seeks to pioneer the development of advanced recommendation systems that are capable of understanding and predicting customer purchase intentions across different languages and market segments. This proposal outlines the dataset, the tasks for the project, and the expected outcomes.

Introduction

Modeling customer shopping intentions is a pivotal task for enhancing user experience and engagement in e-commerce platforms. The ability to accurately predict a customer's next purchase based on their current session data, especially in a multilingual context, represents a significant technological challenge and opportunity. Traditional session-based recommendation systems have shown promise but often fall short in real-world scenarios involving multiple languages and imbalanced datasets.

Objectives

The primary objective of this project is to encourage the development of recommendation systems that can effectively operate across different languages, enhancing personalization and understanding of global customer trends. Specifically, the project aims to:

- Develop methodologies that accurately predict the next product a customer is likely to engage with, considering multilingual session data.
- Possible application of transfer learning techniques to improve recommendation performance in underrepresented languages.

Methodology

- Our group will primarily utilize graph neural network techniques to address the tasks outlined.

Dataset Description

The "Multilingual Shopping Session Dataset" comprises millions of anonymized user sessions across six locales: English, German, Japanese, French, Italian, and Spanish. It includes detailed product attributes such as title, price, brand, and description, aiming to represent a diverse array of customer interactions. The dataset is split into training, test set to facilitate the development of robust recommendation systems across different language contexts.

Tasks Overview

Next Product Recommendation:
Our group will predict the next product engaged in sessions from English, German, and Japanese locales, aiming to optimize for Mean Reciprocal Rank (MRR).

Evaluation

The evaluation metric for our project, focusing on item recommendations for customers, is Mean Reciprocal Rank (MRR). MRR assesses the model's accuracy in ranking relevant items at the top of its recommendations. It is calculated by first determining the reciprocal rank, which is the inverse of the rank at which the first relevant recommendation appears. If no relevant recommendations are found, the reciprocal rank is set to zero. Then, we average these reciprocal ranks across all test sessions. Specifically, MRR is defined as:

$$\mathrm{MRR@}K = \frac{1}{N} \sum_{t \in T} \frac{1}{\mathrm{Rank}(t)}$$

where *Rank(t)* represents the position of the first relevant item within the top *K* ranked recommendations for session *t*, and *N* is the total number of sessions. A reciprocal rank of zero is assigned if the relevant item does not appear within the top *K* recommendations. MRR values span from 0 to 1, with 1 indicating the model's perfect ability to place the first relevant item at the top for every session, and 0 signifying that the model failed to identify any relevant recommendations. This metric efficiently captures our model's performance in providing top-tier recommendations to enhance customer experience.

Weekly timeline

Week 1 (Mar 25 - Mar 29): Project Start and Data Familiarization

- Brainstorming Sessions: Engage in discussions to explore approaches to the challenges presented by the dataset.
- Project Selection: Finalize the project's scope and specific tasks to tackle, ensuring alignment with the overall objectives.
- Understanding the Data: Deep dive into the "Multilingual Shopping Session Dataset" to grasp its structure, anomalies, and potential insights.
- Data Preparation: Begin data cleaning, wrangling, and exploratory data analysis (EDA) to identify patterns, trends, and any data quality issues.

Week 2 (April 1 - April 5): Establishing a Baseline

- Baseline Model Development: Implement a baseline model to establish initial performance benchmarks for the project. This model will serve as a comparison point for future improvements.
- Initial Evaluation: Assess the baseline model's performance using predefined metrics, highlighting areas for immediate enhancement.

Week 3 (April 8 - April 12): Optimization and Exploration

- Parameter Tuning: Refine the baseline model through extensive parameter optimization to improve accuracy and efficiency.
- Exploratory Modelling: Investigate various model architectures and methodologies that could lead to better performance, including transfer learning and deep learning techniques.

Week 4 (April 15 - April 19): Finalization and Preparation

- Model Finalization: Conclude the experimental phase by finalizing the model with the best performance.
- Presentation Preparation: Start preparing for the final presentation. This includes creating slides, visualizations, and any other necessary materials to effectively communicate the project's findings and methodology.

Week 5 (April 22 - April 25): Conclusion and Cleanup

- Code Cleanup: Clean the project code to ensure readability, efficiency, and reproducibility.

- Project Finalization: Wrap up the project by finalizing all documentation, including a comprehensive report and a detailed explanation of the methodology, findings, and conclusions.
- Presentation and Submission: Deliver the final presentation, showcasing the project's achievements, insights, and potential impact on e-commerce personalization.