



Conversational Recommendation System for Marketing Application using Deep Learning

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Abstract: In today's digitally-driven world, the demand for personalized and context-aware recommendations has never been greater. Traditional recommender systems have made significant strides in this direction, but they often lack the ability to tap into the richness of conversational data. "Conversational Recommender System for Marketing Application using Deep Learning," represents a novel approach to recommendation systems by integrating conversational insights into the recommendation process. The Conversational Recommender System integrates cutting-edge technologies such as deep learning, leveraging machine learning algorithms like Apriori for Association Rule Mining, Convolutional Neural Networks (CNN), Recurrent Neural Networks (RNN), and Long Short-Term Memory (LSTM). Furthermore, sophisticated voice recognition technologies, including Hidden Markov Models (HMMs) and Dynamic Time Warping (DTW) algorithms, play a crucial role in accurate speech-to-text conversion, ensuring robust performance in diverse environments. The methodology incorporates a fusion of content-based and collaborative recommendation approaches, enhancing them with deep learning techniques. By integrating voice recordings and transcriptions, the deep learning model not only interprets explicit user preferences but also captures the subtleties of conversational nuances. This innovative integration ensures a more personalized and context-aware recommendation experience, particularly in marketing applications.

IndexTerms - Deep Learning, Machine Learning, Artificial Intelligence, Natural Language Processing, API.

I. INTRODUCTION

1.1 Background

Recommendation systems are everywhere – from entertainment to healthcare, education, E-Commerce and so on. With the exponential rise of big data, new and advanced recommendation systems are bound to be developed. Technology has evolved to such a stage that merely the activity of the user and the similarity between the items may not be enough for appropriate and efficient recommendation. In the modern era of technology, people's conversations and subconscious behaviour would also factor in during the process of recommendation by an artificially intelligent system.

1.2 Motivation

Traditionally, the recommendations are made based on the activity of the user, computed using Machine Learning or Deep Learning models. It involves elements of text processing and analysis. Therefore, recommendations can also be done through voice capturing of the user, thereby increasing the marketing purpose, and putting a forward step in the recommendation systems currently present.

II. LITERATURE SURVEY

1. Machine Learning Based Recommender System for E-Commerce:

Authors: Manal Loukili, Faycal Messaoudi, Mohammad El Ghazi.

Year of Publication: 2023.

Summary: A practical implementation of a Machine Learning based Recommendation system using Association Rule Mining.

2. Recommender Systems in the Era of Large Language Models

Authors: Wenqi Fan, Zihuai Zhao, Jiatong Li, Yunqing Liu, Xiaowei Mei, Yiqi Wang, Zhen Wen.

Year of Publication: 2023.

Summary: This survey explores the integration of Large Language Models (LLMs) like ChatGPT and GPT-4 in recommender systems, focusing on pre-training, fine-tuning, and prompting techniques to enhance personalized recommendations.

3. Recommendation system using NLP techniques with machine and deep learning

Authors: Hoger K. Omar, Mondher Frikha, Alaa Khalil Jumaa

Year of Publication: 2023

Summary: This research paper presents a cloud-based recommendation system for processing big data, employing matrix factorization with three distinct approaches, including traditional Singular Value Decomposition (SVD), Apache Spark's Alternating Least Squares (ALS) algorithm, and deep learning with TensorFlow. The study successfully addresses the challenge of handling large-scale datasets, outperforming conventional techniques and achieving efficient recommendations for readers, with future work focused on further improvements and optimization techniques.

4. Emotional Speech Recognition Using Deep Neural Networks

Authors: Loan Trinh Van, Thuy Dao Thi Le, Thanh Le Xuan, Eric Castelli.

Year of Publication: 2022

Summary: A modern technique of voice recognition using Deep Learning algorithms and to collect required dataset.

5. Recommender Systems in E-Commerce

Authors: Lopamudra Mohanty, Laxmi Saraswat, Puneet Garg, Sonia Lamba.

Year of Publication: 2022

Summary: A brief explanation of different types of Recommender Systems used in E-Commerce applications, including Collaborative, Content-Based, Knowledge-Based and Community-Based, among other subtypes.

6. Voice Recognition using Deep Learning

Authors: Nur Farhana Hordri, Siti Sophiyati Yuhaniz, Siti Mariyam Shamsuddi.

Year of Publication: 2022

Summary: The paper provides a comprehensive overview of deep learning in Automatic Speech Recognition, Image Recognition, and Natural Language Processing, emphasizing its impact and research potential.

7. Issues and Solutions in Deep Learning Enabled Recommendation Systems within the E-Commerce Field

Authors: Rand Jawad Kadhim Almahmood and Adem Tekerek.

Year of Publication: 2022

Summary: The paper by Rand Jawad Kadhim Almahmood and Adem Tekerek delves into e-commerce recommendation system challenges and solutions, emphasizing deep learning techniques' importance and their contributions.

8. Machine learning and artificial intelligence use in marketing

Authors: Andrea De Mauro, Andrea Sestino, Andrea Bacconi.

Year of Publication: 2022

Summary: In "Machine learning and artificial intelligence use in marketing: a general taxonomy" (2022), De Mauro, Sestino, and Bacconi present a taxonomy of machine learning applications in marketing, emphasizing AI's transformative role.

9. A Novel Time-Aware Food Recommender System Based on Deep Learning and Graph Clustering

Authors: Mehrdad Rostami, Mourad Oussalah, Vahid Farrahi.

Year of Publication: 2022

Summary: Implements a dynamic, robust food recommender system using the method of graph clustering; that takes into account various complex parameters like user similarities, food similarities, ingredients and so forth, through the technique of deep learning.

10. A Deep Neural Network (DNN) Approach for Recommendation Systems

Authors: Shashi Shekhar, Anshy Singh & Avadhesh Kumar Gupta

Year of Publication: 2022

Summary: This research paper introduces a recommendation system model that combines deep learning technology with Collaborative Filtering (CF) algorithms to improve recommendation quality in the face of data sparsity and scalability challenges. By effectively addressing issues related to user behaviour and feature analysis, the proposed model demonstrates superior performance compared to traditional techniques, as evidenced by higher metrics such as F1-measure, Recall, and Precision in experimental evaluations using Amazon dataset.

11. A survey on Conversational Recommendation systems

Authors: Dietmar Jannach, Ahtsham Manzoor, Wanling Cai, Li Chen.

Year of Publication: 2021

Summary: A recommender system takes the dataset from any user search and recommends appropriate products. The dataset, when contains normal interactions and conversations, forms a conversational recommender system.

12. Similarity Measures for Collaborative Filtering-Based Recommender Systems: Review and experimental comparison

Author: Fethi Fkih.

Year of Publication: 2021

Summary: Explores the techniques of User-Based collaborative filtering and Item-Based Collaborative Filtering with various similarity measures; with each method's results and limitations.

13. Speech Recognition using Machine Learning

Authors: Vineet Vashisht, Aditya Pandey, Satya Yadhav.

Year of Publication: 2021

Summary: This research paper focuses on leveraging speech recognition technology to break down language barriers and enhance human-computer interactions. By implementing neural machine translation and speech synthesis, the study aims to enable efficient communication and control of devices through voice input, offering a potential solution for individuals facing language constraints.

14. Unsupervised feature enhancement for speaker verification

Authors: Phani Nidadavolu, Saurabh kataria, Paola Garia-Perena, Najim Dehak.

Year of Publication: 2020

Summary: To identify the speaker's age, gender and etc in an unstructured type of dataset.

15. Speech Recognition Using Deep Neural Networks: A Systematic Review

Authors: Ali Bou Nassif, Ismail Shahin, Imtihan Attali, Mohammad Azzeh, Khaled Shaalan.

Year of Publication: 2020

Summary: This research paper provides a comprehensive analysis of the use of deep learning in speech-related applications over the past decade, showcasing its remarkable advancements in speech recognition and other areas. By systematically reviewing 174 research papers published between 2006 and 2018, the study offers insights into the trends and emerging research topics in the field of deep neural networks for speech applications.

III. EXISTING METHODOLOGY

If one were to broadly classify existing recommendation system into two types [5], they would be:

- Content-Based [9]: In these systems, recommendation is made upon the user activity on the specific platform. The similarity is calculated by the association with the products themselves.
- Collaborative [7]: In these systems, recommendation is made based on the activities and ratings of the users like the main user.

Various machine learning and deep learning algorithms can be used to execute the recommendation process, including Apriori (Association Rule Mining), Convolutional Neural Networks (CNN), Recurrent Neural Networks (RNN), Long Short-Term Memory (LSTM) among other techniques [5].

The major purpose is to bridge the gap between traditional recommendation systems and the evolving landscape of conversational data. Leveraging advancements in deep learning, our methodology introduces a 'Conversational Recommender System' that seamlessly integrates user interactions and voice data into the recommendation process. The proposed system builds upon the foundation of content-based and collaborative recommendation approaches, augmenting them with the rich conversational insights obtained from user interactions within the application. By incorporating voice recordings and transcriptions, our deep learning model not only considers the user's explicit preferences but also captures the nuances of their conversational context. This integration aims to enhance the overall recommendation accuracy and relevance, offering a more personalized and context-aware experience for users interacting with marketing applications.

The existing methods of voice recognition systems incorporate a range of sophisticated technologies to enable accurate and robust speech-to-text conversion. These technologies include the utilization of Hidden Markov Models (HMMs) for analysing sound wave patterns [13], enabling the recognition of phonemes and words. Additionally, these systems leverage Dynamic Time Warping (DTW) algorithms, facilitating effective pattern matching between varying speed and time signals [15]. To address the challenge of noisy environments, voice recognition systems integrate Voice Activity Detectors, which employ techniques such as pitch detection, energy threshold analysis, periodicity measurement, and spectrum analysis to enhance the extraction of feature vectors during the speech recognition process.

Furthermore, advancements in computational capabilities have led to the incorporation of sophisticated neural networks that mimic the functioning of the human brain, enabling these systems to learn and recognize intricate speech patterns and nuances [6]. The comprehensive framework of these voice recognition systems encompasses a fusion of these technologies, enabling real-time and distributed speech recognition while addressing challenges such as diverse accents, varying speech speeds, and accurate punctuation recognition.

3.1 Research Gap Analysis

Existing research in the field of recommender systems points to the various types of algorithms and methods currently used. However, in the context of upcoming technologies, new types of recommender systems are prone to be deployed. One of those techniques, sparsely explored, is one of the conversational recommender systems. It essentially means that recommendations are generated through the medium of real-life conversations. To put simply, traditional content-based recommendation systems relied on the user activity on the application to generate the dataset for association functionality; however, in the new conversational recommender systems, even the regular conversations made by the user in day-to-day life will have tremendous impact in the quality of recommendations made by the application.

IV. FUTURE SCOPE

Voice recognition and Natural Language Processing, using the technology of Deep Learning would prove to be highly effective in the development of a conversational recommender system. Seamless integration and transmission of data between different applications and platforms based on the keywords computed by the recommender system model would serve as an apt structure for a model prototype.

V. CONCLUSION

Conversational Recommender Systems represent a step forward in the evolution of recommendation systems. This is due to the analysis of words and meanings behind the conversations of users and understanding their subconscious behaviour with regards to the consumption of specific products; in the case of an E-Commerce application. Deep Learning techniques would prove to be appropriate for the purposes of Voice Recognition, Natural Language Processing, and Recommendation System modelling. The prototype of the conversational recommender system would demonstrate an improvement in the precision and relevance of recommendations over previous systems.

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