

**Machine Learning for Recommender Systems: A Review of Recent Developments and Applications**

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<i>Article History</i>	<i>Abstract</i>
<p>Received: 28 November 2022 Revised: 30 January 2023 Accepted: 14 February 2023</p>	<p>Recommender systems are ubiquitous in today's world, enabling personalized and targeted recommendations across a wide range of applications such as e-commerce, social networks, and online content platforms. Machine learning (ML) techniques have played a critical role in the development of recommender systems, enabling the generation of accurate and effective recommendations by leveraging user data and behavior. In this paper, we provide a comprehensive review of recent developments and applications of ML for recommender systems. We first introduce the basic concepts of recommender systems and then survey the state-of-the-art ML techniques used in recommender systems, including collaborative filtering, content-based filtering, and hybrid approaches. We discuss recent advancements in ML for recommender systems, such as deep learning, matrix factorization, and graph-based approaches. We also provide an overview of the evaluation metrics used to assess the performance of recommender systems and highlight some open research challenges in this field. Finally, we present some promising applications of ML for recommender systems, including personalized health recommendations and intelligent transportation systems.</p> <p><b>Keywords:</b> machine learning, recommender systems, collaborative filtering, content-based filtering, hybrid approaches, deep learning, matrix factorization, graph-based approaches, evaluation metrics, personalized health recommendations, intelligent transportation systems.</p>
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## **1. Introduction:**

Recommender systems have become a ubiquitous tool in modern society, from e-commerce sites like Amazon to social media platforms like Facebook. These systems provide users with personalized recommendations, based on their past behavior and preferences. With the increasing amount of data available to users, there is a need for more advanced and accurate recommender systems. Machine learning (ML) has emerged as a promising tool for developing these systems, providing a way to analyze large datasets and generate more accurate recommendations. This paper provides a review of recent developments in ML for recommender systems, covering the basic concepts of recommender systems, the state-of-the-art ML techniques used, and the applications of these techniques in different fields.

Recommender systems are an essential component of modern online platforms and services, enabling personalized and targeted recommendations to users based on their past behavior and preferences. The use of machine learning (ML) techniques has significantly advanced the field of recommender systems, enabling the generation of accurate and effective recommendations by leveraging user data and behavior. In this paper, we provide a comprehensive review of recent developments and applications of ML for recommender systems.

## **2. Methods:**

A systematic literature review was conducted to identify recent studies on ML for recommender systems. The search was conducted on several databases including ACM, IEEE, and ScienceDirect. The studies included in this review were published between 2015 and 2021, and only studies that focused on ML techniques for recommender systems were considered. The studies were evaluated based on their contribution to the field, the rigor of their methodology, and their relevance to the topic.

We first introduce the basic concepts of recommender systems and the challenges associated with developing effective recommendation algorithms. We then survey the state-of-the-art ML techniques used in recommender systems, including collaborative filtering, content-based filtering, and hybrid approaches. We discuss recent advancements in ML for recommender systems, such as deep learning, matrix factorization, and graph-based approaches. We also provide an overview of the evaluation metrics used to assess the performance of recommender systems.

## **3. Results:**

The review found that collaborative filtering (CF) and content-based filtering (CBF) are the most commonly used ML techniques in recommender systems. Hybrid approaches that combine both techniques have also been widely used. Recently, deep learning techniques, such as neural networks and deep autoencoders, have been gaining attention for their ability to handle the large-scale, high-dimensional data typically encountered in recommender systems. Matrix factorization and graph-based approaches have also been explored as alternative methods for generating recommendations. Evaluation metrics, such as accuracy, coverage, and diversity, have been used to assess the performance of recommender systems.

#### **4. Conclusion:**

Machine learning has significantly improved the performance of recommender systems, providing more accurate and personalized recommendations to users. The review highlights the importance of selecting appropriate ML techniques based on the specific application and data available. Deep learning techniques have shown great potential in handling large and complex datasets, while matrix factorization and graph-based approaches offer alternative methods for generating recommendations. The review also identifies some open research challenges, such as the need for more explainable and interpretable models, and the development of personalized health recommendation systems and intelligent transportation systems.