

# Survey of Classical and Advanced Techniques for Product Recommendations

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**Abstract:** Extensive use of data and increasing sales by implementing recommender system by various retail and e-commerce companies through their website is tremendously boosted in current scenario. Recommendation systems is a software application that provide suggestions to the intended user regarding which products is buy and which is not to buy. This systems uses various filtering techniques to provide recommendations to the customers. Filtering techniques that helps in decision making of customers are most likely content-based filtering, CNN model filtering and hybrid filtering. In order to reduce information search time of user it is need to integrate the recommended facility in E-Commerce. Content-based filtering is used due to its suitability in the domain or in situations where the products are more than users. IDF Weighted word to vector model were used to determine whether a product is relevant or similar to a user's profile of interest. CNN model is used to find out image based similarities and both of this technologies integrated as a hybrid system and finally system give recommendation based on hybrid filtering system. This paper also gives an importance of an algorithm for providing recommendations or suggestions based on queries of users. Algorithms employ both IDF Weighted Word to vector model and CNN model. This review gives an overview of available data sets, methods for preprocessing data sets, recommendations techniques and challenges involved.

**Index Terms** - Recommendation system, CNN model, Content based filtering, Collaborative Filtering, Hybrid filtering, Word2Vec, TF-IDF

## INTRODUCTION

A timely product recommendation can lead customers to choose one product over another. E-Commerce companies offer different types of products through their websites. Therefore finding favorite objects from a huge collection of product available in website is one of the main problems facing the E-Commerce users while using websites. Company like Amazon estimated 35% of incremental revenue from product recommendation. Users need help to finding product according to their interests. The recommendation system provides a solution to this problem because E-Commerce users will receive recommendations based on their interest (user spend less time for searching product). The problem here is to develop or produce a software or system that users can use to locate quick items of interest in the E-Commerce, which contains a large collection of product [3].

A recommendation system is a system that analyses the user behavior to suggest product which they are likely to prefer. A recommendation system uses data analysis techniques to figure out the product that match the users' interest. The main purpose of any recommendation engine is to provide recommendations and reduce the search time of user using different recommendation algorithms. Recommendation engines can be used in cases like in entertainment, e-commerce, mobile apps, education etc. In general, a recommendation engine can use wherever there is a need to give personalized suggestions and advice to users. This paper gives a comprehensive review on techniques and or algorithms suitable for recommendations. Also provides importance of using hybrid algorithm for recommendations in future.

## RELATED WORK

In this section we briefly present some of the research literature related to the recommendation system, open challenges related to recommendation system, attacks on the recommender system and address different technologies used by the recommender systems. Recommendation systems are classified into two broad groups. Content-based systems, which examine properties of items recommended and Collaborative filtering systems, which recommend items based on similarity measures between item and users. Now Image based recommender system is also in trending. Prem Melville and Vikas Sindhvani explain Hybrid approach which combines both methods Collaborative and content based approaches. Due to its implementation on large scale researchers and even industry observed some open challenges related to recommendation system.

We have referred papers related to recommendation system. Content-Boosted Collaborative Filtering for Improved Recommendations by Prem Melville of Texas University [9]. In this paper, author presents an elegant and effective framework for combining content and collaboration. Our approach uses a content-based predictor to enhance existing user data, and then provides personalized suggestions through collaborative filtering. Author present experimental results that show how this approach, Content-Boosted Collaborative Filtering, performs better than a pure content-based predictor, pure collaborative filter, and a naive hybrid approach.

RSF: A Recommendation System for Farmers by Miftahul Jannat Mokarrama, Mohammad Shamsul Arefin Department of CSE, CUET, Bangladesh CUET, Bangladesh [8].

In this paper, Author present a recommendation system named as RSF for farmers, which can recommend farmers most suitable crops to produce in different areas. The system first detects a user's location and works with different agro-ecological and agro-climatic data in upazila level to calculate similarity between upazilas using person co relation similarity algorithm. Then it selects top-*n* similar upazilas. Finally, utilizing the seasonal information and crop production rates of each crop of the similar upazilas, it recommends top-*k* crops to a user of a upazila. The system has been evaluated with real data and we have found a reasonable and satisfactory accuracy. The system can help farmers in producing appropriate crops.

CrsRecs: A Personalized Course Recommendation System for College Students by Yiu-Kai Ng Computer Science Department, Brigham Young University Provo, Utah [10].

Using topic analysis, tag analysis, sentiment analysis, predicted course professor ratings, and survey data revealing student priorities with respect to classes (i.e., easy A, quality of the class, etc.), CrsRecs ranks potential courses in order of perceived preference for the student based on a hybrid technique combining the analysis results of a course. Empirical studies conducted to evaluate the performance of CrsRecs have revealed that CrsRecs not only suggests relevant courses to users by considering all the features of a course, but also outperforms existing state-of-the-art course recommendation approaches.

Image-based Product Recommendation System with Convolutional Neural Networks by Luyang Chen Stanford University 450 Serra Mall, Stanford, CA [2].

In this paper, they presented a smart search engine for online shopping. Basically it uses images as its input, and tries to understand the information about products from these images. System first use a neural network to classify the input image as one of the product categories. Then use another neural network to model the similarity score between pair images, which will be used for selecting the closest product in our e-item database. They used Jaccard similarity to calculate the similarity score for training data.

## TECHNIQUES & BACKGROUND

In this section, commonly used basic techniques and related concepts of recommender System and convolutional neural network technology described. Recommendation Techniques: Most E-Commerce companies uses recommendation systems which build relationship between users who may visitors or customers and Products consists of different kinds of items and helps in decision making process of users for appropriate selection. Traditional methods of recommendations includes content-based recommender systems, collaborative filtering recommender systems and hybrid recommender systems [1].

**Content-Based Filtering** – This is a common approach when designing recommender systems. Content-based filtering methods are based on a description of the item and a profile of the user's preferences. In a content-based recommender system, keywords are used to describe the items and a user profile is built to indicate the type of item this user likes. In other words, these algorithms try to recommend items that are similar to those that a user liked in the past. In particular, various candidate items are compared with items previously rated by the user and the best-matching items are recommended. This approach has its roots in information retrieval and information filtering research [9].

**Collaborative Filtering**- In this method products suggested to user based on like-minded users' recommendation. Main categories of Collaborative filtering are Memory-Based and Model-Based Filtering. In Model based approach similar users are find out on the basis of cosine similarity or Pearson correlation whereas in model based approach various machine learning techniques like matrix factorization, PCA, SVD etc. are used to find similar users rating [4] [5].

### Hybrid Filtering Technique-

Recent research has demonstrated that a hybrid approach, combining collaborative filtering and content-based filtering could be more effective in some of the cases [3].

**Classical and advanced technique discussion:** Review of various algorithms like bag of words (BOW), term frequency-inverse document frequency (TF-IDF), which are classical techniques for recommendation along with some recent techniques like word2vec, Image based recommendations gives idea to the customer for decision making process of customer [2]. In bag of words technique set of unique words are created if titles of product is to be consider. Main advantage of bag of words technique is discard sequence of information of text. This is powerful technique where count of number of unique words present in title are considered for recommendation. Euclidean distance is one of the measure to find similar or closest item for recommendation. TF is term's frequency and IDF is its inverse document frequency. For each word its TF and IDF score is calculated. On title of product TF-IDF algorithm will generate n-dimensional vector of unique words with data corpus and Euclidean distance is used to calculate similar words used for recommendations. Also word2vec technique semantic similarity of word is checked whereas in image based recommendations where visual based product similarity is used based on Euclidean distance.

### Product Recommendation

Figure 1 depicts architecture of recommendation system based on combination of classical and advanced techniques. The proposed system generate a recommendations of product using product description and image processing technique to generate recommendations. Dataset proposed for this is amazon product dataset. The system is using only static data. Our goal is to provide most effective recommendations. For this we are review effective algorithms like word2vec and convolutional neural network to generate recommendations of product.

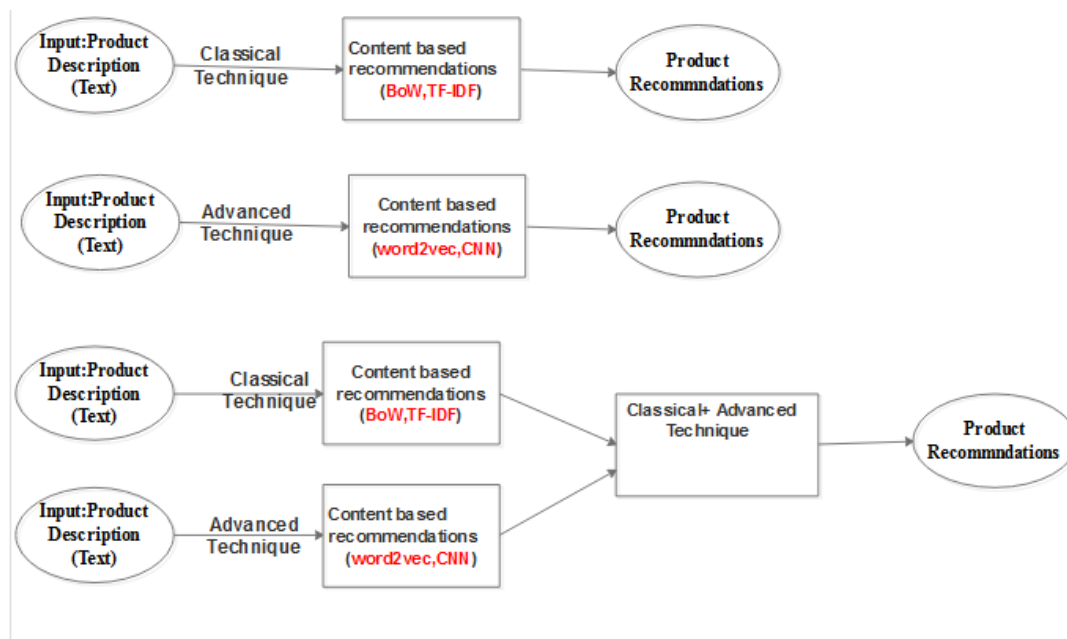


Fig 1. Techniques for product recommendation system

The system is using only static data. Our goal is to provide most effective recommendations. For this we are review effective algorithms like word2vec and convolutional neural network to generate recommendations of product. After training, word2vec models can be used to map each word to a vector of typically several hundred elements, which represent that word’s relation to other words.

Convolutional Neural Network is a type of deep neural network that is used to analyze images. Results shows effective and most similar recommendations. CNNs use relatively little pre-processing compared to other image classification algorithms. Convolution is one of the main building blocks of a CNN In the case of a CNN, the convolution is performed on the input data with the use of a filter to produce a feature map [11].

Using only one technique that is content based technique or image processing technique does not give good recommendations. So we have combined this two techniques to get best possible recommendations for intended user.

Actual product recommender system is shown in figure2

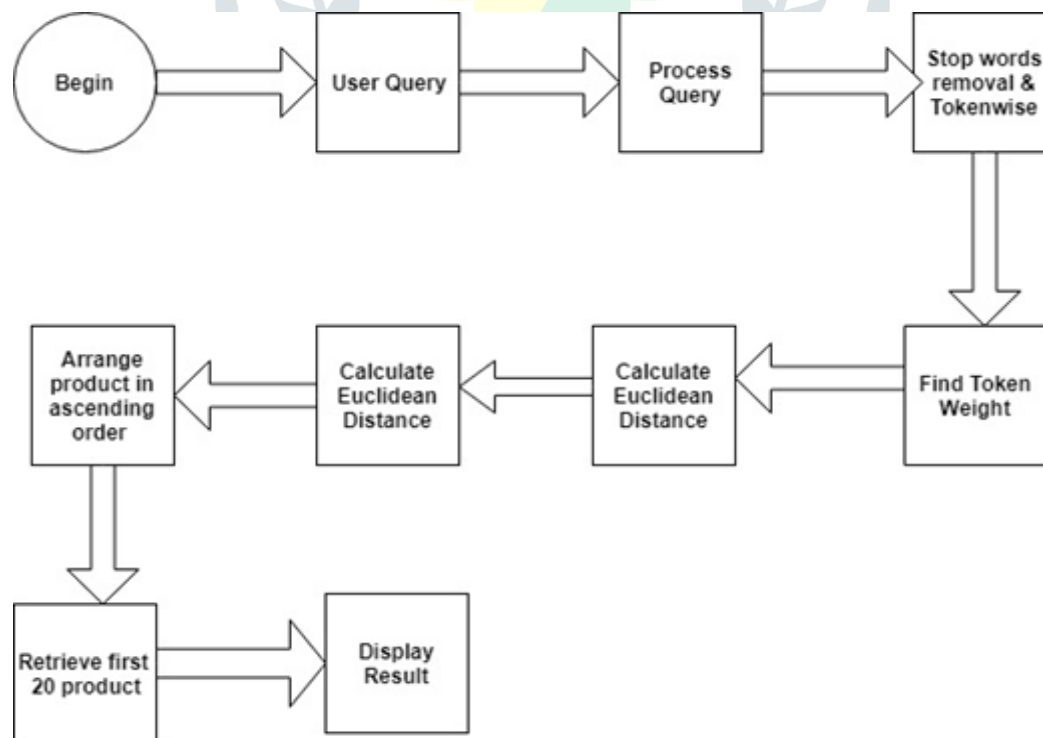


Fig.2 Schematic of Product Recommender System

## CONCLUSION AND FEATURE WORK

For most of E-commerce companies uses recommender systems as a powerful technology to attract people to buy product and increase their sales. These system helps to customer in their decision making process to choose product they like and save their time from doing all processes manually. Conversely, they help the business by generating more sales. Recommender systems are rapidly becoming a crucial tool in E-commerce on the Web. Huge amount of data in exist in companies database and it is added incrementally which creates information overload. In this research paper we have presented the Word2Vec filtering technique and image based filtering using Convolutional Neural Network. Reviewed algorithm will produce high-quality recommendations for user based on product description and product image from large volume of database. So user can easily find out what exactly he want from billion number of products. In future we can combine more than two algorithm and check good variety of product recommendations to the customer.

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