A Particle Swarm Optimization based Hybrid Recommendation System

Rabi Narayan Behera, Department of Computer Science, North Orissa University, Baripada, Orissa, India
Sujata Dash, North Orissa University, Baripada, India

ABSTRACT

Due to rapid digital explosion user shows interest towards finding suggestions regarding a particular topic before taking any decision. Nowadays, a movie recommendation system is an upcoming area which suggests movies based on user profile. Many researchers working on supervised or semi-supervised ensemble based machine learning approach for matching more appropriate profiles and suggest related movies. In this paper a hybrid recommendation system is proposed which includes both collaborative and content based filtering to design a profile matching algorithm. A nature inspired Particle Swarm Optimization technique is applied to fine tune the profile matching algorithm by assigning to multiple agents or particle with some initial random guess. The accuracy of the model will be judged comparing with Genetic algorithm.

KEYWORDS

Collaborative Filtering, Content Filtering, Genetic Algorithm, Machine Learning, Particle Swarm Optimization, Profile Matching Algorithm, Recommendation System, Sentiment Analysis

1. INTRODUCTION

The World Wide Web is continuing to grow at an exponential rate and the complexity of the numerous websites is also growing with it. It becomes extremely difficult for the web users to find the right kind of information they are looking for. Value for the customer was one of the main reasons that led to the design of recommender system (RS) to enable customers to find things that are interesting, helped to narrow down the set of choices from space of available options. RS also helped providers in many ways like additional and probably unique personalized service for the customer, increase of trust and customer loyalty, increase of sales, clicking of trough rates, creating opportunities for promotion and persuasion, obtaining more knowledge about customers, etc.

RS are software agents that elicit the interests and preferences of individual consumers and make recommendations accordingly. They have the potential to support and improve the quality of the decisions consumers make while searching for and selecting products online (Xiao & Benbasat, 2007). RSs help to match users with items and eases the problem of information overload and also provides sales assistance like guidance, advisory, persuasion, etc. Different systems are designed based on the data available for exploitation, feedback given by implicit and explicit data, domain characteristics, etc.

RS is seen as a function in which input is given in the form of user model (like ratings, preferences, demographics, situational context) or items (with or without description of item characteristics) to find the relevant score or is used for ranking. Finally, it recommends items that are assumed to be
relevant but the relevance might be context-dependent or the characteristics of the list itself might be important (diversity).

The two basic approaches for recommender systems are: collaborative filtering or content-based filtering (CBF). Other approaches (such as hybrid approaches) also exist. Collaborative filtering provides recommendation that is based on a model of prior user behaviour. The model can be constructed solely from a single user’s behaviour or from behaviour of users having similar characteristics. When other users’ behavior is taken into account, group knowledge is used by CF to form a recommendation based on like users. In essence, recommendations are based on an automatic collaboration of multiple users and filtered on those who exhibit similar preferences or behaviors. Content-based filtering designs a recommendation on the basis of the behavior of a user. For example, this approach might use history about a user’s likes and dislikes, and also about his different purchasing habits. CBF uses such data for the purpose of recommendation. Hybrid approaches that combine collaborative and content-based filtering are also making RS more efficient. Combining the results of collaborative and content-based filtering gives more accurate recommendation results.

A good recommendation system have certain measures in practice like keeping in mind total sales number, promotion of certain items, click-through rates, interactivity on platform, customer return rates, customer loyalty and satisfaction. A RS minimizes searching cost, provides the correct proposals with the assumption that the customers know in advance what they require and a good RS also identifies products from the “long tail” about which the users were completely unaware (Jannach & Friedrich, 2013).

In this work, a movie recommendation system is designed which uses movie reviews and other personal information about users to form profiles for the purpose of recommendation. The reviews are used to generate profiles which are grouped into clusters which consist of similar kind of profiles that share some common characteristics like age, gender, occupation etc. A new labeled dataset is prepared using user profile along with their cluster name as class value. Some portion of the dataset will be considered as training and rest for validating the model. A simple naive Bayes classifier is used to learn from the training data and predict the class value for an active user based on the users’ similarities.

The accuracy can be measured through some statistical measures like Recall, Precision, F-Score etc.

A nature based algorithm, called the Particle Swarm Optimization, is used to optimize the profile matching algorithm between selected profiles. In 1995, Eberhart and Kennedy invented the PSO technique which is based on the convergence nature of a flock of birds (Herlocker, Konstan, & Riedl, 2000).

2. RELATED WORK

Over the years a number of works on recommendation have been done and the research over recommendation is still going on. Some of the works which have given fruitful results and are related to our work are as under:

Supiya and Bentlley (2002) use a evolutionary search to fine tune a profile matching algorithm which employs a Genetic Algorithm within a RS by considering the preference of individual users. They have improved their work by employing PSO algorithm (Ujjin & Bentley, 2003) to optimize profile matching algorithm and the results are compared to those obtained from GA (Ujjin & Bentley, 2002).

Cayzer and Aickelin in their work has been designed a movie recommendation system to find close matches and not the perfect match and uses the concept of biological immune system where the user preferences are used as antibodies and the active user as antigen. Their paper presents an Artificial Immune System that has tried to use the highly adaptive, distributive and other characteristics of the highly complicated human immune system for the purpose of film recommendation by Collaborative
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