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Product Recommendation using Multiple Filtering Mechanisms on Apache Spark

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Abstract— Recommendation system is used by enormous users. Recommendations based on rating prediction provides useful recommendations for products, ratings are predicted using various methods. It is used commonly in recent years, and is used in variable areas in many popular applications which comprise of movies, songs, bulletin, files, research courses, online shopping, social networking sites, and product recommendation. Gradually, the amount of users, objects and facts has matured rapidly, the big data scrutiny problem for examination of recommender systems. Conventional recommender systems frequently suffer from scalability, efficiency and real time recommendation problems while processing or analyzing documents taking place at huge scale. To get rid from these problems, recommendation algorithms such as SVD, Trust SVD, and Incremental SVD are implemented on Apache Hadoop and Spark for evaluating most efficient recommendation. Analysis proves which prediction algorithm works more efficient than other algorithms. Proposed framework will provide real time and multiple recommendations to multiple users simultaneously.

Keywords— Bigdata, Collaborative, Hadoop, Incremental SVD, MapReduce, Product, Recommendations, Spark, SVD, Trust SVD.

I. INTRODUCTION

Merchandise database are frequently becoming larger, making it progressively difficult for impartial systems to practice produces data. The outsized spread of data is accessible on the network in the custom of ratings, ranks, appraisals, ideas, complain, explanations, response, and observations about any product which can be any product, event, distinct and services which be capable to use for making accurate conclusion [1, 2, 3]. Moreover lots of blog forums exist on the web where web users can give their judgment, examinations, and comments about the items. The recommendation created on the rankings and summary of appropriate text about the items can be used for decision making. The growth of e-commerce sites and online dealings are improving the requirements of a stout recommendation system. Now a day the many of users buy products from online shopping website. Approaches of praising innovative things take their boundaries, particularly for information discovery [4,5,6]. Recommender systems have news, books, research objects, search enquiries, social codes, and products. These systems are advantageous substitute to search algorithms as they benefit users to determine stuffs they might not have set up by themselves.

Traditional recommender system can be divided into following categories: the content-based filtering, the collaborative filtering and hybrid recommender system [7].

A. Content-based Filtering

This filtering method is centered on the item and profile of user's fondness. In the content-based filtering, keywords are used to define the items and a user summary is erected to designate the type of item the user likes. The content based recommender technique is made, using the buyers profiles based on their pre-experienced item features and the consistency with other items. With the usage of the customer's summaries, it can emulate the outcomes of the recommendation or customers histories of purchases with ease [8, 9]. There are numerous limitations in the content-based filtering. In this filtering, the attributes of recommending goods must be textual and it cannot recommend multi-media files [10,11].

B. Collaborative Filtering

This filtering method is based on assembling and scrutinizing immense quantity of records on user's preferences, activities the recommender system. It predicts based on what user will like built on the resemblance among other users. The collaborative filtering can be said that the most widespread item is recommended for every customer. It is recognized as the most commercially successful recommender technique [12,13]. This method is founded on the postulation that the user who like an item in past will also the like the same or similar type of item in the future. Collaborative filtering repetition can be separated into the user-based technique using the relations among customers and the item-based procedure using the associations between goods [14,15]. Examples of this filtering are Facebook and LinkedIn recommendations.

C. Hybrid Filtering

This filtering is the grouping of content based and collaborative filtering approach. Hybrid approach was presented to handle with a difficultly of traditional recommendation systems [16, 17]. Some primary issues that are declared by investigators in this field are cold-start problem and stability versus plasticity problem. Cold-start problem happens once learning based method like collaborative, content- based, and demographic recommendation algorithms are used. Netflix is the example of hybrid recommendation system [18].

Rest of the paper is ordered as follows. Review of literature is explained in section II. Section III contains system overview, section IV contains problem formulation, section V contains experimental analysis and Conclusion is given in section VI.

II. REVIEW OF LITERATURE

Guibing Guo, Jie Zhang, and Neil Yorke-Smith proposed a novel recommendation model regularized with user trust and item ratings it proposes TrustSVD, a trust-based matrix factorization technique for recommendations. Trust SVD assimilates several evidence sources into the recommendation prototype in order to diminish the data sparsity and cold start problems and their degradation of recommendation performance. A study of social trust data from four real-world data sets recommends that not only the obvious but also the contained influence of both ratings and trust should be taken into deliberation in a recommendation model [1].

Gejianxin and Liu jiaomin proposed the recommender system for software test cases founded on collaborative filtering the paper contains value and software test case design. At the identical time it analyses the compensations and difficulties of various algorithms in changed computational complexity and under the situation of the act and suggests a combination organization filtering algorithm and software test instance recommendation system basic frame, it presents the difficulties need to be upgraded and resolved in collaborative filtering algorithm [2].

Bartosz Kupisz and Olgierd Unold projected Collaborative Filtering Recommendation Algorithm based on Hadoop and Spark the purpose of this work was to mature and associate recommendation systems which practice the collaborative filtering algorithm, based on Hadoop and Spark. The Hadoop form was applied with the usage of the Mahout library which was a component of the Hadoop system [3].

Riyaz P A, Surekha Mariam Varghese proposed a Scalable Product Recommendations using Collaborative Filtering in Hadoop for Bigdata. Conservative recommender service structures often grieve from absence of scalability as well as competence problems when dispensation or examination of this data on a bulky scale. To evade these difficulties, a new recommendation system using collaborative filtering algorithm is implemented in Apache Hadoop leveraging MapReduce paradigm for Bigdata [4].

Dheerajkumar Bokde, Sheetal Girase and Debajyoti Mukhopadhyay proposed a method to a university recommendation by multi-criteria collaborative filtering and dimensionality reduction techniques this paper proposes key not only to decrease the computation cost but also increases the estimate truth and efficiency of the Multi-criteria filtering algorithms implemented using the Apache Mahout context [5].

Zhiyang Jia,Wei Gao, Yuting Yang, Xu Chen, proposed the system for tourist attraction based on user based collaborative filtering here system is created as an online application which is proficient of creating a custom-made list of fondness attractions for the tourist. In edict to govern the likenesses between each user, the cosine arrangement is adopted during the fruition of the generation of neighbor's [6].

Jyoti Gupta, Jayant Gadge proposed Performance Analysis of Recommendation System Based on Collaborative Filtering and Demographics. Prediction using item based collaborative filtering is collective with prediction using demographics based employer clusters in a weighted scheme. The expected solution is scalable while magnificently lecturing user cold start [7].

Suman Datta, Joydeep Dasy, Prosenjit Gupta and Subhashis Majumder, proposed SCARS: A Scalable Context-Aware Recommendation System. Main impartial of this graft is to moderate the running interval without bargaining the recommendation excellence. This safeguards scalability, agreeing us to challenge bigger datasets using the same means [8].

FAN Lu, LI Hong, LI Changfeng, suggested the enhancement and employment of distributed item-based collaborative filtering algorithm on Hadoop in this paper adopts real data set to run the algorithm and the research result couriers that the developed algorithm can run efficiently on the outsized volumes of data with the improved accuracy, and at the similar time, can overwhelmed the cold-starting drawback successfully [9].

Shunmei Meng, Wanchun Dou, Xuyun Zhang, and Jinjun Chen offered KASR: A Keyword Aware Service Recommendation Method on MapReduce for Big Data Applications to expand its scalability and efficiency in big data background, KASR is instigated on Hadoop, an extensively adopted disseminated computing platform using the MapReduce parallel processing archetype [10].

Kunhui Lin, Jingjin Wang, Meihong Wang, proposed a hybrid recommendation algorithm based on Hadoop. The earlier hybrid recommendation algorithm was designed to parallel on MapReduce framework. The experimentations were applied to the MovieLens dataset to achieve the welfares of parallel algorithm [11].

Yingya Zhang, Cheng Yang, ZhixiangNiu proposed the recommendation scheme for the investigation of job created on collaborative filtering this paper is user based and item-based collaborative filtering algorithm is compared to select a better executed one. It takes background information containing student's resumes and details of recruiting material into consideration, bring weights of co-apply users that is the users who had smeared the candidate jobs and weights of student used-liked jobs into the algorithm [12].

Poonam Ghuli, Atanu Ghosh and Dr. Rajashree Shettar suggested a Collaborative Filtering Recommendation Engine in a Distributed Environment this paper focus on parallelism of both item-based and user-based CF algorithm distinctly on MapReduce by excruciating the CF algorithm computations into three Mapper and Reducer phases [13].

Xiao Peng, Shao Liangshan, Li Xiuran proposed improved collaborative filtering algorithm in the inquiry and solicitation of personalized movie references. Electronic business recommendation system, it emphases on the collaborative filtering algorithm in the solicitation of personalized movie recommendation system [14].

Suyun Wei, Ning Ye, Shuo Zhang, Xia Huang, Jian Zhu proposed Item-based Collaborative Filtering recommendation Algorithm Combining Item Category with interestingness measure a top-N recommendation algorithm that uses items classes similarity and item-item interestingness to calculate the recommendations. Proposed algorithm affords additional accurate recommendations than those given by traditional CF techniques [15].

Michael D. Ekstrand, John T. Riedl and Joseph A. Konstan., proposed Collaborative Filtering Recommender Systems[16], this paper deliberates a varied diversity of the selections accessible and their implications, pointing to provide both experts and investigators with an introduction to the important subjects essential for recommenders and existing superlative practices for addressing these issues [16].

Wu Yueping and Zheng Jianguo proposed a research of recommendation algorithm based on cloud model. The paper use cloud model which are knowledge demonstration in quality and bond function of the conversion between quality and quantity, provide an item cataloguing recommendation algorithm based on cloud
Model [17].

Yanhong Guo, Xuefen Cheng, Dahai Dong, Chunyu Luo and Rishuang Wang proposed an improved collaborative filtering algorithm based on trust in e-commerce recommendation system. This system propose that the traditional accentuate on customer likeness may be excessive and there are added factors taking an imperative role to play in guiding recommendations. It proposes computational archetype of trust and then a predictive algorithm based on it. The tentative results proved the validity and superiority of the proposed algorithm at last [18].

Jun Wang, Arjen P. de Vries proposed Unifying User based and Item based Collaborative Filtering Approaches by Similarity Fusion. The paper reformulates the memory-based collaborative filtering problem in a generative probabilistic framework, treating individual user-item ratings as predictors of missing ratings [19].

Vlabo Kostov, Eiichi Naito, Jun Ozawa proposed Cellular Phone Ringing Tone Recommendation System Based on Collaborative Filtering Method. System has deployed a model of cellular phone ringing tone recommendation system using memory-based collaborative filtering and has carried out examinations to appraise its performance. The ringing tone content was stockpiled on a

server from where the consumers were able to download the desired items according to their preferences [20].

Simon Fong, Yvonne Ho and Yang Hang proposed Using Genetic Algorithm for Hybrid Modes of Collaborative Filtering in Online Recommenders. This paper presents a GA-based method for backup mutual styles of collaborative filtering. In particular, system show that how the input variables can be coded into GA chromosomes in various modes. Insights of how GA can be used in recommenders are resultant through trials with the input data taken from Movielens and IMDB [21].

Zan Huang, Daniel Zeng and Hsinchun Chen proposed A Comparison of Collaborative Filtering Recommendation Algorithms for E-commerce. Results show, the user object interaction matrix overall sparsity level and row-column density clearly influenced the algorithms relative performance. However, such data characteristics are far from complete and lack predictive power as a foundation for the Meta level guideline we suggested earlier [22].

Xiangwei Mu, Yan Chen and Jinsong Zhang proposed Improvement of Collaborative Filtering Algorithm Based on Hesitation Degree. In this paper, Hesitation Degree was projected to progress the exactness of collaboration filtering together built on item and user, kinds of Hesitation Degree were introduced into item and user similarity computation, and the results show that the prediction accuracy can be improved from 10 percent to 25 percent in different case, using this improved similarity algorithm, Mean Absolute Error can be also reduced faster than classic methods [23].

Khushboo Ramesh Shrote, Prof. Anil V. Deorankar proposed Hotel Recommendation System using Hadoop and MapReduce for Big Data. In this paper Hadoop framework based hotel recommendation system is proposed. Sentiment analysis is pragmatic for score calculation. This total score will then use for recommendation purpose. Efficiency and Scalability is improved using Hadoop framework [24].

Dheeraj kumar Bokde, Sheetal Girase and Debajyoti Mukhopadhyay proposed An Item-Based Collaborative Filtering using Dimensionality Reduction Techniques on Mahout Framework. This paper proposes an efficient MC-CF algorithm using dimensionality reduction methodology to advance the recommendation eminence and prediction accuracy. Dimensionality reduction techniques such as Singular Value Decomposition (SVD) and Principal Component Analysis (PCA) are used to resolve the scalability and alleviate the sparsity problems in overall rating [25].

III. SYSTEM OVERVIEW

A. *Problem Statement*

Recommender provision systems often grieve from dearth of scalability and efficiency glitches when handling or scrutinizing of data on an outsized scale. Many systems need to react instantly to online recommendations for all users nevertheless of their consumptions and assessments antiquity, which hassles large scalability. To circumvent these problems, a proposed recommendation system using filtering algorithms is implemented in Spark on top of Apache Hadoop. Main objective of this system is developing a scalable big data exploration system with recommendation related algorithms which delivers scalable and real time recommendations based on ratings predictions.

B. *Proposed System Architecture*

Hadoop has a distributed file structure so it takes input data from various file systems. Input data is taken from various datasets. From this datasets, system is using some portion of data for training purpose and the remaining portion of data for testing [18, 19]. The data is collected in a structured format and transferred from local file system to Hadoop distributed file system as shown in Figure 1.

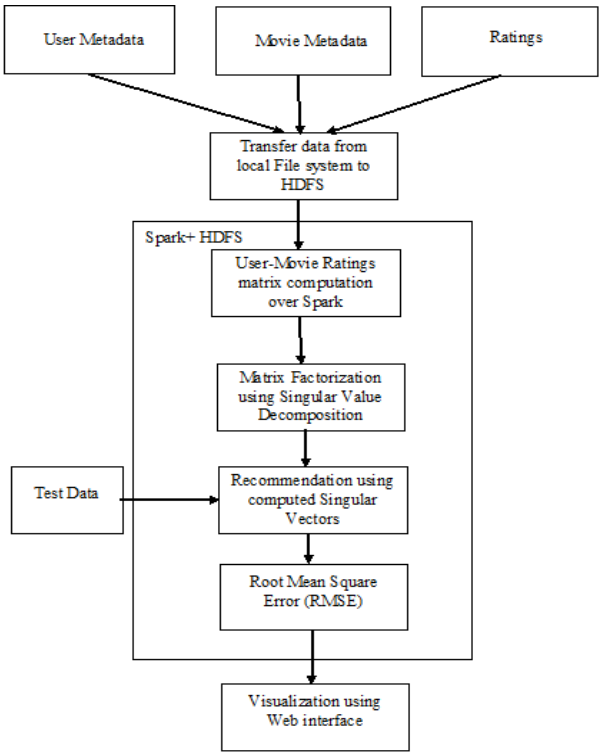

Figure 1. Proposed system Architecture

In Singular value decomposition algorithm that is SVD, system is using metadata of user, movies and ratings. Then this data is combined and converted into matrix format.

Using Singular vector decomposition algorithm matrix is factorized over spark so as to predict ratings. To envisage user ratings factorize the matrix into vectors and values. Then assistant this factorized data with test user input statistics, this value which this system will get by combining factorized matrix and user test data should approximately match with the original training matrix data. Test user input data comes from the input's testing data which is stored in HDFS [20].

Then recommendations are provided using singular vector with the help of test data. Then system will compute the RMSE that is root mean square error and then visualization is provided using web interface [21]. Root Mean Square Error (RMSE) is used to calculate the error between original and calculated matrix. This RMSE must be minor as possible. In equation (1) of RMSE, *yj* denotes original matrix and *ȳj* denotes calculated matrix.

$$RMSE= \sqrt{1/n\sum}^{n}_{j=1} (yj-\bar{y}j)^{2} \qquad (1)$$

Here system will test implementation with minimum 3 nodes using Apache spark for computation and HDFS for storage of movies data. This system uses MovieLens as datase1t. Main modules of this system are implementing item-based recommendation, SVD that is singular value decomposition, and then system will implement Incremental SVD and Trust SVD.

In item based recommendation resemblance among items calculated using people's ratings of those items [22, 23]. SVD finds a hidden feature space where the users and items they like have feature vectors that are closely aligned it is commonly used for producing low-rank approximations. Incremental SVD is used to handle dynamic databases, where new terms and documents may arrive once the model is built it handles incremental databases. Incremental SVD is highly scalable than SVD. The rationale behind Trust SVD is to take into attention user/item biases and the influence of rated items other than user/item-specific vectors on rating prediction [24, 25].

IV. PROBLEM FORMULATION

Let S contains the set of attributes required for the computation of recommendation algorithm.

$S= \{U_r, P, R, M, U, \sum, V, T, P_r\}$

$Ur= \{U_{r1}, U_{r2}, U_{r3}\ldots U_{rm}\}$

U is a set of users

m - Number of users.

$P= \{P_1, P_2, P_3\ldots P_n\}$

P is set of products (i.e. Movie)

n - Number of movies

$R= \{R_1, R_2, R_3\ldots R_l\}$

$R_i= \{U_i, P_j, RT_k\}$

Where,

U_i – Users

P_j – Movie

RT_k- Ratings

l=m*n

Function $F_1 (U_r, P, R) \rightarrow M$

Function F_1 constructs matrix from user metadata, product metadata and ratings

Function $F_2 (M) \rightarrow (U, \sum, V)$

Function F_2 factorizes matrix M into U, $\sum$ and V

Where,

U- Left singular vector

$\sum$ - Singular values

V – Right singular vectors

Function $F_3 (U, \sum, V, T) \rightarrow (P_r)$

For test user input data, function F_3 predicts ratings

Where,

T- Test user input data

V. EXPERIMENTAL ANALYSIS

This system will implement recommendation system over Hadoop and Apache Spark. Apache Spark is used as it provides low latency computation. It is a cluster computing system and does in memory processing of data. A recommendation engine build using only Hadoop will not provide real time recommendation so system is using Spark to offer real time computation of data.

Experiment has been carried out on minimum 2 systems having i3 processor with 500GB HDD and 1GB RAM. It requires Ubuntu 15.10 OS and requires platform such as Hadoop 2.6.0, Apache Spark 2.0, JDK, python and flask library with eclipse neon, ssh and rpc. Table 1 shows evaluation of ranking algorithms; they are SVD, SVD++/Incremental SVD, Trust SVD, and Item-based collaborative filtering.

TABLE I. PERFORMANCE ANALYSIS

SVD	SVD++	Trust SVD	Item-based collaborative filtering
0.9677	0.875496	0.8349503251	1.1821
0.9632	0.86483	0.8270072002	1.09701
0.963	0.86356	0.8239940005	1.07125
0.957	0.86082	0.8216696779	1.0021

A. *Item-based Collaborative Filtering*

In item-based collaborative filtering, RMSE is maximum than other techniques. Figure 2 shows the graphical representation of item-based filtering approach.

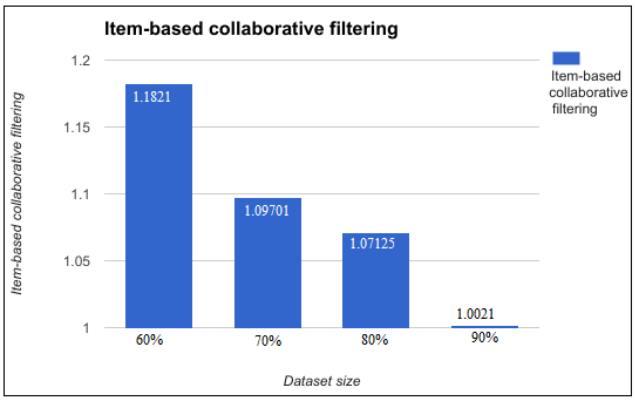

Figure 2. Item-based Collaborative Filtering

B. *SVD*

In SVD, RMSE for dataset is calculated. As shown in figure 3, X-axis represents training data set and Y-axis represents RMSE. As the training dataset is increased periodically RMSE goes on decreasing.

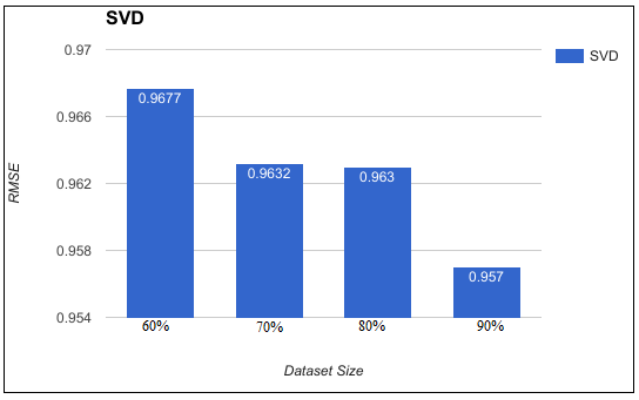

Figure 3. SVD

C. *Incremental SVD*

The analysis shows that this algorithm is more efficient than SVD. As shown in figure 4, RMSE for each training dataset is less than SVD. So according to analysis SVD++ is more effective than SVD.

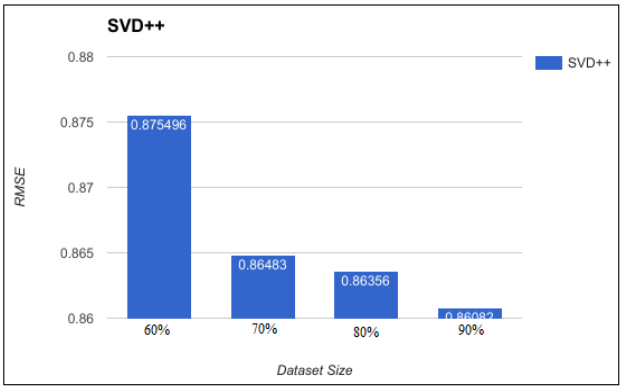

Figure 4. Incremental SVD

D. *Trust SVD*

Trust SVD is more efficient than other algorithms as it has minimum RMSE compared to other methods. Figure 5, represents performance of Trust SVD; it represents RMSE for training datasets.

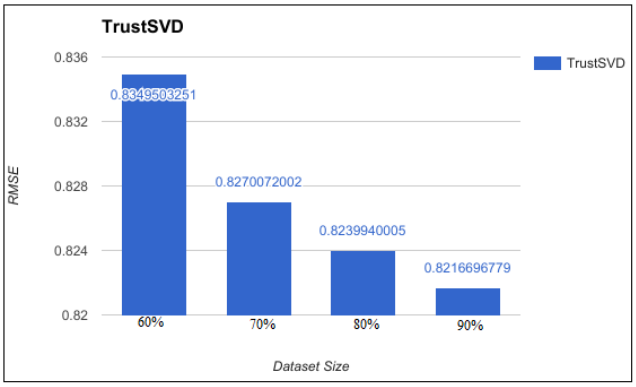

Figure 5. Trust SVD

Figure 6, shows the comparison of all implemented algorithms they are Item-based collaborative filtering, SVD, SVD++, Trust SVD. Performance analysis proves that Trust SVD is more proficient, scalable and provides real time recommendation using rating predictions.

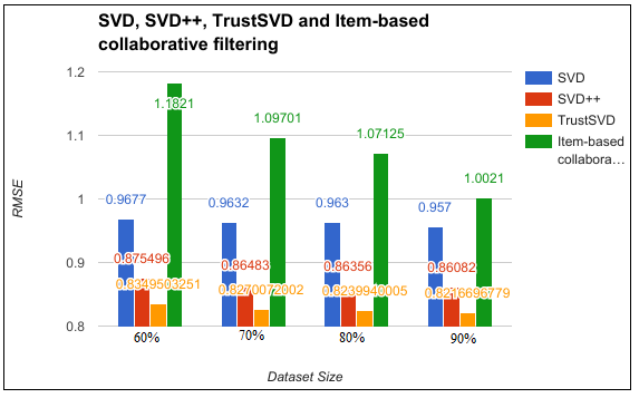

Figure 6. Comparison between algorithms

VI. CONCLUSION

An ascendable product recommendation filtering for Bigdata on Apache Hadoop and Spark can process superior than regular recommendation system based on Hadoop. Apache spark is a reckless and universal engine for large scale records processing. It runs software package up to 100 times fast than Hadoop MapReduce in memory, so realizing this system on Spark provide scalability and real time commendations. Here system will implement several reference algorithms and then comparison shows which one is further efficient and will provide accurate real time recommendation using rating predictions. As the scope of data escalates the Apache Spark accomplishes well by accumulating additional data nodes for processing.

REFERENCES

[1] Guibing Guo, Jie Zhang, and Neil Yorke-Smith, "*A Novel Recommendation Model Regularized with User Trust and Item Ratings*", IEEE transactions on knowledge and data engineering, Vol.28, Issue.7, pp.1607-20, 2016.

[2] Gejianxin and Liu jiaomin, "*Software Test Cases Recommendation System Research based on Collaborative Filtering*", IEEESNPD, China, pp. 557-562, 2016.

[3] Bartosz Kupisz and Olgierd Unold, "*Collaborative Filtering Recommendation Algorithm based on Hadoop and Spark*", 2015 IEEE International Conference on Industrial Technology (ICIT), Spain, 1510-1514, 2015.

[4] Anshu Choudhary and C.S. Satsangi, *"Query Execution Performance Analysis of Big Data Using Hive and Pig of Hadoop*", International Journal of Computer Sciences and Engineering, Vol.3, Issue.9, pp.91-97, 2015.

[5] Brijesh Ahirwar and Vishal Pasi, "*A Survey Paper on Inter-carrier Interference Reduction Techniques in OFDM Systems*", International Journal of Computer Sciences and Engineering, Vol.3, Issue.6, pp.26-29, 2015.

[6] Zhiyang Jia,Wei Gao, Yuting Yang, Xu Chen, "*User-based Collaborative Filtering for Tourist Attraction Recommendations*", IEEE 2015International Conference on Computational Intelligence Communication Technology, Usa, PP.7-13, 2015.

[7] Jyoti Gupta, Jayant Gadge, "*Performance Analysis of Recommendation System Based On Collaborative Filtering and Demographics*", IEEE International Conference on Communication, Information Computing Technology (ICCICT), Indian, 1-6, 2015.

[8] C. Thangamalar, P. Sathiyapriya, "*Context-Aware Quantity Established Entrance Device Developing Operator Connection*", International Journal of Computer Sciences and Engineering, Vol.3, Issue.11, pp.113-118, 2015.

[9] V. Jain, "*Outlier Detection Based on Clustering Over Sensed Data Using Hadoop*", International Journal of Scientific Research in Computer Science and Engineering, Vol.1, Issue.2, pp.45-50, 2013.

[10] R. Murugesh, I. Meenatchi, "A Study Using PI on: Sorting Structured Big Data In Distributed Environment Using Apache Hadoop MapReduce", International Journal of Computer Sciences and Engineering, Vol.2, Issue.8, pp.35-38, 2014.

[11] Kunhui Lin, JingjinWang, MeihongWang, "*A Hybrid Recommendation Algorithm Based on Hadoop*", the 9th International Conference on Computer Science Education, Canada, pp. 540-543, 2014.

[12] Yingya Zhang, Cheng Yang, ZhixiangNiu, "*A Research of Job Recommendation System Based on Collaborative Filtering*", Seventh International Symposium on Computational Intelligence and Design, China, pp. 533-538, 2014.

[13] Poonam Ghuli, Atanu Ghosh and Dr. Rajashree Shettar, "*A Collaborative Filtering Recommendation Engine in a Distributed Environment*", India, pp.568-574,2014.

[14] Xiao Peng, Shao Liangshan, Li Xiuran, "*Improved collaborative filtering algorithm in the research and application of personalized movie recommendations*", Fourth International Conference on Intelligent Systems Design and Engineering Applications, China, pp. 349-352, 2013.

[15] Suyun Wei, Ning Ye, Shuo Zhang, Xia Huang, Jian Zhu, "*Item-based Collaborative Filtering Recommendation Algorithm Combining Item Category with Interestingness Measure*", International Conference on Computer Science and Service System, China, pp. 2038-2041, 2012.

[16] Michael D. Ekstrand, John T. Riedl and Joseph A. Konstan, "*Collaborative Filtering Recommender Systems*", Foundations and Trends R in Human Computer Interaction, Vol.4, No.2, pp. 291-324, 2010.

[17] Wu Yueping and ZhengJianguo, "*A research of recommendation algorithm based on cloud model*", China, pp. 469-473, 2010.

[18] Yanhong Guo,Xuefen Cheng, Dahai Dong, Chunyu Luo and Rishuang Wang, "*An improved collaborative filtering algorithm based on trust in e-commerce recommendation system*", Cina, pp.1-4, 2010.

[19] Jun Wang, Arjen P. de Vries, "*Unifying User based and Item based Collaborative Filtering Approaches by Similarity Fusion*", SIGIR06, USA, pp. 501-508, 2006.

[20] Vlabo Kostov, Eiichi Naito, Jun Ozawa, "*Cellular Phone Ringing Tone Recommendation System Based on Collaborative Filtering Method*", Proceeding 2003 IEEE International Symposium on Computational Intelligence in Robotics and Automation, Japan, pp. 378-383,2003.

[21] Simon Fong, Yvonne Ho, Yang Hang, "*Using Genetic Algorithm for Hybrid Modes of Collaborative Filtering in Online Recommenders*", Eighth International Conference on Hybrid Intelligent Systems, Spain, pp. 174-179, 2008.

[22] Zan Huang, Daniel Zeng, Hsinchun Chen, "*A Comparison of Collaborative-Filtering Recommendation Algorithms for E-commerce*", IEEE Intelligent Systems, Vol.22, Issue.5, pp. 68-78, 2007.

[23] Xiangwei Mu, Yan Chen, Jinsong Zhang, "*Improvement of Collaborative Filtering Algorithm Based on Hesitation Degree*", International Conference on Computer, Mechatronics, Control and Electronic Engineering , China, pp. 302-305, 2010.

[24] Rahul R. Ghuleand Sachin N. Deshmukh, "*Comparative Study on Speculative Execution Strategy to Improve MapReduce Performance*", International Journal of Computer Sciences and Engineering, Vol.3, Issue.3, pp.197-200, 2015.

[25] Dheeraj kumar Bokde, Sheetal Girase, Debajyoti Mukhopadhyay, "*An Item-Based Collaborative Filtering using Dimensionality Reduction Techniques on Mahout Framework*", 2015 IEEE International Symposium on Nanoelectronic and Information Systems, India, 2015, pp. 231-236, 2003.

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