

User Tags Based Effective Recommendations for New Items

Danish Irfan, Dr. Khurram Zeeshan Haider, Dr. Muhammad Awais, M. Yahya Saeed

danishirfan533@gmail.com haider_25@hotmail.com muhammadawais@gcuf.edu.pk m_yahya_saeed@yahoo.com

Department of Software Engineering, Government College University, Faisalabad, Pakistan

Summary

In this paper, we exhibit a tag based Recommender System which produces customized proposals clients. The proposed approach, in light of community oriented separating suggestion calculation, utilizes comparability computation of new coming items and vector creation to process the clients' information. With a specific end goal to test the appropriateness of this strategy, we worked a few trials on irregular clients' information, and the general outcome achieved the precision rate of 9.5%, the review rate of 12.9%, and the scope rate of 11.7%, the normal ubiquity level of 1.92.

Plentitude of data as of late has turned into a genuine test for web clients. Recommender algorithm have been frequently used to lighten this issue. Recommender algorithm prune extensive data spaces to prescribe the most important things to clients by thinking about their inclinations. In any case, in circumstances where clients or things have couple of feelings, the suggestions can't be made legitimately. This remarkable weakness in reasonable Recommender frameworks is called recently things issue. In this test, we propose another method for moving toward this issue by fusing light into long haul casual interchanges. It was computed based on an enhanced substance based web-based social networking calculation (ECSN), and the proposed account considers the assessments gave to business partners and participants other than client introduction. The practicality of the ECSN account was surveyed through its operationalization, an as of late recognized non-administrative association (NS) for things in Pakistan. The genuine sections of the live relationship to the clients of the record are recorded with the components portrayed for 6 successive weeks. Four one of a kind, particular, sporadic, network based, content ward, and ECSN accounts have been connected as time. The observational outcomes demonstrate noteworthy execution of ECSN in alleviating the recently recommender things issue other than enhancing the expectation exactness of suggestions when contrasted and other considered recommender calculations.

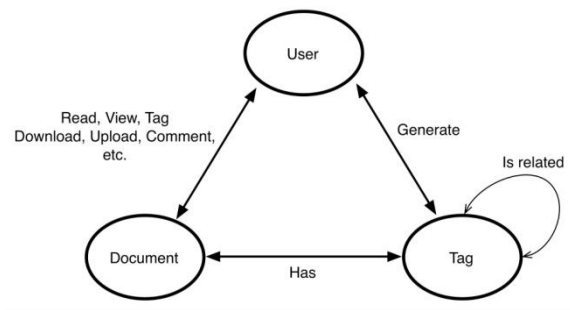
Key words:

Recommender System, ECSN, Content-Based Recommender, Collaborative Filtering.

1. Introduction

The perilous advancement in the proportion of open automated information and the amount of visitors to the Internet have made a potential trial of information overburden which blocks opportune access to things of excitement on the Web. Information recuperation systems, for instance, Google, Devil Finder and AltaVista have not entirely handled this issue yet prioritization and

personalization (where a structure maps available substance to customer's interests and tendencies) of information were truant. This has extended the enthusiasm for recommender systems more than ever already. Recommender structures are information filtering systems that plan with the issue of information over-trouble [1] by filtering significant information segment through of tremendous proportion of intensely delivered information according to customer's tendencies, interest, or watched lead about thing [2]. Recommender system can anticipate whether an explicit customer would support a thing or not established on the customer's profile.



The pervasiveness of computerized innovation and fast improvement of Social Media has altered our general public toward a culture in light of the estimation of data. The online situations, for example, interpersonal organizations and weblogs, have subsequently turned into a copious data source confirming a noteworthy impact on clients' way of life. Comparable situation has happened in SNs. A colossal measure of e-content is created on the web each and every day, covering different sorts of things, for example, news, occupations, grants, and gatherings. As prescribing the most significant data to clients in view of his/her needs is getting troublesome [1], recommender frameworks have developed to lighten above difficulties by giving clients the most applicable things. Recommender frameworks use the clients' past assessments and associations with framework to foresee potential further likes and interests of their clients.

The cool begin issue is separated into two classifications of chilly things that begin with cool polycenics [8]. Cool begin. The test of things occurs because of new things that must be portrayed to the customers, while insufficient assessments are made about them [12]. The chilly begin

issue happens when another customer that really joins an online position indicates just some default esteems. In such conditions, there is no association between the new and elective customer, and in this way cannot envision the closeness between them. Subsequently, prescribed edges cannot give solid proposals [10]. The two casings of the social and topical proposition have shortcomings related to the topic of a chilly begin [2]. For ideal proposals, collaboration figuring's require thorough records of past assessments. In any case, in a few territories where there are new things without past assessment records, normal strategies cannot work really. Starting now and into the foreseeable future, in the network arranged methodologies, new things start in these conditions when new things must be portrayed [12]. This point has been checked somehow by content-based structures, which can be alarmed to something even without earlier assessment [11]. Considering all things, even the suggested structures depend on the substance of the negative impacts involvement to begin testing fascinating new customers. They cannot portray things to new customers with no past history of participation with the system [6].

Two most well-known methodologies among Recommender frameworks are shared and content-based recommender calculations [5]. In community oriented calculation, the proposals are made in light of the things that individuals with comparative inclinations and interests favored already [11], while, in content-based strategies, prescribed things are those with content tag beforehand favored things by an objective client [7]. Since, in community oriented sifting procedures, the investigation of the real substance isn't required, they are broadly utilized as a part of making forecasts to channel any sort of things, for example, content, photographs, music, and recordings [3]. Content-based Recommender frameworks, then again, examine thing portrayals to discover things that are exceptionally compelling to the client [6]. They receive an all-around organized system for contrasting client interests and the things' determinations to at last propose the most reasonable thing to an objective client [12]. Albeit content-based proposal techniques settle the new things' issues, despite everything they experience the ill effects of the chilly begin issue in circumstances when new clients are included [13].

To direct the issues specified over, an enhanced type of material-based figuring is proposed in the stream and stream test. Casual long haul correspondence methodology are utilized to address the issue of chilly begin and enhance the exactness of projection in the proposition. . This model breaks down the worries and desires for associates of customers and partners, paying little mind to client inclinations. In this new approach, the interests and desires for the customers are situated in the tree structure. The accompanying parts are orchestrated by what is required.

The accompanying segment shows some pertinent research deal with the point of cool begin. Demonstrates the ECSN account proposed in this pursuit. The consequences of a month and a half of examinations are introduced in this investigation and are talked about, lastly, the area closes the work distinguishing our future research patterns.

2. Related Work

The characterizing property of the Internet these days is the wealth of data and decision. In such a huge online condition, proposal frameworks were intended to lighten this issue by giving customized thing suggestions to clients [1]. Two generally utilized strategies in such frameworks are cooperative and substance based separating yet they both experience the ill effects of chilly begin issue [6]. This issue has prompted the development of some mixture suggestion calculations to avoid this inadequacy and enhance the proposal quality.

By showing a labeling technique in community oriented sifting calculations, Saini and Banda [18] were among the most punctual analysts who recommended an answer for tackling the cool begin issue. Stop and Chu [16] likewise proposed prescient component based relapse models that use all accessible data of clients and things. A few specialists have proposed the utilization of appraisals operators, known as channel bots, for increasing the evaluations of things in light of their substance highlights [18], while some others have coordinated a client display with trust and doubt systems to distinguish dependable clients [1]. In another examination work, a suggestion calculation is recommended that decides how the guided gathering system is guided by a determination tree with various questions in each area. Lam et al. built up a half and half model in view of investigation of two probabilistic viewpoint models. Their examination consolidated the unadulterated communitarian sifting with clients' data to take care of the cool begin issue. Networks' data, removed from various measurements of informal communities, was utilized as a part of [21] to help proposal frameworks in taking care of chilly begin issue in view of the wellspring inert likenesses. Proposing another closeness measure is likewise another arrangement which was utilized as a part of [24] to deal with this issue. In its acknowledgment, the makers utilized a change in light of neurological issues to figure out how to accomplish a superior execution in the depiction of new customers. In [24], CCF was presented as another methodology that develops a two-advance computation, the first occasion when they look at the customer's substantive neighbors, utilizing their own particular attributes, while in the second they set up the gathering model in the arrangement of neighbor information and discretionary ventures. Now, it is assessed

that the system of the suggestions is the target assessment of the objective customer.

As expressed in [25], the dominant part of past recommender calculations have concentrated on upgrading the execution of the proposal procedure and relieving the chilly begin issue without considering the social components of basic leadership and counsel chasing. All the more particularly, customary recommender frameworks overlook social connections among clients. It has been confirmed that recommender calculations could be fundamentally enhanced by drawing on highlights from social frameworks [27]. Filling this hole, a few analysts have directed related examinations by using the long range informal communication highlights. For instance, Said et al. [28] exhibited a probabilistic way to deal with thing suggestion keeping in mind the end goal to improve the proposals amid the cool begin time frame in CiteULike people group. The creators broadened the past models, for example, probabilistic inert semantic investigation (PLSA) by combining both client thing and thing label perceptions into a brought together portrayal. Additionally in this unique circumstance, an enhanced technique was proposed by presenting a thing focused capacity, concentrating on unraveling the difficulty of the suggestion precision between the cool and mainstream things [27]. This technique depended on a half breed calculation joining the warmth conduction and likelihood spreading forms. The trial results demonstrate that their proposed calculation essentially enhances the suggestion precision of the chilly things, while it keeps the suggestion exactness of the by and large and the well-known things. Moreover, Zhang et al. proposed a suggestion calculation in view of the client tag-question tripartite which makes utilization of social labels. Other than improving the algorithmic exactness and decent variety, this technique fundamentally settle the chilly begin issue in social labeling frameworks with heterogeneous question degree appropriations [28]. Another calculation [27] was acquainted with use the rich social data in a single stage to help the development of another client arrange in another stage on client level. In light of led information examination, they demonstrated that companion relations and regular contact conduct can be better exchanged to another social stage.

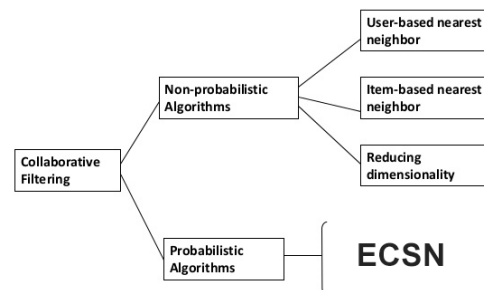
3. Proposed System

In this document, advanced improvements are created to the recommended frameworks that bring together the informal components of the community to improve the implementation of the proposal procedure. Specify the graph to describe the top 10 elements for individuals in the Recommendation system. This procedure involves the aggregation of existing contributions from customers, the

production and preservation of improved customer data in light of their trends charged in the middle of collaboration and, finally, the ECSN provider account to determine the top 10 out of 100. suppliers in seven days. Extend the research and send one week per week of electronic bulletin to each party.

More specifically, the ECSN account uses the "companion profile" and the "employer profile" that are not the client's preferences. In doing so, the ECSN recommendation engine checks all exchange records for specific customer owners and the most important axes will be invoked in the tree structure of the objects. At this point, the rating of the mobile positions in the pending tree of the given customer will be updated. A similar procedure will be completed with respect to the colleagues of the target client's staff.

Block Diagram



The ECSN calculation calculates the client's slope for object classes in the tree information structure that is formed in a different level frame. Therefore, in the ECSN calculation, the customer's mileage grades are drawn to classify everything in light of the following definition.

1. The degrees of mileage (PS) are as follows: Where is the customer's added inclination to center the classroom of objects? Each element of this definition is photographed below. SelfClickScore is the class that identifies with the snapshots of the given client for the object classification center, which is referenced by calculating the number of client snapshots that are shown in the exploration experiments. RankScore is calculated by adopting the rates provided by the client for the things arranged in the ratings axis. The member rating of MemberMatesScan is verified by looking at 3 interesting tree axis tilt centers among people who have enrolled in a workforce similar to the one the client has a place. The last element, FriendsScore, is dedicated to the tendencies of the partners of the given part. The above procedure was adopted to confirm MemberMatesScore here for FriendsScore with this distinction which is considered the best 3 axes for the most exciting part among the owners of the pieces.

2. The customer tilt tree is similar to the progress tree for object classification, and the arrangement of the tilt axes is

as follows: where, customer ID, object ID for the command line tree and grade of inclination, separately.

As reported in previous queries in [29], some weights can be assigned to each parameter of the recipe to record the tilt scores. Appropriately, in 1, talk to the relative weights of each component. Since SClickScore and RankScore are the two most important individual components that should be given to clients, In general, the weight of 3 has been considered since MemberMatesScore is less massive than the special trends of the clients. What's more, after a long time, it is assigned by 1, where FriendsScore has the least influence on definition 1. The assigned weights are abstract qualities to reflect the levels of importance among the trends of clients, co-workers and companions. Although the results of this experimental research show that these adjustments work admirably to improve the accuracy of the projections of the proposals, in any case, as the future works, even these weights can be updated by applying some different procedures, for example , Genetic calculations

After confirmation of the PS scores for each client, definition 3 is connected to some paperless axes of the tilt tree, which are still zero.

3. The degrees of inclination (PS) is a category of elements not printed that is the following: The slope tree of a particular client is set to zero when the client creates a profile in an informal organization:

The attributes shown are used to update the mileage (1) when the selected customer compares the selected objects with the classification axis, (2) when the selected customer clicks on the specified objects with the classification axis. It is not necessary to update the slopes for all axes of the trees, but it is only necessary to update the degrees of inclination of the defined axes with the objects visited and evaluated.

In light of this recognized need, the highest scores can have up to three things, while the next two higher types have two things in the list of suggestions. Others have a similar appreciation for one thing. In a set through a circle, a classified movement list (TopItemsList) is created for each client.

In contrast to the effectiveness of the ECSN account and previous methodologies, synergies based on content were calculated and connected to this test.

In a group separation approach, expectations are expected in the light of the things preferred by individuals who have similar tendencies and interests. There are two basic arrangements for the recommended community based on frames, that is, based on memory (based on the client) and based on the show (based on the thing). To mitigate some of the weaknesses of the previous approach, a strategy was developed based on models that looked for comparative objects in exchange for performing groupings between pairs [6, 32]. Therefore, the model-based approach was

implemented in this test to use your points of interest. In this strategy, the probability of similarity of things appears everywhere in the order of all the clients that have evaluated both. As required, and is evaluated by customer evaluations of things and, separately 30. In addition, to anticipate any possibility of things being the best that will be described for each particular individual, the work has been associated with the use of the indicator in this stage:

To achieve a proposal based on an article in this research, the slope registration structure was used to show the client profiles [30]. Like the ECSN calculation method, this approach also deals with the degree of client inclination for the object classes in the tree's information structure that is planned in a multilevel framework. Therefore, the information structure identified in definition 1 is used for this strategy: identification of the client, identification of the classification of the article for the chain of importance of the tree and degree of inclination, individually.

However, when calculating the proposal, specific customer trends are used only to confirm the degree of inclination.

The examination of the previous recipe with its improved version in definition 2 shows how the ECSN is calculated in the escrow account and the staff member, regardless of the specific trends of the client. The exploratory results in the next section show the positive impact of this improvement on the promotion of the precise expectation.

4. Results

The examinations proceeded in this investigation amid a time of 5 weeks from the seventh of July to the seventh of the long stretch of August of 2018. Around there, related with the supplier of four records (self-assertive, the network, in view of the substance, and Switches) and executed in the assembling was thought better recommendations among them. In doing as such, after the initial two tests led over the most recent two weeks, the self-assertive record was utilized for three weeks to portray things to customers. Consequently, the system of the joint and topical recommendations was received for three weeks, going with the accumulation of data. At last, over the most recent two weeks, people got recommendations from the ECSN record to finish the trial of this examination. In these five weeks of money amassing, 790 records were submitted, including 295 employments, 200 gatherings, 155 stipends and 140 news things. These things were sent to 602 enlisted people from 10 resources in Pakistan. To evaluate the normal exactness of the analyzed partner's records, accuracy, audit, post occurrence, and surely understood assessments were utilized in this setting [5, 29]. The purposes of enthusiasm for the aftereffects of the tests are exhibited beneath concerning the issue of chilly begin and the introduction of relevant recommendations.

5. Solving the Newly Item Problem

In situations where helpful techniques and substance experience the ill effects of a cool begin issue when new components or new clients are shared, [28] the ECSN calculation related with informal community capacities was utilized to take care of this issue. The remarks gathered were dissected from 14 weeks of tests to indicate how the proposed calculation of the proposition was relaxed in the momentum look into point.

Demonstrates point by point insights in this specific situation. The second segment shows, a serial number of information accumulation 9, a progression of information gathering stage where three principle calculations suggest the application (collective, content-based, and, Switches). The following three segments (new components, new clients and current clients) demonstrate the economic wellbeing of every seven day stretch of examinations as indicated by the quantity of clients and components. At long last, the last four sections speak to the qualities of a portion of the parameters used to gauge the cool begin issue. Know the four parameters used to assess the execution of the prescribed calculations to take care of the issue of the start of the chilly activity in the accompanying way: tot_EU: the aggregate number of new components suggested for existing clients that have the anticipated value > 1; tot_NU: the aggregate number of new things prescribed for new clients who have predicted > esteem 1; avg_EU: the normal number of new things suggested for existing clients who have anticipated value > 1; avg_NU: the normal number of new things prescribed for new clients who have predicted > 1 esteem.

To represent the cool begin express, this exploration concentrated on the measure of new components prescribed for new and existing clients. In this specific circumstance, tot_EU explored the issue of the new parts, while tot_NU concentrated on the new viewpoint of the client of the cool begin issue. The normal estimation of these estimations for every client demonstrates how well the affirmed suggestion calculation has tackled the cool begin issue.

As appeared, the agreeable suggestion calculation couldn't contribute at all to new clients and new things in the driving rain begin issue. New components have been recommended for existing clients. Consequently, this technique just applies when it is prescribed to utilize already assessed components for existing clients. Consequently, the past insights demonstrate that the coordinated effort calculation represents a cool begin issue both on account of new components and new clients.

The innovation in view of the substance found a normal of 3 new components for existing clients. Be that as it may, despite everything it faces an issue with new clients. As appeared, 24 new clients were added to the informal

community amid the test tie CB_Series1 to CB_Series3. As per the tot_NU section (the aggregate number of suggested things with a normal value > 1 for new clients), the substance based approach couldn't prescribe new things to new clients. Along these lines, it presumed that the new piece of the cool begin issue was tackled with a normal of 3 new components prescribed for existing clients. In any case, the deficiency of new clients stays in this approach.

The ECSN suggestion calculation can settle both new clients and new issues identified with the chilly begin issue. The insights from the ECSN_Series1 exploratory string to ECSN_Series3 plainly demonstrate that 4 new articles have been proposed for existing clients. In the event that the quantity of prescribed things with forecast esteems greater than 1 for new clients, the normal esteem is around 3.7 as indicated by the avg_NU segment. This implies the youngster sexual abuse calculation has tackled the issue of cool begin frameworks just past proposal, yet it is additionally evident that the normal number of existing clients with the above suggested esteems 1 things enhanced by 15%.

Taking everything into account, the cool begin state is represented in the four suggestion calculations inspected (irregular, community oriented, content-based and ECSN). This issue does not make a difference to the Random Recommendation calculation, since it has distinguished just 10 irregular components and sent them to clients. The coordinated effort calculation is encountering the new part and the client another issue, while unraveling the substance based way to deal with the new segment deformity yet not the new client issue. As portrayed in the last columns, both the new client and the new issues identified with the cool begin issue were settled with the ECSN proposal calculation.

6. Conclusion

In spite of the fact that the frameworks of suggestions have been examined in the most recent decade, the investigation of social proposition frameworks is an ongoing wonder. The reason for this exploration was to decide how to tackle the chilly begin issue of informal community suggestion frameworks by actualizing a calculation in view of the improved substance utilized by interpersonal organization capacities (ECSN). To test the viability of the proposed suggestion calculation, a 14-week try was led to think about the ECSN calculation, content-based approach, cooperative separating, and randomization. The consequences of the investigation of the comfort perceptions gathered from the clients demonstrate that the ECSN calculation can contribute essentially to taking care of the cool begin issue. Notwithstanding tending to both the issues of new and new components in this specific

circumstance, the proposed suggestion calculation appears to enhance the normal estimation of the prescribed components for new clients by 15% contrasted with the unadulterated calculation in light of the substance. What's more, the aftereffects of the test, in light of four distinct estimations, demonstrate that the ECSN calculation gives preferred in general expectation exactness over alternate strategies considered. As far as exactness, the ECSN calculation had a noteworthy commitment of 28% (arbitrary), 14% (helpful) and 12% (in view of substance). As far as recuperation estimation, the commitment of the ECSN strategy is clear with a 3% agreeable change and a 3% content-subordinate technique.

The outcomes of the sensational pattern were in a month and a half of tests. With reference to the meaning of outcomes, a lower drop rate shows a superior execution of the borrower's calculation. In this way, in view of this estimation, the change of the forecast calculations for the suggestion of irregular precision (0.084) to an agreeable equation (0.081), in light of the substance (0.080), and the calculation at long last, switches (0.077), while that the qualities of the scale suggestions fell consistently. As a fundamental measure that incorporates calls and accuracy, it is the last measure utilized in this examination. The test results demonstrate a consistent increment in the qualities within a month and a half of the preliminaries. The least esteem has a place with the arbitrary calculation (0.288) while the pinnacle of 0.346 compares to the situation when the ECSN calculation is connected. As such, obviously the ECSN calculation unequivocally adds to the qualities of irregular, communitarian and content-based calculations by 26%, 14% and 11%, separately. Taking everything into account, a month and a half in light of the four assessments of the most widely recognized models, to be specific precision, review and precipitation, and show that the suggestion of the calculation proposed in this examination (Switches) was fruitful in fortifying exactness of the expectation contrasted with different nations that have been contemplated and approaches actualized. Simple application calculation ECSN suggests getting existing clients for the most important articles. Moreover, new clients of informal organizations have the chance to be prescribed through more pertinent components, and the issue of making proposals for new components without settling the past characterizations by applying the ECSN calculation.

As another subject for future research, the attributes of the informal communities utilized in this investigation can be joined with the ideas of interpersonal organization examination (SNA) to propose another model to enhance the conduct and proposals of the association. The aftereffects of this exploration can be utilized, for instance, in Decision Support Systems (DSS). Another inquiry must be more concentrated research is whether it is conceivable

to enhance the weights that have been considered for the estimation of hub focuses in 1. In this hunt, contingent upon the level of significance, we considered the heaviness of 5 inclinations client particular, weight 3 for associates at the college, the principal weight is to apply inclinations of companions. In spite of the fact that the use of these weights can give a noteworthy commitment to the arrangement of the cool begin issue and furthermore enhance the precision of the forecast of the suggestions, it might be smarter to apply the methods of intelligent systems or diffuse neural systems to accomplish weights standards better [28,30]. Likewise, the informal organization, which was produced for the investigation as a working domain for the production of online analyses, can possibly be utilized in future research. The revelation of abnormalities and network examines are two pertinent research regions that can be utilized by this working condition to make their experience.

References

- [1] Chen, C.C., et al., An effective recommendation method for cold start new users using trust and distrust networks. *Information Sciences*, 2012.
- [2] Xiao, Y., et al., Analyzing, modeling, and simulation for human dynamics in the social network. *Abstract and Applied Analysis*, 2012.
- [3] Yuan, G., S. Xia, and Y. Zhang, Interesting Activities Discovery for Moving Objects based on Collaborative Filtering. *Mathematical Problems in Engineering*, 2013. 2013: p. 1 - 9.
- [4] Rohani, V.A. and O.S. Hock, On Social Network Web Sites: Definition, Features, Architectures and Analysis Tools. *Journal of Advances in Computer Research*, 2010. 1(2): p. 41-53.
- [5] Kim, H.-N., A. El-Saddik, and G.-S. Jo, Collaborative error-reflected models for cold-start recommender systems. *Decision Support Systems*, 2011. 51(3): p. 519-531.
- [6] Pazzani, M. and D. Billsus, Content-based recommendation systems. *The adaptive web*, 2007: p. 325-341.
- [7] Ricci, F., L. Rokach, and B. Shapira, Introduction to recommender systems handbook. *Recommender Systems Handbook*, 2011: p. 1-35.
- [8] Lü, L., Medo, M., Yeung, C. H., Zhang, Y.-C., Zhang, Z.-K., & Zhou, T., Recommender systems. *Physics Reports*, 2012, 519(1), 1-49.
- [9] Abdullah, N.A., Content-Based Image Retrieval Based on Electromagnetism-Like Mechanism. *Mathematical Problems in Engineering*, 2013. 2013.
- [10] Adomavicius, G. and A. Tuzhilin, Toward the next generation of recommender systems: A survey of the state-of-the-art and possible extensions. *Knowledge and Data Engineering, IEEE Transactions on*, 2005. 17(6): p. 734-749.
- [11] Lops, P., M. Gemmis, and G. Semeraro, Content-based recommender systems: State of the art and trends. *Recommender Systems Handbook*, 2011: p. 73-105.
- [12] Schein, A.I., et al. Methods and metrics for cold-start recommendations. in *Proceedings of the 25th annual*

- international ACM SIGIR conference on Research and development in information retrieval. 2002. ACM.
- [13] Ahn, H.J., A new similarity measure for collaborative filtering to alleviate the new user cold-starting problem. *Information Sciences*, 2008. 178(1): p. 37-51.
- [14] Park, S.-T. and W. Chu. Pairwise preference regression for cold-start recommendation. in *Proceedings of the third ACM conference on Recommender systems*. 2009. ACM.
- [15] Saini, S. and L. Banda, Improving Scalability Issues Using Gim In Collaborative Filtering Based On Tagging. 1963.
- [16]
- [17] Melville, P., R.J. Mooney, and R. Nagarajan. Content-boosted collaborative filtering for improved recommendations. in *Proceedings of the National Conference on Artificial Intelligence*. 2002. Menlo Park, CA; Cambridge, MA; London; AAAI Press; MIT Press; 1999.
- [18] M. Sun, F. Li, J. Lee, K. Zhou, G. Lebanon, and H. Zha, "Learning multiple-question decision trees for cold-start recommendation," in *Proceedings of the 6th ACM International Conference on Web Search and Data Mining*, pp. 445–454, Association for Computing Machinery, Rome, Italy.
- [19] P. Melville, R. J. Mooney, and R. Nagarajan, "Content-boosted collaborative filtering for improved recommendations," in *Proceedings of the National Conference on Artificial Intelligence*, AAAI Press, MIT Press, London, UK, 1999.
- [20]
- [21] Park, S.-T., et al. Naïve filterbots for robust cold-start recommendations. in *Proceedings of the 12th ACM SIGKDD international conference on Knowledge discovery and data mining*. 2006. ACM.
- [22]
- [23] X. N. Lam, T. Vu, T. D. Le, and A. D. Duong, "Addressing cold-start problem in recommendation systems," in *Proceedings of the 2nd International Conference on Ubiquitous Information Management and Communication (ICUIMC '08)*, pp. 208–211, Siem Reap, Cambodia, 2008.
- [24] S. Sahebi and W. W. Cohen, "Community-based recommendations: a solution to the cold start problem," in *Proceedings of the Workshop on Recommender Systems and the Social Web (RSWEB '11)*, 2011.
- [25] J. Bobadilla, F. Ortega, A. Hernando, and J. Bernal, "A collaborative filtering approach to mitigate the new user cold start problem," *Knowledge-Based Systems*, vol. 26, pp. 225–238, 2012.
- [26] P.-Y. Zhu and Z. Yao, "Cold-start collaborative filtering based on user registration process," in *Proceedings of the 19th International Conference on Industrial Engineering and Engineering Management*, 2013.
- [27] H. Ma, D. Zhou, C. Liu, M. R. Lyu, and I. King, "Recommender systems with social regularization," in *Proceedings of the 4th ACM International Conference on Web Search and Data Mining (WSDM '11)*, pp. 287–296, 2011. View at Publisher ·
- [28] X. Zhou, Y. Xu, Y. Li, A. Josang, and C. Cox, "The state-of-the-art in personalized recommender systems for social networking," *Artificial Intelligence Review*, vol. 37, no. 2, pp. 119–132, 2012.
- [29] P. Bonhard, C. Harries, J. McCarthy, and M. A. Sasse, "Accounting for taste: using profile similarity to improve recommender systems," in *Proceedings of the Conference on Human Factors in Computing Systems (SIGCHI '06)*, pp. 1057–1066, Association for Computing Machinery, Québec, Canada, 2006.
- [30] A. Said, R. Wetzker, W. Umbrath, and L. Hennig, "A hybrid PLSA approach for a warmer cold start in folksonomy recommendation," in *Proceedings of the Workshop on Recommender Systems & the Social Web (RecSys'09)*, pp. 87–90, New York, NY, USA, 2009.
- [31] T. Qiu, G. Chen, Z.-K. Zhang, and T. Zhou, "An item-oriented recommendation algorithm on cold-start problem," *Europhysics Letters*, vol. 95, no. 5, Article ID 58003, 2011.
- [32] M. Yan, J. Sang, T. Mei, and C. Xu, "Friend transfer: cold-start friend recommendation with cross-platform transfer learning of social knowledge," in *Proceedings of the IEEE International Conference on Multimedia and Expo (ICME '13)*, pp. 1–6, San Jose, Calif, USA
- [33] Z.-K. Zhang, C. Liu, Y.-C. Zhang, and T. Zhou, "Solving the cold-start problem in recommender systems with social tags," *Europhysics Letters*, vol. 92, no. 2, Article ID 280002, 2010.