**A Trust Enhanced Recommender System for Medicare Applications**

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**Link to the paper** : <https://ieeexplore.ieee.org/abstract/document/7229734>

**Summary** : In the system accommodates **a trust factor** in the classical recommender system and **reaps the efficiencies of the k-means++ algorithm**, which provides the **threshold rating for the cold start users**. The number of clusters required is computed using the **slope statistic method**. The results of the work show that the proposed system provides **cost effective recommendations**.

**Research on recommender systems that exist** :

1. Social tagging systems – where the user gives implicit feedback and the tagging is done and recommendations are provided.
2. Memory based algorithms – make use of user-item database to predict the required goal.
3. Neighbour-based approach – where we see the neighbours of the new user and take mean of all ratings and predict.
4. Model based approaches like Bayesian Collaborative Filtering – they incorporate missing data , also does co-clustering of users and items to improve the model’s accuracy and robustness.

**Challenges in recommender systems** :

1)Cold start is the unavailability of information at the beginning for a fresh user.

2) Explainability is distracting recommendation by intuitive reasoning, where shilling attacks are giving a biased and an intentional rating to distract other users.

3) Synonymy refers to a large amount of same item called in different names.

4) Grey sheep is due to the users who are in part of no group, (i.e.) users don't share any common interest with any other users

**System Architecture** :

Diagram

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**Two recommender systems have been shown in the paper**

1. **Blood donor recommender system** 
   1. Interaction between two users rather than a user and an item.
   2. User will make a request to a set of finite donors.
   3. User is given a success factor which refers to how successful the user is in getting the required amount of donors.
   4. Donor will respond to user request
   5. Then the donor is given a trust score – that describes the characteristics of the donor.
   6. So at the end a user has a trust network of donors and vice versa.
   7. The user preference and history of actions are stored.
   8. Every user is assigned the top donors who have more possibility of getting requested by the user. This is done by learning the condition history of the user.
   9. Similarly, every donor is assigned a set of users from which the donor has a higher possibility of getting a request next time. This is done by learning the previous responses of donor under different condition.
   10. The errors in prediction are calculated as the ratio of the number of false predictions to the total number suggested.
   11. Hence the trusted associated with each user and each donor gets updated. Similarity among users and donors are calculated by means of k means.
   12. The similar users are clustered to a single group. Thus, the system gains the efficiencies of model based collaborative filtering. Slope statistic algorithm is used to determine the optimal number of clusters to be taken (i.e.) the value of k
   13. Trust score calculation :

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* 1. Dealing with the cold-start problem :
     1. If the number of direct trusted donors is less than the need the donors from similar users are returned.
     2. When a new donor enters the system it clustered with zero trust score. The cluster to which the donor mapped is the most accurate one since the trust score is greater than or equal to zero always and hence the donor moves closer to the center as the trust score increases.
     3. When a new user arrives, the top-x donor in each blood group is assigned and the user is clustered with zero success factors.

1. **Hospital recommender system :**
   1. The hospitals are given a Health Care Yalue (HCY) based on the feedback from the users under different conditions such as specialization, hospitality, hygiene, number of successful operations and healthcare, availability and charges
   2. The feedbacks on these constraints from different users are stored
   3. Algorithm is showcased in the paper to determine the health care values.
   4. Problems are handled as :
      1. User is intentional – to prevent this feedback impacts the HCV of the hospital depending on the previous feedback given by the other users.
      2. Cold Start : When a new hospital is added' its HCY is predicted after handling two cases:
2. If the hospital has a sister-node (hospital from same institutions), their HCYs are considered.
3. If the hospital is a fresh institution, the HCY is predicted by an unsupervised learning agent which takes as input the HCYs of hospitals with proximal distance function and gives the HCY of the newer one

**Experimental results obtained and evaluation:**

Chart, line chart

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