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Structural Balance Theory based Recommendation System

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Abstract - *The project helps to recommend product using SBT based recommendation is that due to the sparseness of big rating data in E-commerce, similar friends and similar product items may be absent from the user-product purchase network, which leads for a big challenge to recommend appropriate options to the user. Our system provides user-specific recommendations based on the enemy of an enemy is a friend concept.*

Key Words: Recommendation, Big data, SBT.

1.INTRODUCTION

The proposed system helps E-commerce websites to predict the user's preference and recommending items which is the major factor for success of E-commerce websites. If any person searches for a particular product, he gets the same set of recommendations whereas SBT provides user-specific recommendations based on enemy of an enemy is a friend concept. We aim to enhance the recommendation of product in e-commerce website through possible friends, according to enemy's enemy is a friend concept of SBT, and recommend the product items preferred by possible friend to the user.

1.1 Techniques Used

A. Structural balance theory

Structural balance theory (SBT) is based on the assumption that certain types of relationships when viewed from a local perspective are more natural for psychological reasons [2]. The local level is defined as a triangle or triad consisting of relationships between three people. It is natural for three people to be friends: Alice (A) is friends with Bob (B), Bob is friends with Chris (C) and Chris is friends with Alice. This triangle (marked (1) in Figure 1) is considered completely positive. Similarly, a relation where two friends, Bob and Chris have a common enemy Alice, is also natural (triangle (2) in Figure 1). It is considered that in such natural relationships, there is no tension in the interactions. However, it is less natural for Alice and Bob, and Alice and Chris to be friends, but Bob and Chris to be enemies (triangle (4) in Figure 1). This situation is likely to generate tension as now Alice must avoid spending time with Bob when Chris is around. As a result, all definitions of structural balance would consider triangles 1 and 2 as balanced, and 4 as imbalanced. The last type of relationship is one containing all negative edges. This type of relationship can be considered balanced as there is no specific conflict when three people all dislike each other but spend no time together. As a result, in Davis's weak structural balance theory (WSBT), triangle (3) is considered balanced [2][4]. However, there is an opportunity for one of the pairs in this triangle to become friends, and team up against the common enemy. For this reason, (strong) SBT, considers triangle (3) unbalanced as well [3][2]. A complete network in which all pairs of people are connected to each other satisfies the WSBT if all triangles in it are balanced with respect to WSBT.

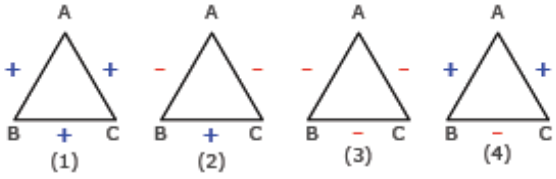

Fig -1: Classic structural balance with four different types of triads

Guha et. al. [5] introduce one of the earliest methods that addresses the propagation of both trust and distrust. They propose the concepts of direct propagation, co-citation and backwards propagation, and compute trust propagation by repeating matrix operations that combine the three types of propagations. They report an overall 85% prediction accuracy over data samples from Epinion that has equal number of positive and negative edges. Leskovec, Huttenlocher and Kleinberg [7] conduct a series of experiments on three large datasets: Epinions, Slashdot and Wikipedia. In particular, they collect two classes of features, one of which is based on degree and the other is based on triads. These relatively local features form a high dimensional space on which they perform standard machine learning methods and perform edge sign predictions. Similar to our work, they interpret some of their results in terms of the classical balance theory [3], but unlike our work, they do not use balance theory as a starting point.

Balance theory was initiated by Heider (1946) [6]. He analysed a simple P-O-X system composed of two persons P and O, with a fixed symmetric positive or negative P-Relationship, who are oriented differently in sign to the same object X. Heider focused on P's response to different states of this constrained system. Newcomb (1961), attending to Heider's work, proposed an A-B-X system with more moving parts. The A-B sentiment symmetry constraint is relaxed, AorB's signed orientation to Xmay alter, and AorB's sentiments toward one another may alter. In Cartwright and Harary's (1956) advancement of balance theory, the object X

is another individual, and all triads of individuals are nested in a sentiment network in which each individual has an alterable positive or negative sentiment toward every other individual. This is a system with many moving parts. It is in Cartwright and Harary's American journal of sociology work that Simmel's triad surfaces in an especially interesting way and where the macro structural implications of balance theory are formalized. The set of assumptions involved in their analysis is now referred to as the classic model of structural balance. Using the term "friend" to designate a positive sentiment and the term "enemy" to designate a negative sentiment, the classic balance model defines a sentiment network as balanced if it contains no violations of four assumptions:

(A1) A friend of a friend is a friend,
(A2) A friend of an enemy is an enemy,
(A3) An enemy of a friend is an enemy,
(A4) An enemy of an enemy is a friend.

In these terms, the assumptions are evocative of maxims that appear in various cultures. The four rules permit some types of triads and forbid others. Cartwright andHarary showed that only two generic forms of sentiment network macrostructure are possible under these rules. The sentiment network must be either a network of all-positive sentiments or a network of individuals partitioned into two cliques with all-positive within-clique sentiments and all-negative between-clique sentiments. This discovery has sustained the interest in balance theory.

A complete balance theory should be able to deal with relationships with strengths. As a first step, we need to have a measurement of relations with various strengths. While it is arguable whether such strengths can be expressed by numerical values, it is fairly clear that the strength of any two relations can be compared. For positive relations such as liking, valuing or approving, two relationships are comparable in terms of which one is stronger than the other. Similar argument applies to two negative relations. Finally, a positive relation and a negative relation are comparable by their signs. Hence, relations with strengths by nature inherit a total ordering. A triad is the smallest unit in balance theory, within which two of its relations cause influence over the third one. Such an influence will limit the range of comfortable relations of the third relation in a balanced state; and if it goes out of range, tension occurs and participants will suffer from stress. Participants will seek relationship changes to resolve this type of stress. We call such range of relations tolerance, with which we interpret structural balance at a finer level.

2. PROPOSED SYSTEM

2.1 General Description of the System

We are proposing structural balance theory based recommendation system that applies the concept of balance theory using Structural balance theory algorithms for the recommendation process.

The application is implemented in the python programming language that guarantees the integrity, confidentiality, authentication and non-repudation. Python is object oriented and structural programming. Frameworks like Django, Pandas and libraries like numpy and scipy is used to develop this run this system.

The details of the processes are as following:

1) **Sign in and logging in:** As the user enter the system the system as the user to sign in if the user is new or log in if the user is existing user. After doing the process the system then verifies the user and for the new user as there is no user preference information available system ask user pre-defined preferences like movie genre, actor, rating (in Figure 2).

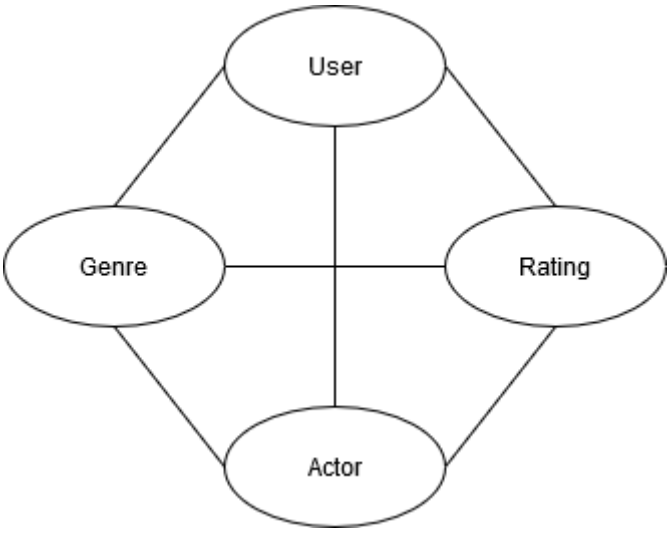

Fig -2: Proposed Structural balance theory

2) **Recommendations:** Once the system get the initial user preference information. The system will filter movies recommendation of other user whose movie preference is similar to the user using structural balance theory. If any movie does not satisfy user preference of genre, actor and rating then that movie will not be recommended to the user. If there is no other user in the system that like similar movie to the user, then the system will display top rated movie in that genre by default to help user.

2.2 Implementation Details

The implementation of structural balance theory based recommendation are as follows:

1) **Home:** When the user enters the system the system will display top rated movies by genre by default the user

need to select signup (if the user is new) or login (for existing users).

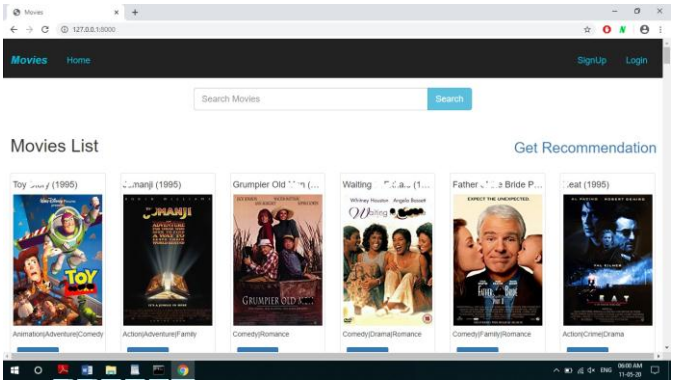

Fig -3: Home Page

2) **Sign-up Process:** If the user is new. User has to create a new login id by entering USERNAME, E-MAIL ADDRESS and PASSWORD and click submit is the email address is already associated with existing user then the system will notification that the user already exist. If the system does not find email address associated with any existing user, then the user request will be accepted and the user will be directed to the login page.

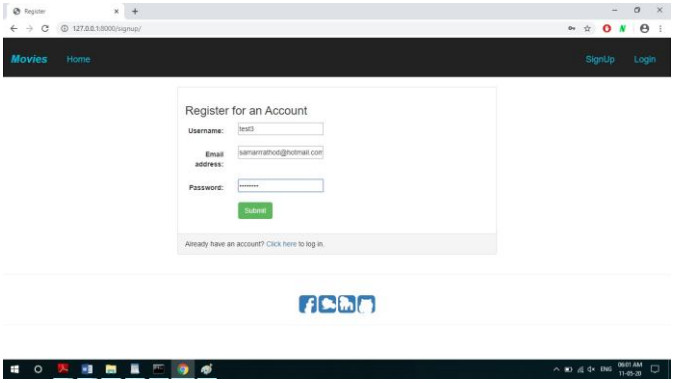

Fig -4: Sign-up Process

3) **Login process:** If the user is the existing user then needs to fill the USERNAME and PASSWORD fields. By clicking the Submit button, the login process begins and the user re-enters the home screen.

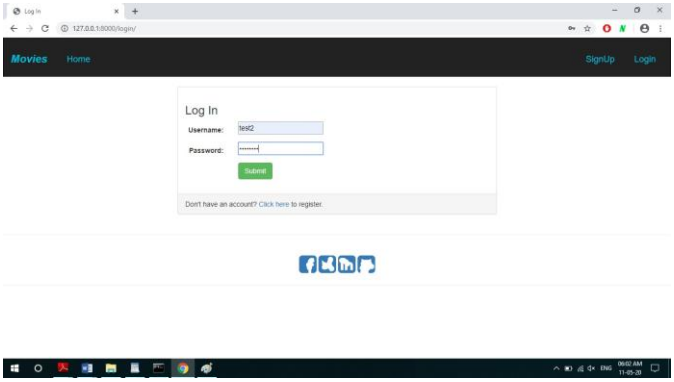

Fig -5: Login Process

4) **Recommendation Process:** After successfully logging in the use is redirected to home screen where user need to click Get Recommendation button to get the movie recommendation according to preference set by the user.

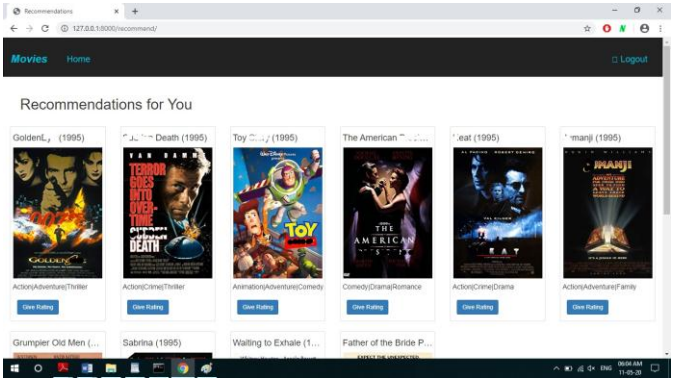

Fig -6: Recommended Movies

2.3 Actor Present in Proposed System

1) **User:** The user will be the person who will use this system for movie recommendations
2) **Database:** To store or retrieve file that the user requested

The design is made user-friendly so that any person who is not a developer can use this application.

3. CONCLUSION

In conclusion, we have developed an system that performs Structural balance theory on data of the users round the world so displays the appropriate recommendation to the user Structural Balance Theory is very useful for dealing with specific recommendation situations when the product item preferred by user have no specific friends and when the user has no specific friends.

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