*2.International Conference on*
*Theoretical and Applied Computer Science and Engineering*
*(ICTACSE, 2018)*
*Istanbul, Turkey, June 29-30, 2018*

# A Link Prediction Approach to Recommender System with Using Cosine Similarity

**Zühal Kurt[1], Kemal Özkan[2]**
*1 Mathematics and Computer Sciences, Eskişehir Osmangazi University, Eskişehir, Turkey*
*zkurt@ogu.edu.tr*
*2 Computer Engineering, Eskişehir Osmangazi University, Eskişehir, Turkey*
*kozkan@ ogu.edu.tr*

Recommendation systems is constituted of a particular type of information filtering technique that provide recommendations about items according to the interest expressed by a user. Generally, recommender systems are employed for e-commerce sites utilizing such systems or customer adapted websites, hence their success is imperative for both users and the e-commerce sites. Selling more products and services depends on precise and dependable recommendations, and also increasing user satisfaction. Person–product recommender systems can be defined as adjacency matrix with persons and products nodes and represented as bipartite graphs, also paths of these graphs have odd lengths. Recommendation in bipartite graphs can be moderated as a sub-problem of link prediction, with particular nodes (persons and products) and links (similar relations among persons/ products, and interactions between persons and products). A good link prediction function should give a higher score when there are more paths connecting two nodes, give a higher score when paths are shorter. The purpose of the eigenvalue decomposition of the adjacency matrix is allows to compute a power of the adjacency matrix as $A^k = U\Lambda^k U^T$, which can be used to define link prediction methods such as the matrix exponential, triangle closing and the Neumann kernel [2,4]. Link prediction functions change the eigenvalues, but do not change the eigenvectors, since they are spectral transformations. In the power sum of biadjacency matrix, even powers contain only intra-group values and odd powers contain only inter-group values. Therefore the sum of odd powers of bipartite graphs is important in recommender systems, the resulting link prediction function is the odd polynomial function.

First, we randomly select 10% of the items rated by each user to form a test set. The test set contains only five-star ratings and the training set contains the remaining ratings. Ratings in the training set are converted to complex numbers, if the rating is greater than or equal to three, it is replaced by j, indicating that the user expresses like for the item, when the rating is less than three, -j is provided to represent dislike, if the (user; item) pair is not contained in the training set, it is replaced by 0. We find the user- user cosine similarity matrix for and we find the item- item cosine similarity matrix for