Amazon.com has new recommendations for you based on items you purchased or told us you own.
Recommender systems?
Open Discovery Space (ODS)
A socially-powered, multilingual open learning infrastructure in Europe

Recommendations!
Which algorithm best fits ODS platform?
Towards a Trust-based Recommender for Social platforms

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Recommender algorithms

1. Content-based

2. Collaborative filtering ✓
Collaborative filtering algorithms

![Diagram showing the collaborative filtering process]

Figure 1: The Collaborative Filtering Process.
Similarity

Sparsity!
Improving prediction accuracy of recommendations

Trustworthy users == like-minded users
• Golbeck’s TidalTrust
• Trust-aware recommender by Massa and Avesani
• Andersen et al’s axiomatic approach
• T-BAR by Bellaachia and Alathel
• And many more…

All require users to give explicit trust ratings!
Centralized approaches → scalability problem

- Lathia et al.’s trust-based recommender #neal-lathia #recsys
- Trust model by O’Donovan and Smyth
A social recommender system: T-index approach

1. Description

• Trust networks: a graph
  • Nodes: users
  • Edges: trust relationships
  • Weights: trust values originating from similarity

• Each user can be assumed as an agent

• Improve the process of finding nearest neighbors
  • T-index
  • TopTrustee
A social recommender system: T-index approach

2. Trust propagation mechanism

- A new trust relationship between two far unconnected users is inferred if and only if:
  - Condition 1:
    - Mutual trust value between intermediate users is higher than a certain threshold ($v$)
  - Condition 2:
    - The number of connecting edges is lower than an upper bound ($L$)
if A trusts B and B trusts C, then A trusts C if and only if condition 1 is met and condition 2 is met
A social recommender system: T-index approach

3. T-index?

- **T-index**: measure of users’ trustworthiness
- **H-index**: the impact of publications of an author

\[
\text{Indegree (} u_a \text{) } = 7 \\
\text{Indegree (} u_b \text{) } = 5 \\
\text{T-index (} u_a \text{) } = 2 \\
\text{T-index (} u_b \text{) } = 4
\]

*Note! Cluster*: a group of users who all trust a common user as the most trustworthy one (central user)
A social recommender system:
T-index approach

3. T-index?

Algorithm 1 Computing T-index

1: procedure COMPUTE-T-index(user, TrusterList)
2:     TrusterValueList ← TrusterList.sort(trustValue, desc)
3:     for all trustValue in TrusterValueList do
4:         trustValue ← multiply(trustValue, Max_T-index)
5:     end for
6:     Counter ← 1
7:     for all trustValue in TrusterValueList do
8:         if Counter < trustValue then
9:             Counter ← Counter + 1
10:        else
11:            break
12:        end if
13:     end for
14:     T-index ← Counter - 1
15:     return T-index
16: end procedure
A social recommender system: T-index approach

4. What T-index is for?

• **TopTrustee** : a list of top raters of an item sorted by T-index
• Helps the process of finding nearest neighbors
  • Providing access to trustworthy users across the trust network including even those outside the traversal path length limit (L)
Social data
• **RQ1:** How to generate more accurate and thus, more relevant recommendations by using the social data originating from social activities of users within an online environment?

• **RQ2:** Can the use of the inter-user trust relationships that originate from the social activities of users within an online environment further evolve the network of users?
Hypothesis
• **H1**: The extended T-index algorithm outperforms the classical collaborative filtering algorithms in terms of F1 score, which is a combined value of precision and recall of the generated recommendations.

• **H2**: Using T-index-based trust relationships between users improves the structure of the trust network by providing balanced degree distribution of the users.
Data-driven study
1. Goal

To find out which recommender algorithms best performs and thus, is suitable for social online platforms like ODS platform
Data-driven study

2. Method

• Testing several recommender algorithms
  • Classical collaborative filtering algorithms using traditional nearest neighbors method
  • T-index approach using graph-based method
• Datasets
  • MovieLens – standard dataset
  • MACE, OpenScout, Travel well -- similar to the future ODS dataset
• Using Mahout
Data-driven study

3. Setting

- $v = 0.1$ (Condition 1), $L = 2$ (Condition 2)
- Training set 80% and test set 20%
- Sizes of neighborhoods $n = (3, 5, 7, 10)$
- Size of TopTrustee list $m = 5$
F1 of the extended T-index and Tanimoto algorithms for different datasets, based on the size of neighborhood.
Data-driven study
4.2. Created trust network

Without T-index

With T-index
2. Data-driven study

4.3. Degree centrality

Degree distribution of top-10 central users for different datasets
Conclusion

• The aim is to support user in social platforms to find the most suitable content or people
• Recommender systems can be a solution
• Using trust-based approaches to improve performance of recommender systems even in case of sparsity
Ongoing and Further work

• Testing recommender algorithms on more datasets coming from social networking sites
• Go online with the ODS platform (October 2013)
• User evaluation study (February 2013)
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