Recommending the Recommenders!

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Motivation

Nowadays, users:

- Provide feedback for items of different types
- Express their opinion on different social media platforms
- provide recommendations to new users (cold-start problem)

Can we find relevant source domain for cross-domain recommendation?

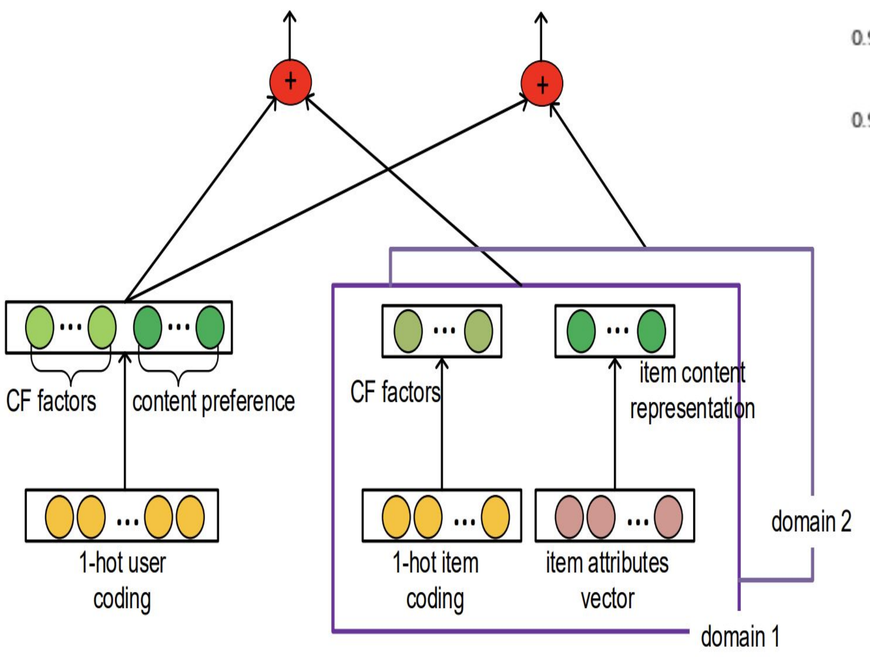
Proposed Solution

- Cross-domain recommendation helps to alleviate the sparsity
- **CCCFNet*- Unified Content-based and Collaborative Filtering**
- The content information is used to augment the CF matrix
- The proposed methodology performs better as compared to other recommendations techniques like SVD and Bayesian Matrix Factorization
- Use CCCFNet on different domains.

The loss function for the CCCFNet model is given by:

$$\mathcal{L} = \frac{1}{2}\sum_{i,j}(r_{ij}^{(1)} - U_{ia}\cdot V_j^{(1)} - U_{ib}\cdot\sum_k a_{jk}^{(1)}B_k^{(1)})^2$$
$$+\frac{\lambda_1}{2}\sum_{i,j}(r_{ij}^{(2)} - U_{ia}\cdot V_j^{(2)} - U_{ib}\cdot\sum_k a_{jk}^{(2)}B_k^{(2)})^2$$

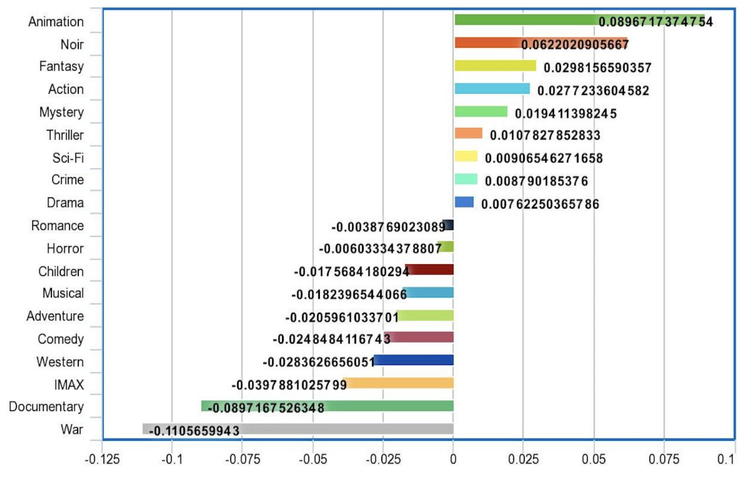
Where,
U_{ia} - User's Collaborative part
U_{ib} - User's Content preference part
V_j - Item's Collaborative part

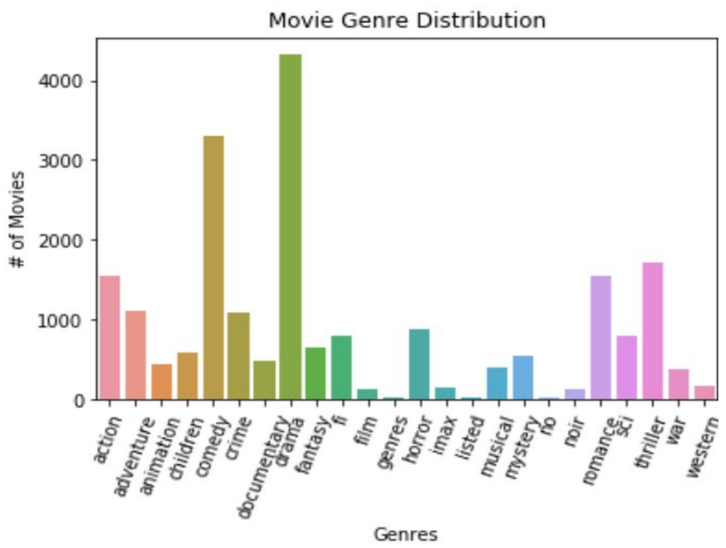


Dataset

MovieLens 100k Dataset

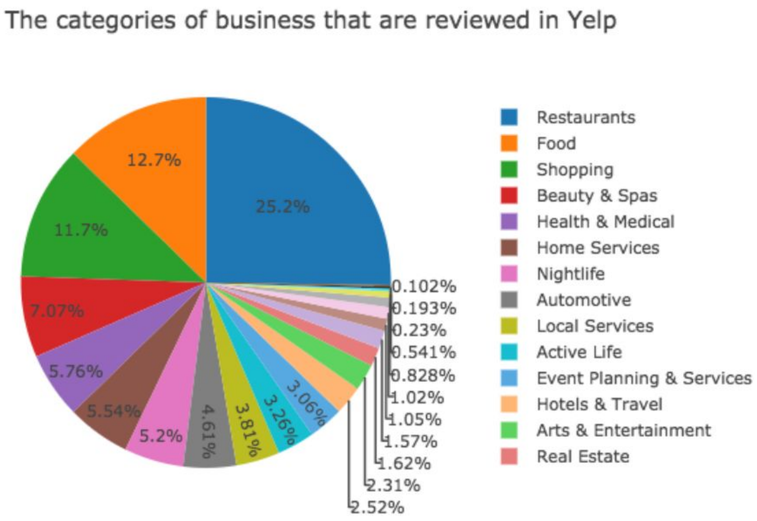
- Training data split into two parts to simulate cross domain scenario
- Movie Attributes - Represented by 19 genres
- User Attributes - Tags given by user to each movie

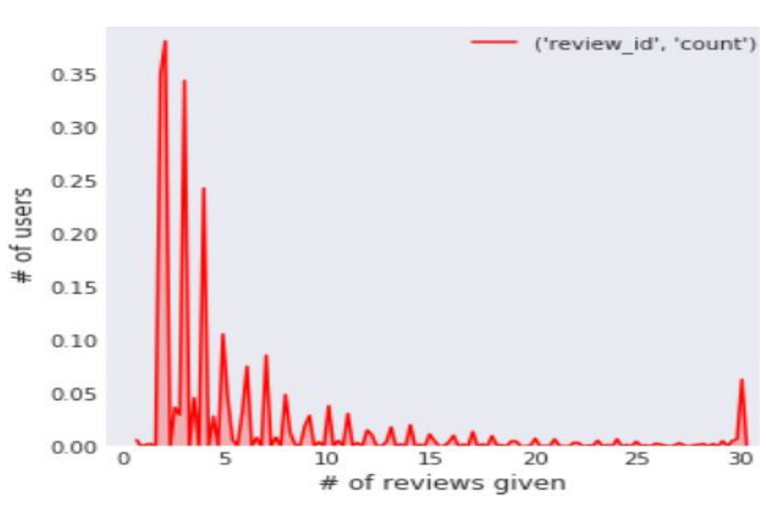




Yelp DataSet

- About 130k unique users and 520k unique reviews
- 21 broad categories in the dataset
- Evaluation was performed on Restaurant vs Food and Restaurant vs Shopping

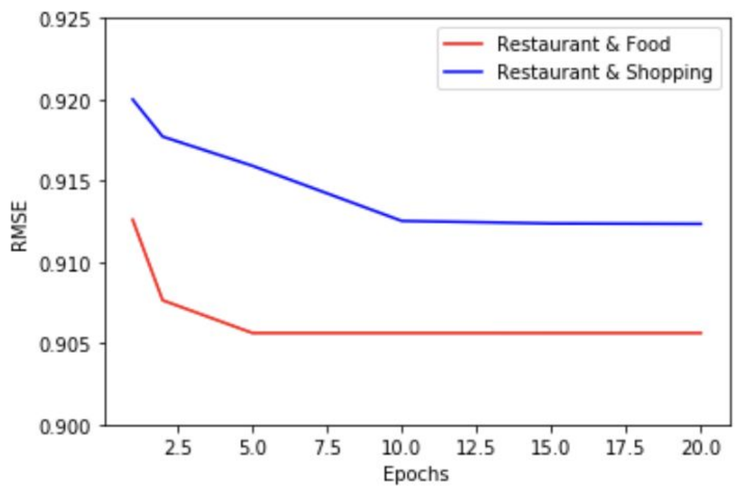




Key Findings

- Using combination of source and target domain for providing recommendations improves RMSE
- Choice of auxiliary domain remains tough
- Feeding model with more data; decreasing the sparsity level gives better results

Results



Ethical Consideration

- Assumption that interest in one domain will always map to another domain is misplaced
- Eg. Teenage kid interested in shooting games like Call of Duty might recommend violent videos

Future Work

- Applying the cross-domain CCCFNet model on multiple domains
- Applying the cross-domain CCCFNet model on different datasets
- Extending the model to automatically calculate the importance score of different source domains

Method		SVD	BMF	CCCFNet
Latent Factors		64	64	16
MovieLens	**RMSE**	0.945	0.931	0.892
Yelp (Restaurant-Shopping)	**RMSE**	0.981	0.978	0.912
Yelp (Restaurant-Food)	**RMSE**	0.978	0.971	0.905

References

Lian, Jianxun, et al. "CCCFNet: a content-boosted collaborative filtering neural network for cross domain recommender systems." *Proceedings of the 26th International Conference on World Wide Web Companion*. International World Wide Web Conferences Steering Committee, 2017.