

# Deep Latent Factor Models for Recommender Systems

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## Recommender system

- Recommends items to users.
- E.g. in e-commerce:  
*Users who like this also like this.*

## Data available to a Recommender system

- Users  $\times$  Items binary interaction matrix, also called the rating matrix  $R$ .
- User attributes  $G$ : age, location, ...
- Item attributes  $H$ : price, image, description, ...

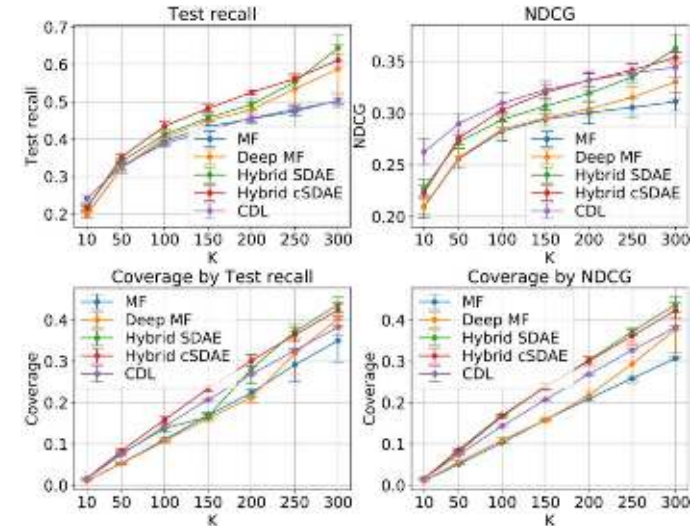
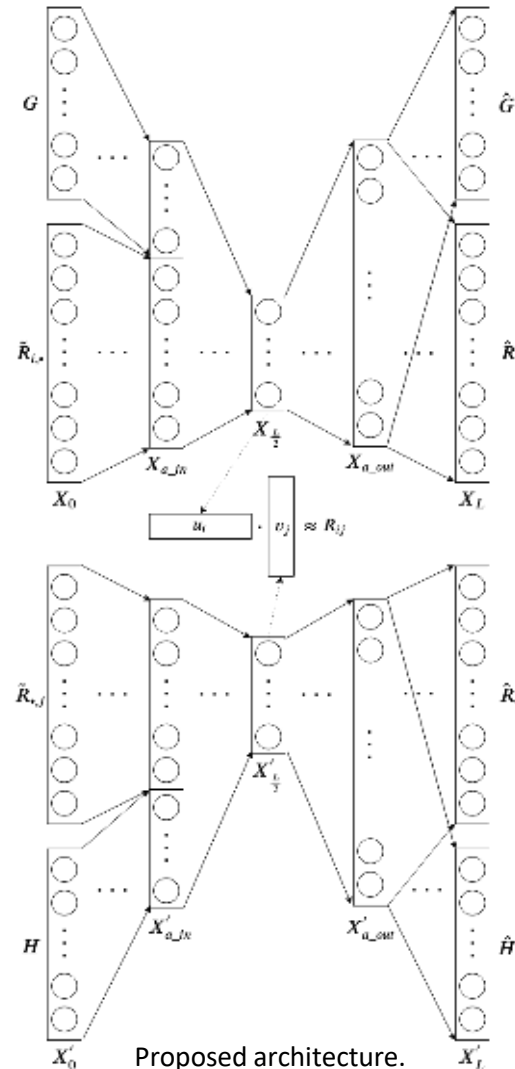
## Current recommendation models

- Use either the interactions or the attributes but almost never both of them.

## Proposed recommendation model

- Combines the interactions and the attributes.
- Recommends the item  $j$  to the user  $i$  with the highest approximated rating  $R_{ij}$ :  

$$R_{ij} \approx u_i \cdot v_j$$
- $u_i = U_i =$  latent representations of user  $i$
- $v_j = V_j =$  latent representation of item  $j$
- $U, V$  factorize the  $R \Rightarrow$  Latent Factor Model (LFM)
- The latent representations are produced by the user/item autoencoders visible in the upper/lower half of the architecture image.



Results on the BookCrossing dataset.

## Conclusion

- A novel state of the art LFM capable of combining both interaction and attribute information has been designed and implemented.
- Four state of the art LFM based on ANN were implemented, evaluated and compared to our proposed model on several standard datasets.
- The proposed model has reached similar or better results across multiple metrics.
- The robustness of the proposed model to different hyperparameters has been evaluated during multiple experiments.
- Our model has been deployed by Recombee which offers recommendation as a service.