

Deep Recommender System: Fundamentals and Advances

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Tutorial website: <https://deeprs-tutorial.github.io>

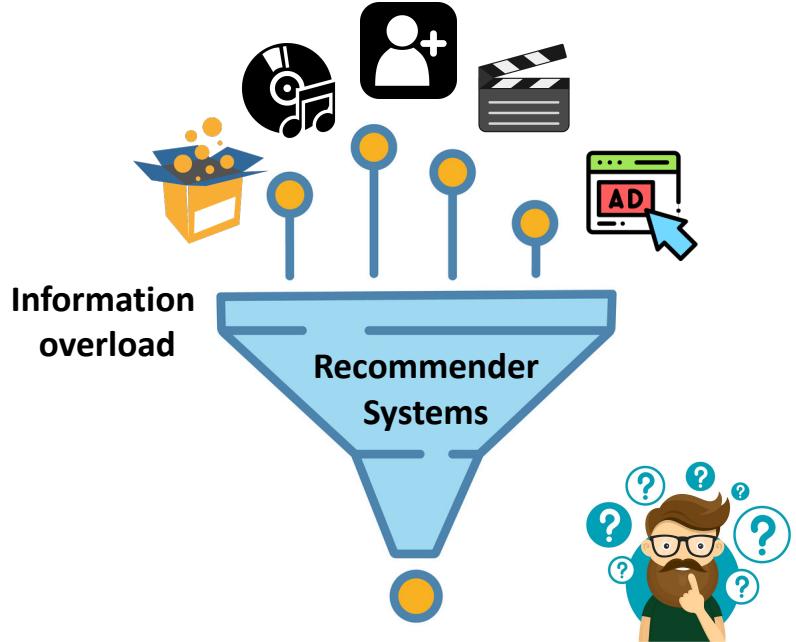


Data Science and Engineering Lab



Recommender Systems

Age of Information Explosion



Items can be: Products, News, Movies, Videos, Friends, etc.

Recommender Systems

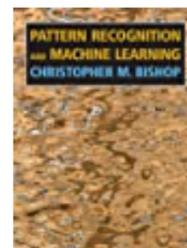
Recommendation has been widely applied in online services:

- E-commerce, Content Sharing, Social Networking ...

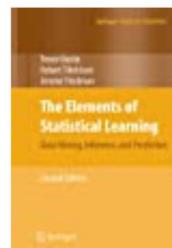


Product Recommendation

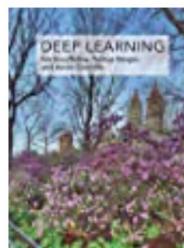
Frequently bought together



A



B



C

Total price: \$208.9

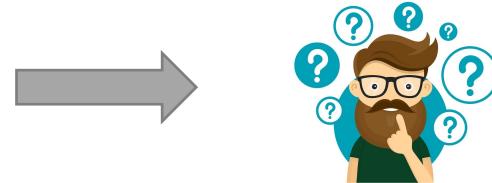
Add all three to Cart

Add all three to List

Recommender Systems

Recommendation has been widely applied in online services:

- E-commerce, **Content Sharing**, Social Networking ...

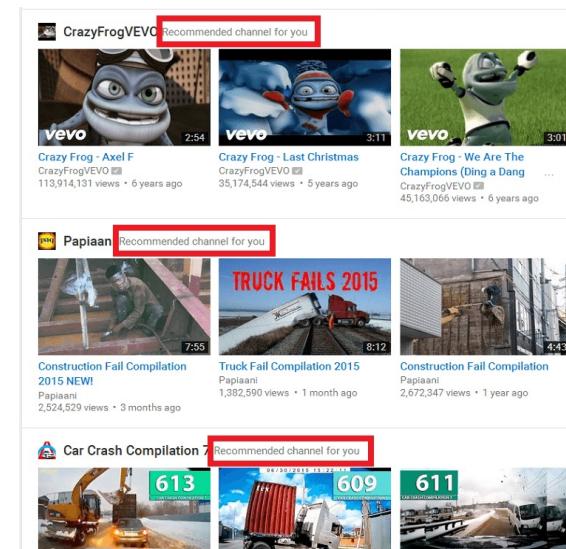


News/Video/Image Recommendation

For you
Recommended based on your interests

This Research Paper From Google Research Proposes A 'Message Passing Graph Neural Network' That Explicitly Models Spatio-Temporal Relations
MarkTechPost · 2 days ago

Tested: Brydge MacBook Vertical Dock, completing my MacBook Pro desktop
9to5Mac · 21 hours ago



Recommender Systems

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- E-commerce, Content Sharing, Social Networking ...

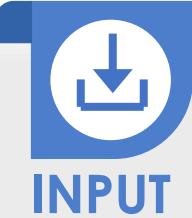


Friend Recommendation

The screenshot shows a Facebook user profile for Andrew Torba. On the left, there's a sidebar with 'FAVORITES' and links to 'News Feed', 'Messages', 'Events', 'Find Friends', 'Tech.li', 'Kuhcoon', and 'APX'. The main area displays a 'Are They Your Friends Too?' dialog box. This box lists four friends with their mutual friend counts and 'Add Friend' buttons. Below the list is a 'See All Suggestions' button.

Profile Picture	Name	Mutual Friends	Action
	User 1	1 mutual friend	Add Friend
	User 2	67 mutual friends	Add Friend
	User 3	39 mutual friends	Add Friend
	User 4	47 mutual friends	Add Friend

Problem Formulation

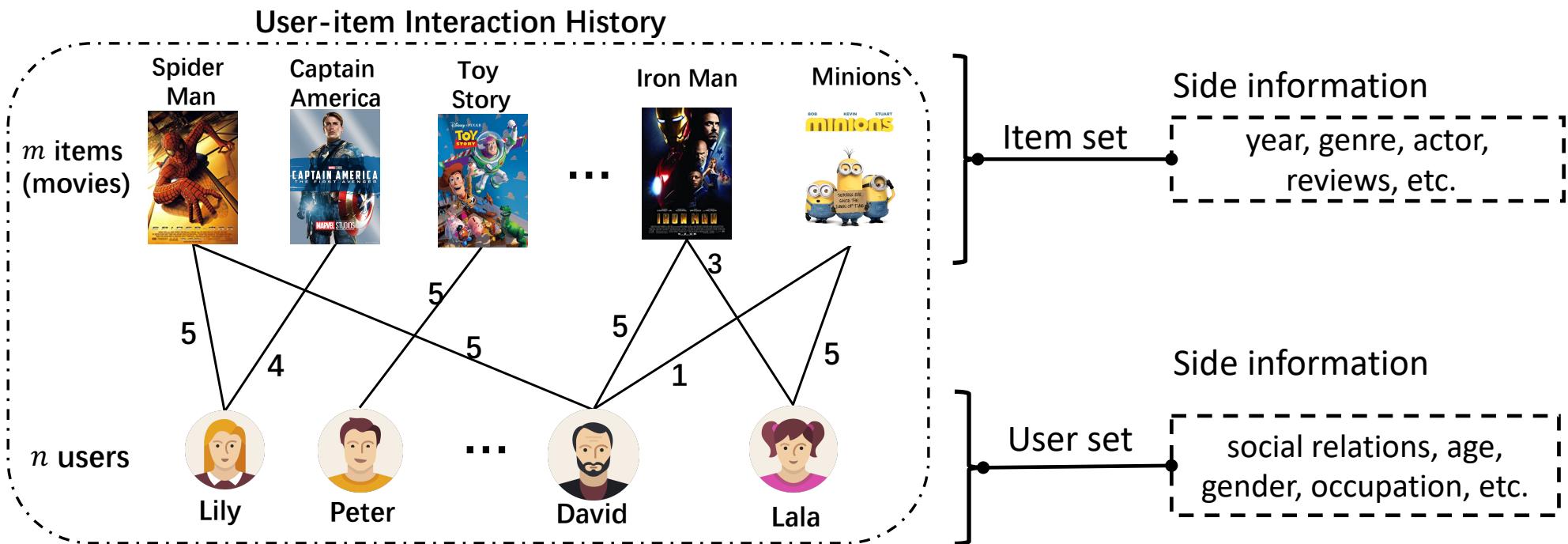


Historical user-item interactions or additional side information (e.g., social relations, item's knowledge, etc.)



OUTPUT

Predict how likely a user would interact with a target item (e.g., click, view, or purchase)

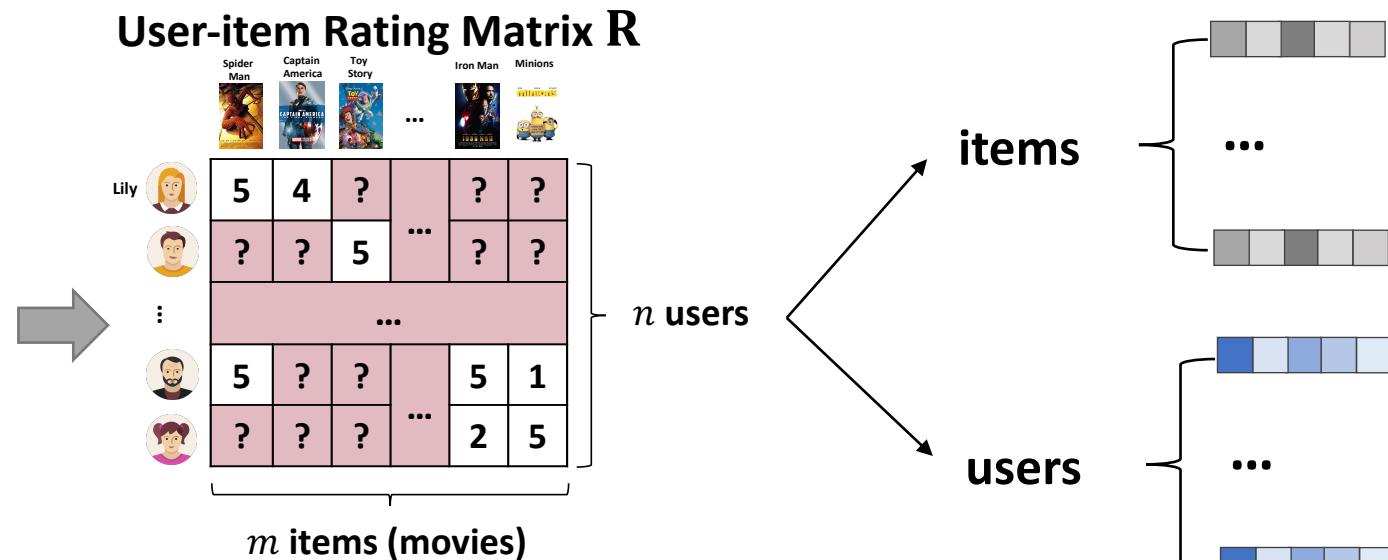
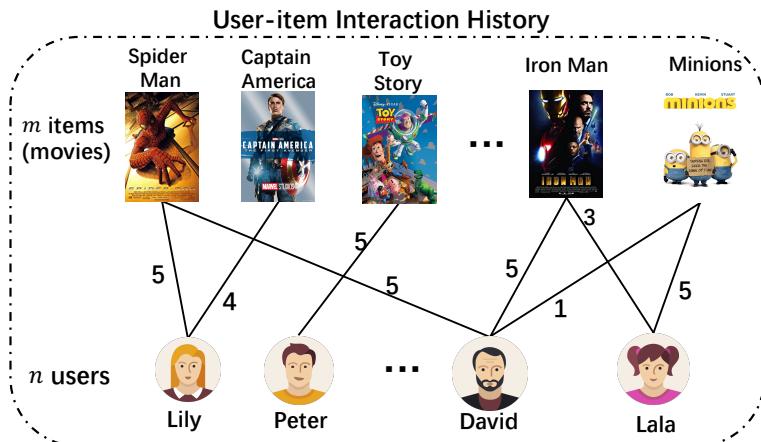


Recommender Systems

Collaborative Filtering (CF) is the most well-known technique for recommendation.

- Similar users (with respect to their historical interactions) have similar preferences.
- Modelling users' preference on items based on their past interactions (e.g., ratings and clicks).

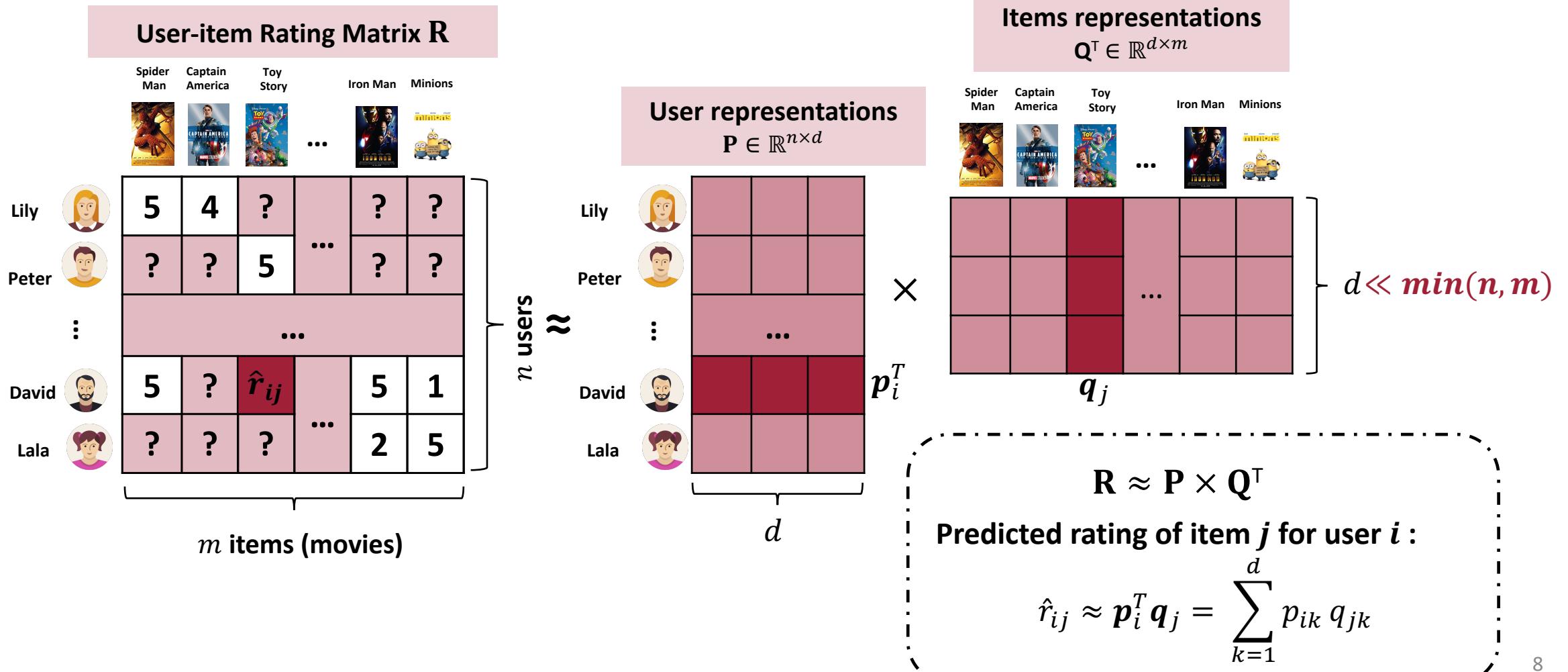
Learning representations of users and items is the key of CF.



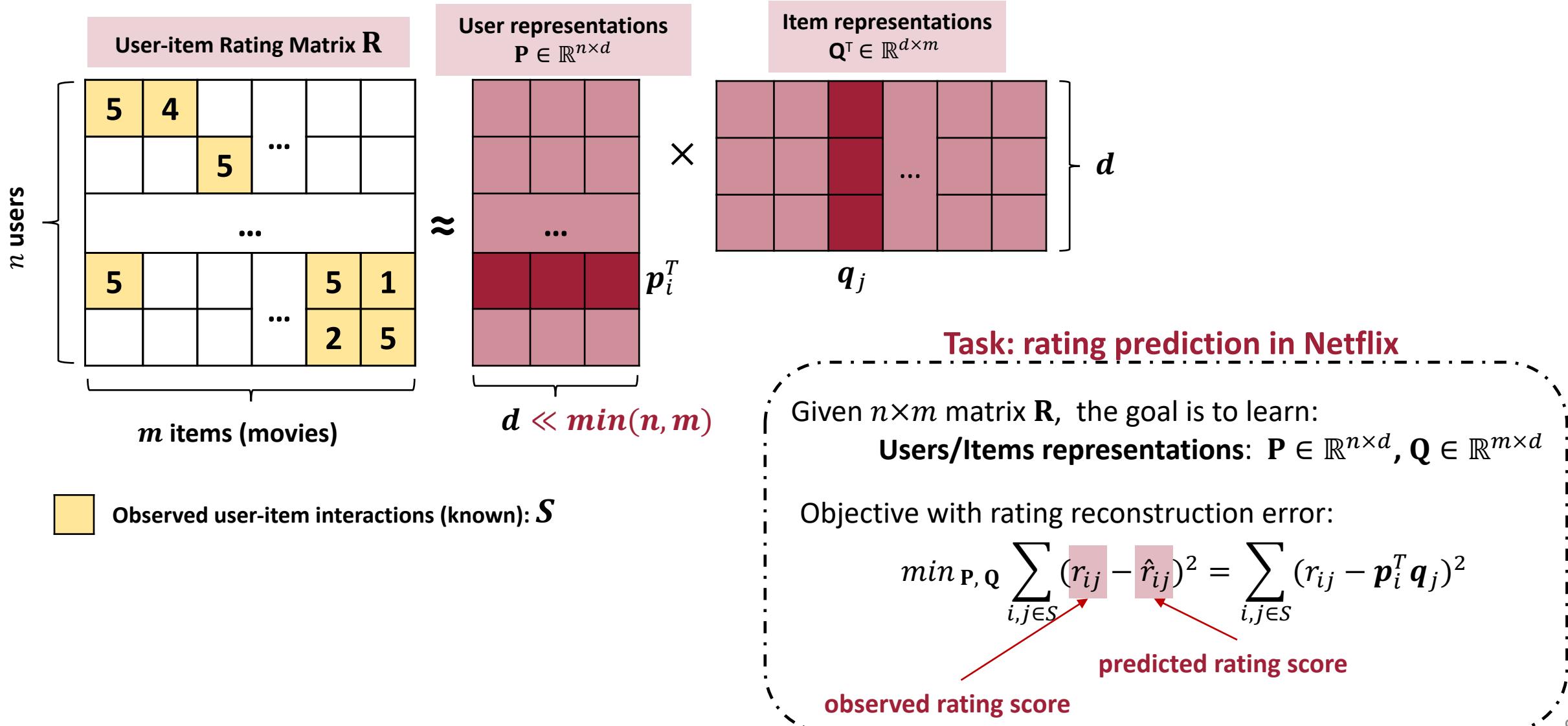
Task: predicting missing movie ratings in Netflix.

Matrix Factorization

- Learn **representations** to describe users and items based on user-item rating matrix \mathbf{R} .

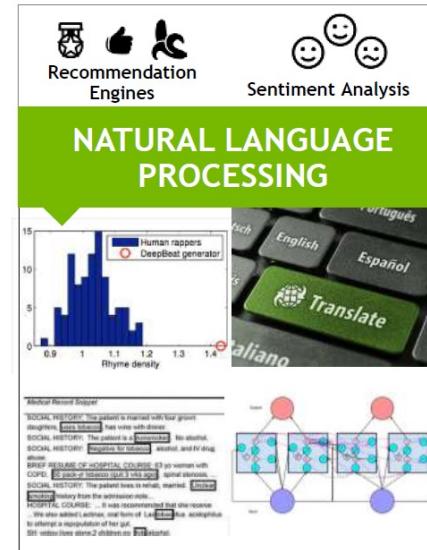
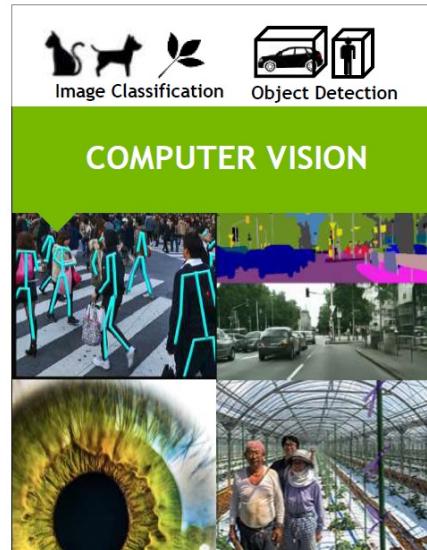
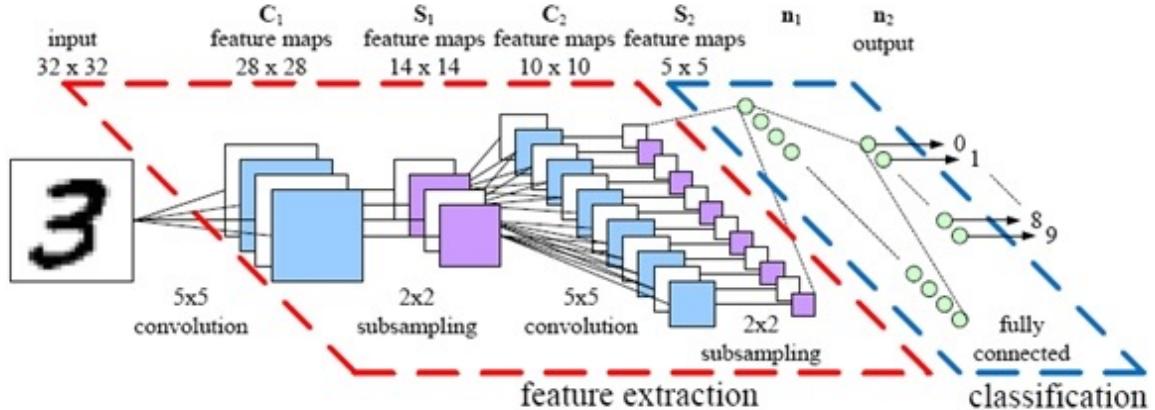
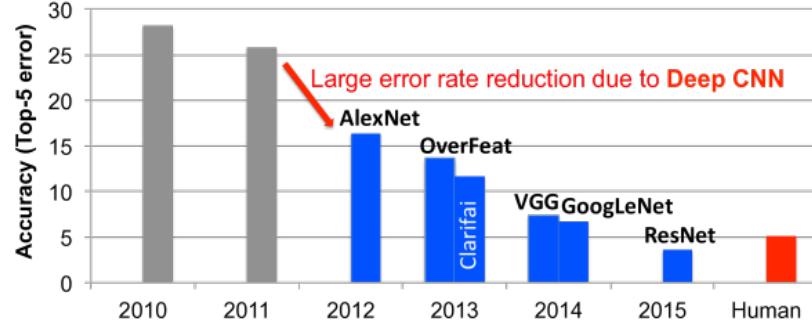


Matrix Factorization



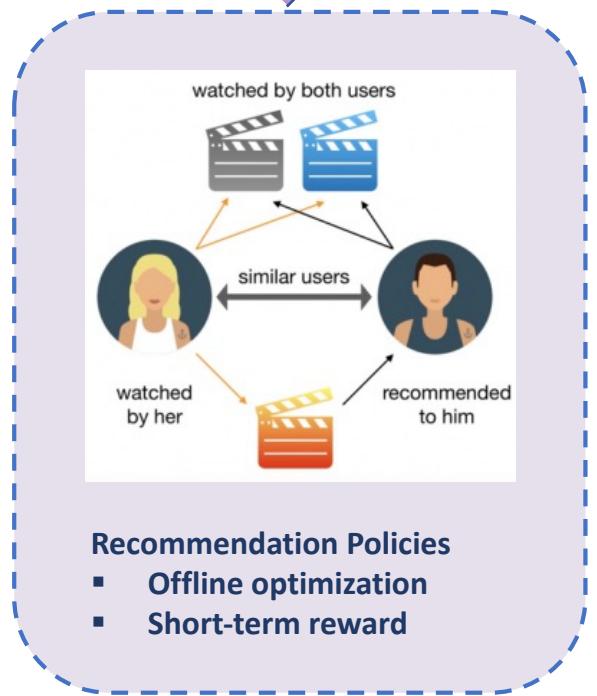
Deep Learning is Changing Our Lives

IMAGENET

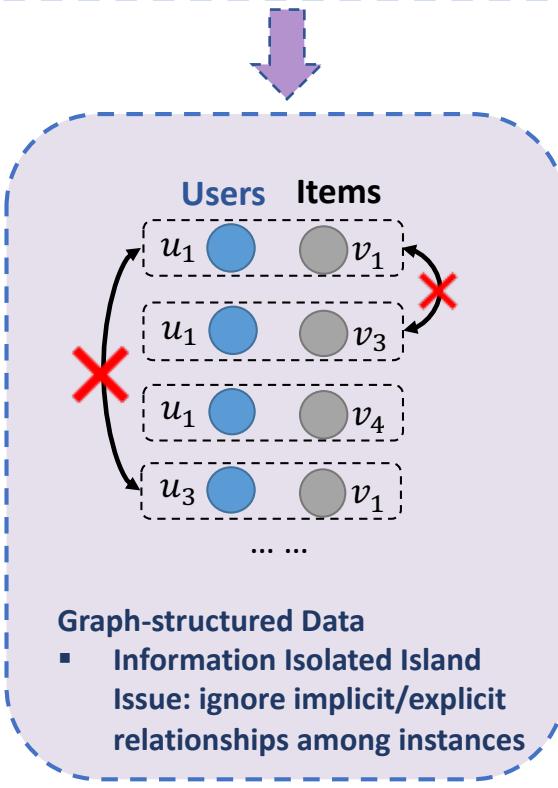


Deep Recommender Systems

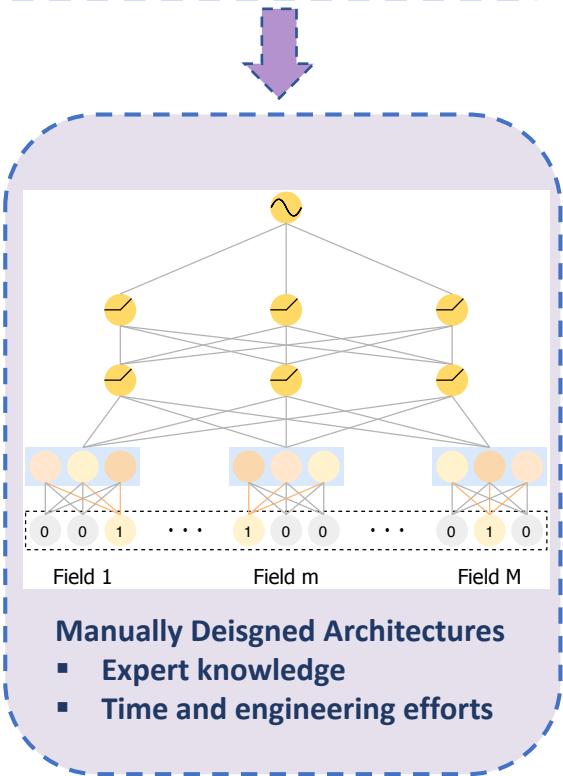
Fundamentals of Deep Recommender Systems



**Reinforcement Learning
(RL)**



**Graph Neural Networks
(GNNs)**



**Automated Machine Learning
(AutoML)**

Agenda

- 9:00 – 9:10 Introduction to Recommender Systems (Jiliang Tang)
- 9:10 – 9:35 Fundamentals of Deep Recommender Systems (Wenqi Fan)
- 9:35 – 10:15 Reinforcement Learning for Recommendations (Xiangyu Zhao)



10:15 – 10:25 Coffee Break (10 mins)

- 10:25 – 11:00 Graph Neural Network for Recommendations (Wenqi Fan)
- 11:05 – 11:35 AutoML for recommendations (Xiangyu Zhao)
- 11:35 – 11:45 Conclusion and QA session