# Recommendation Systems

July, 13 2017

# WHAT

“ A suggestion/proposal as to the best course of action”

Involves predicting user responses to options

# WHERE

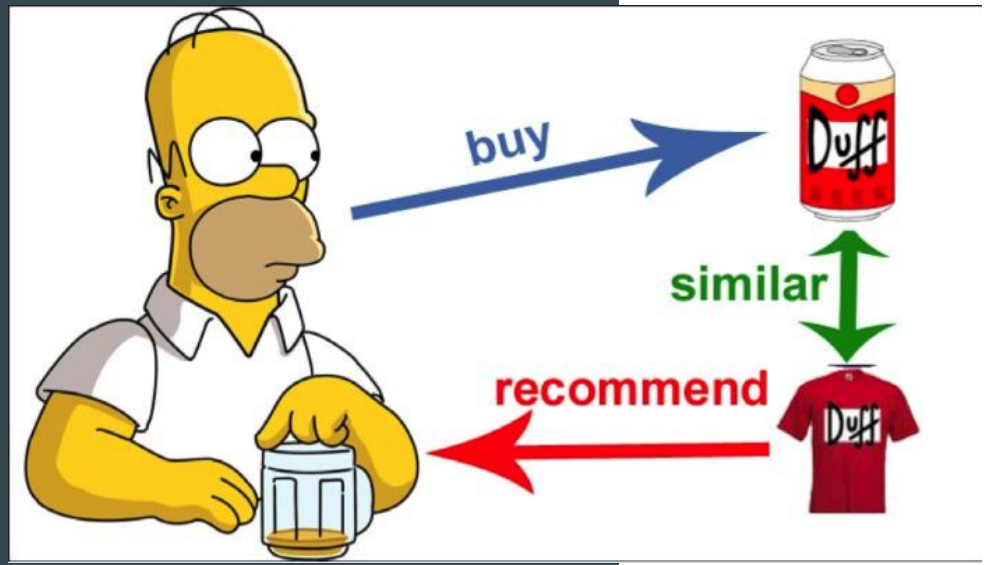
Possible applications: Product recommendations on sites like Amazon, Movie recommendations, News articles, HRS

For companies such as Netflix, and Spotify, recommender systems drive significant engagement and revenue.

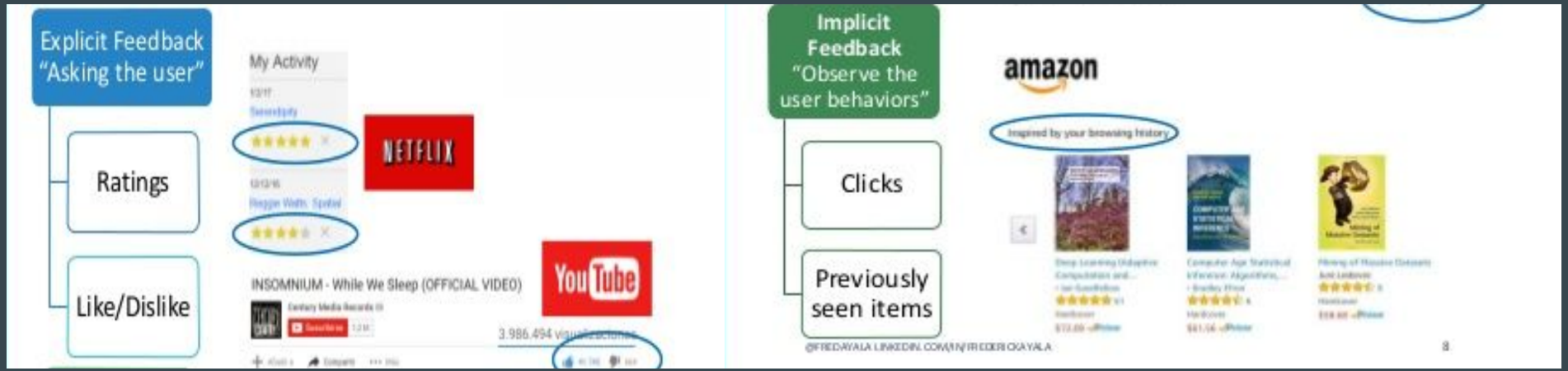
# A PRACTICAL EXAMPLE

1. Show me items similar to what I have liked in the past.
2. Tell me what's popular among my peers.
3. A bit of both ..

# Important Entities



# Kinds of feedback




Slide Courtesy: Bolazsc Leonard University

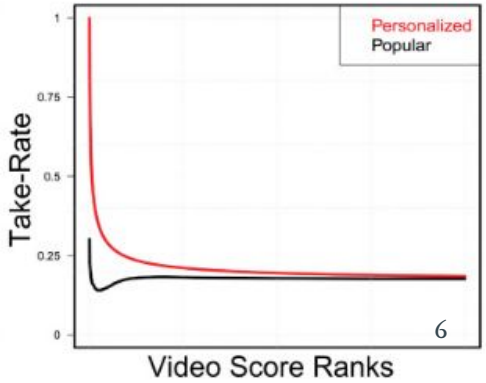
# Netflix

## Data

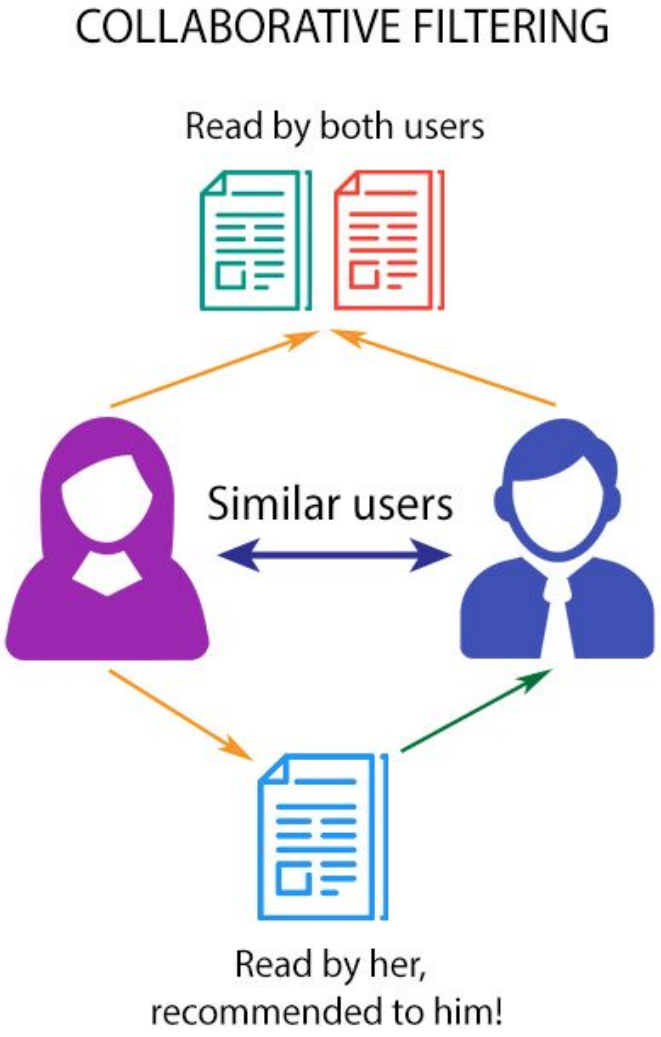
WHAT each Netflix member watches.
HOW each member watches (e.g., the device, time of day, day of week, intensity of watching).
The PLACE in the product in which each video was discovered.
Even the recommendations that were shown but NOT PLAYED in each session.

## Statistics

Influences choice for about **80% of hours** streamed at Netflix
Combined effect of personalization and recommendations save them more than $1B per year.



# Collaborative Filtering



# Dataset Features: Retail Rocket

Behavior Data: Events like clicks, add to carts, transactions

Category Tree

Item Properties

Collected over a period of 4.5 months

80% user's transactions - Train Set

20% user's transactions  - Test Set

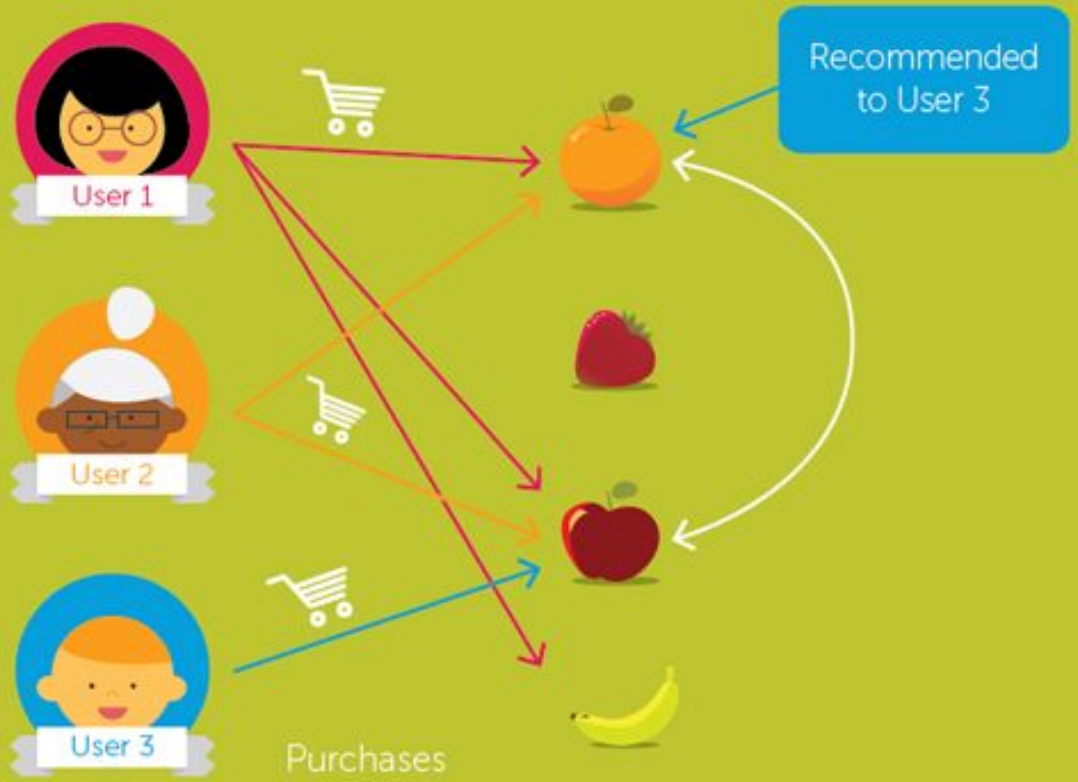
# Approach followed

User based - Find user's similar to test users and approx user-item correspondences

Item based - Find related items

Link Analysis - A graph based method

# Item-based filtering



# Good Recommendation

Problem of ground truth :

No rating available for most of the items

Considering unrated items as irrelevant?

How to count the ranked elements with unknown ground truth

**Coverage:** For how many users can we make recommendations? How many catalog items are ever recommended?

**Diversity & Novelty:** Avoiding monotone lists, discover new (families of) items

**Serendipity:** Unexpected and surprising items might be valuable

**Familiarity:** Give the user the impression of understanding his/her needs

**Biases:** Does the recommender only recommend popular items and blockbusters?

# Precision

$$\text{Precision} = \frac{\text{Total number of recommended items that match with the future transactions}}{\text{Total number of recommended items}}$$

# Recall

$$\text{Recall} = \frac{\text{Total number of recommended items that match with the future transactions}}{\text{Total number of items in the future purchases}}$$

# Evaluation

| Algorithm | Precision | Recall | F-measure |
|---|---|---|---|
| User Based | 0.054 | 0.073 | 0.062 |
| Item Based | 0.046 | 0.056 | 0.050 |
| Link Analysis | 0.144 | 0.075 | 0.089 |

# Would You Like Fries With That?

## Recommendation Systems and Revenue

Product upsell and cross-sell to existing customers.

Generate more revenue, increase customer retention and overall customer satisfaction.

*Study conducted by Wharton School reports:* Purchase-based collaborative filtering ("Consumers who bought this item also bought") - 25% lift in views -> higher likelihood of purchase.

According to one Forrester research analyst, an average of 10-30% of e-commerce revenues.

How we can do it better lies in the recommendations we provide.

# Thank You