RECOMMENDER SYSTEM IN RETAIL

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TRADITIONAL RETAIL APPROACH TO INCREASE CUSTOMER ENGAGEMENT & LOYALTY

- Traditionally **Non-personalized** channels and mass offers have had the strongest presence
- Success is difficult to measure
- Future of retail focuses on customer needs

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SHIFT TO CUSTOMER CENTRICITY

Target Customers

Based on propensity to purchase product

Personalization

Personalize each unique product based on relevance to Target customers

High Response

Significantly Increase Response

Incremental Revenue

Focused on Customer Centricity

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Who Else?

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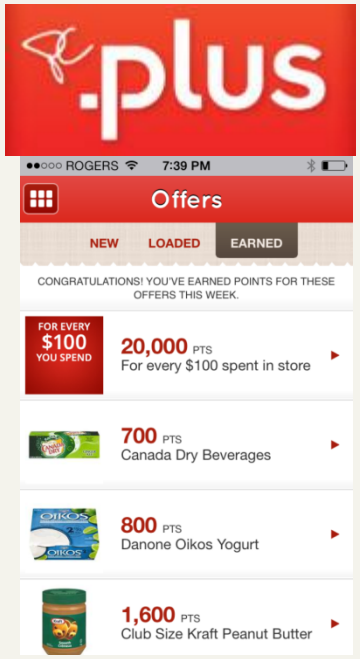
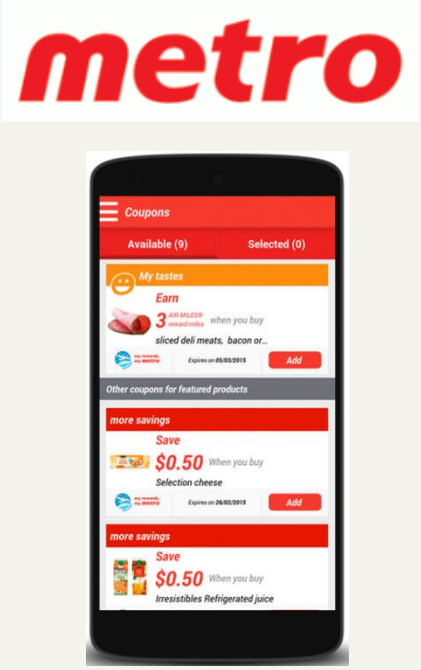
EVERYDAY APPLICATIONS OF PERSONALIZATION





RECOMMENDER SYSTEMS

RECOMMENDER SYSTEMS

- System to recommend items to users based on examples of their preferences/purchases/ratings

CURRENT STATE

STRATEGY AT SDM?

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RECOMMENDER SYSTEM AT SDM

DIRECT MAIL

DIGITAL

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CUSTOMER-CENTRIC APPROACH TO PERSONALIZATION

- Ultimate goal: Build personalization with 100% variability across all levers (currency, product, etc…) and types of offers
- Leverage Customer segments & prediction to drive offer type pairing

Offer Type	Acquisition	Onboard	Grow	Maintain	Decline
Thank You	High	Medium	Low	Medium	High
Cross-Sell	Low	Medium	Medium	Medium	Low
Up-Sell	Low	Low	High	Medium	Low
Other	Leverage “look-alike” models	New channels, vehicles (RBC, etc…)	Need to understand potential value	New products, brands, preference centre	Predict attrition, proactive approach

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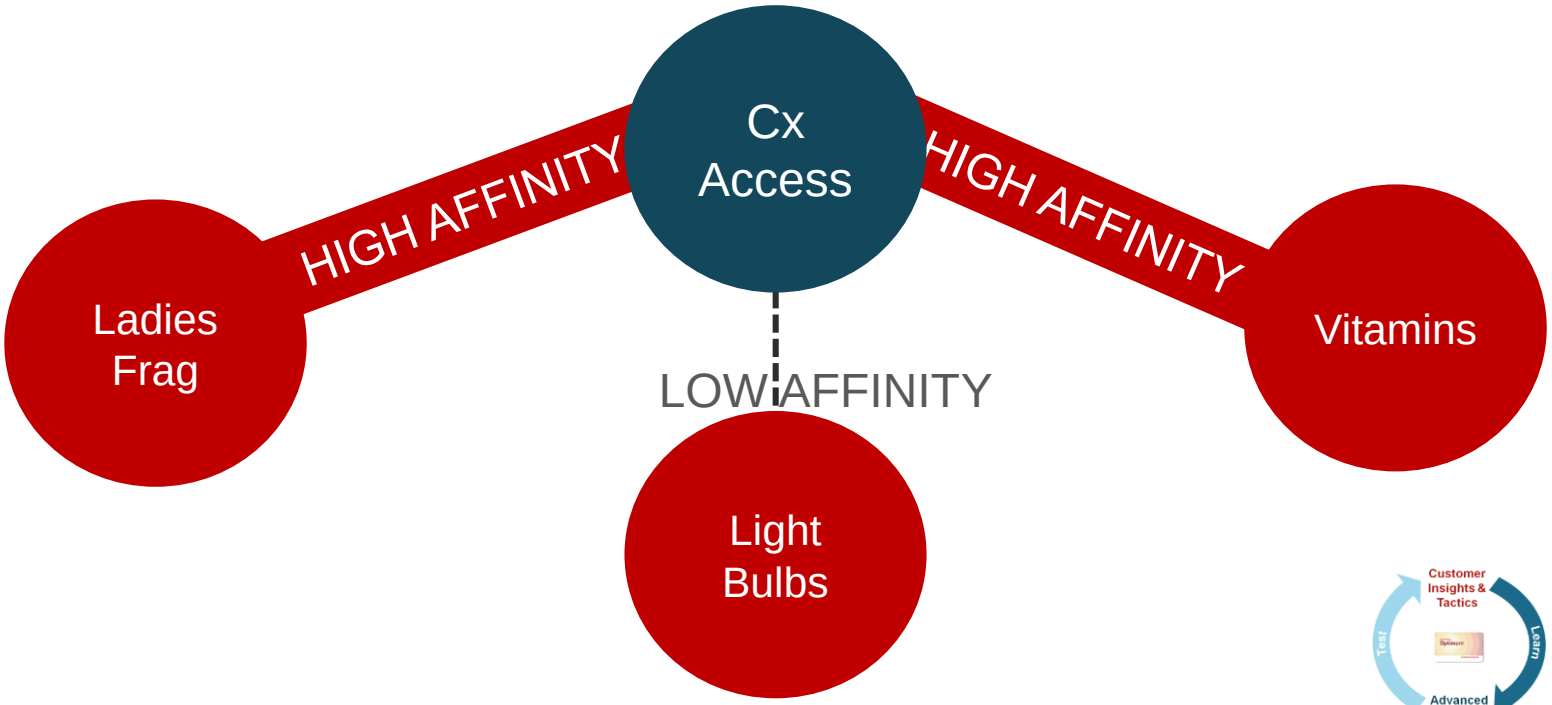
METHODOLOGY EXAMPLE - CATEGORY AFFINITY

Category 1	Category 2	
Description	Description	Affinity
Bath Products	Mens Fragrance	High
Cosmetic Accessories	Vitamins	High
Cosmetic Accessories	Ladies Fragrance	High
Derm Face & Body	Skin Care	Medium
Derm Face & Body	Prestige Facl Trtmt	High
Face & Body Colours	Skin Care	High



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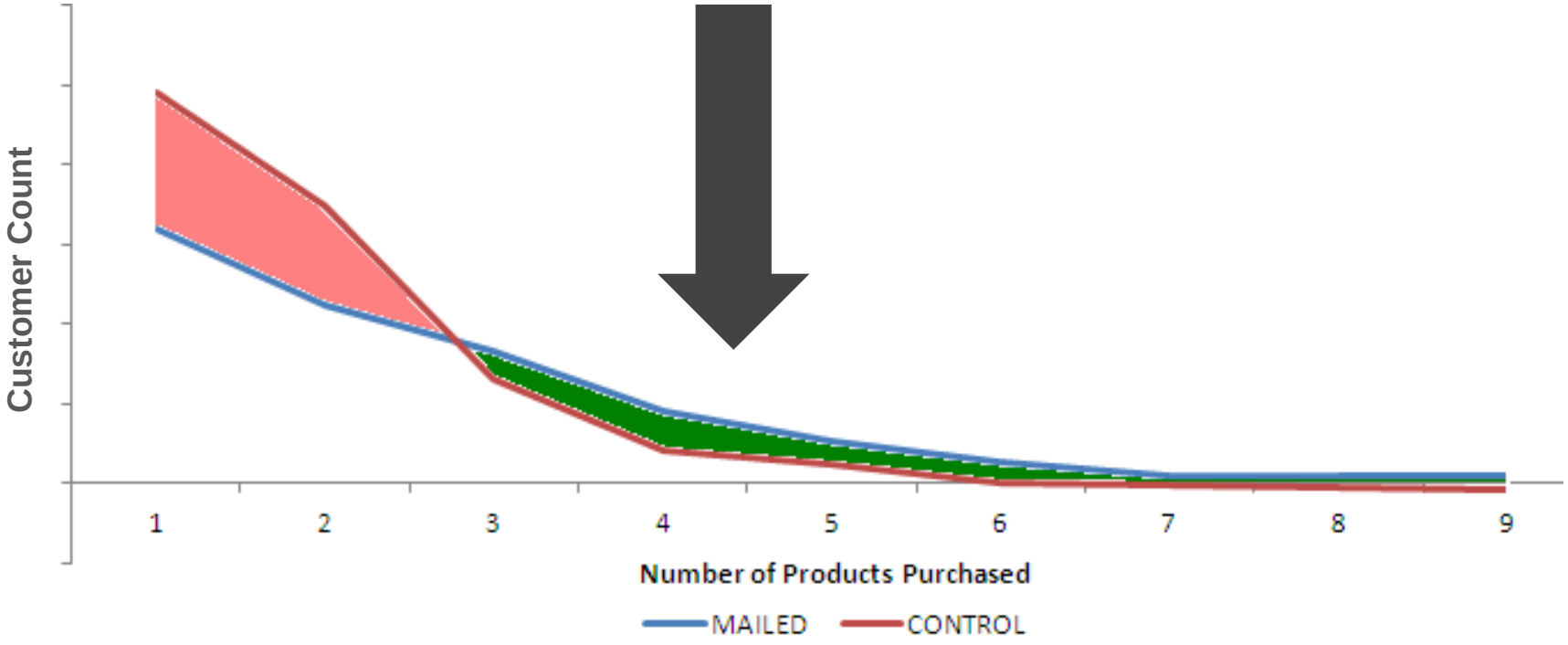
DIRECT MAIL EXAMPLE

Increase Incremental Sales and Profitability by focusing on customers purchasing more products per basket



CURRENT STATE

HOW WE DO IT AT SDM?

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TWO APPROACHES TO RECOMMENDER SYSTEMS:

Content Based

- Focuses on **properties** of **items**
- Similarity of items is determined by measuring the similarity in their properties
- Example: Profiling of Internet Movie Database (IMDB) - assigns a genre to every movie

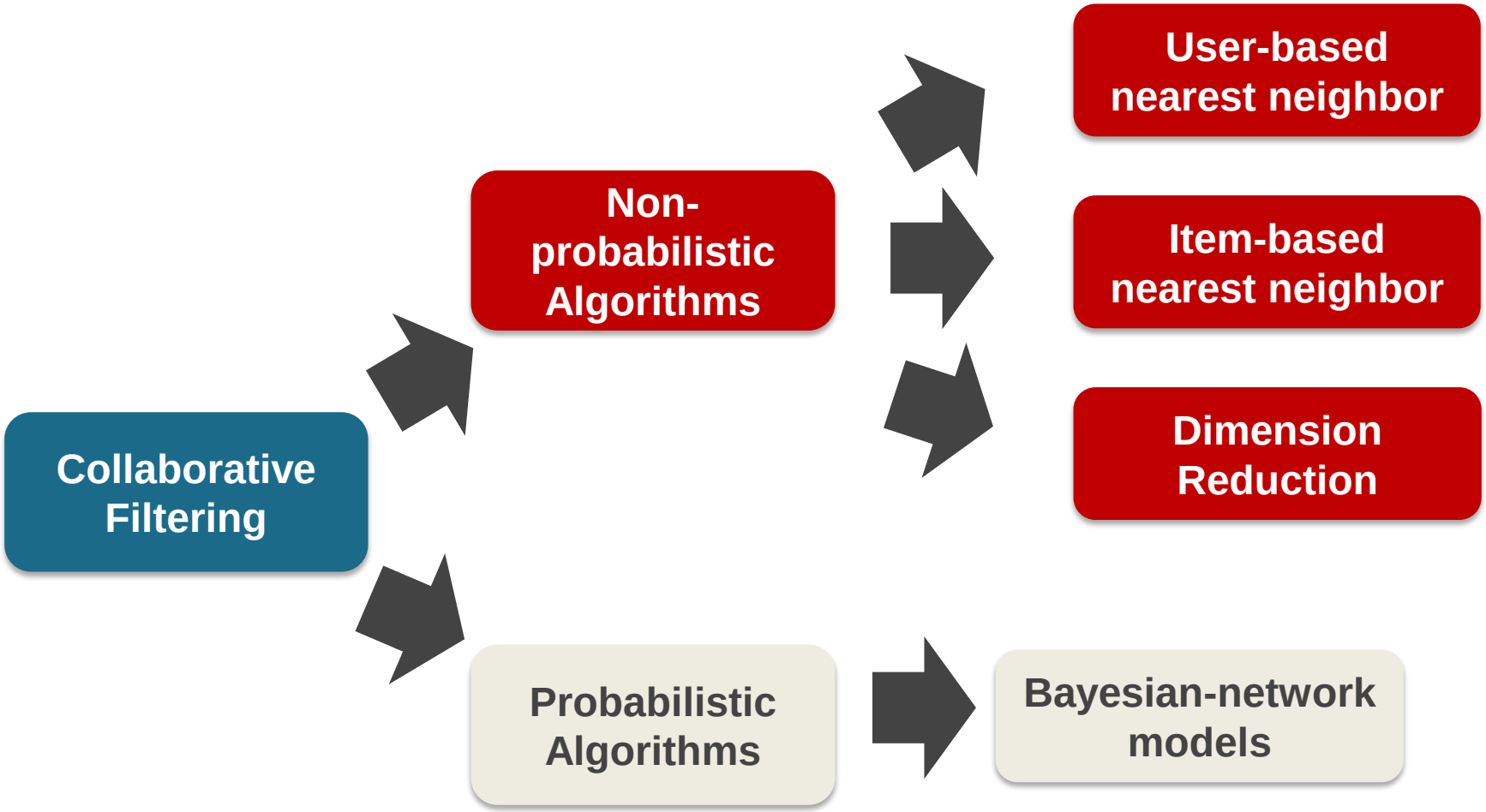
Specialized Application

Collaborative-Filtering

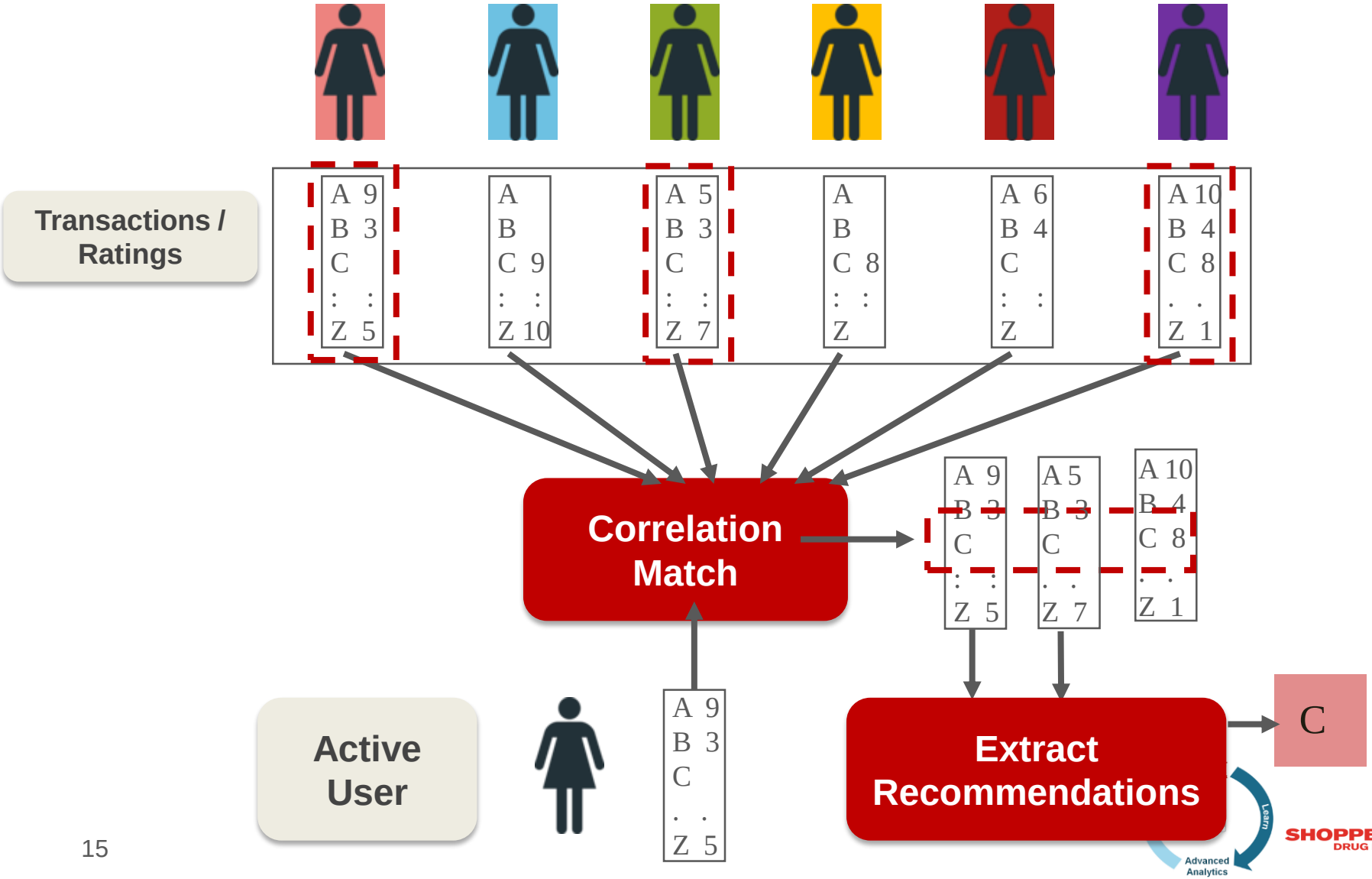
- Focuses on the **relationship** between **users** and **items**
- Similarity of items is determined by the similarity of the ratings of those items by the users who have rated both items
- Example: Recommending Products / Movies

General Application

COLLABORATIVE FILTERING



COLLABORATIVE FILTERING



METHODOLOGY - MEASURING SIMILARITIES

Cosine Similarity

measures similarity between two vectors of **an inner product space** that measures the **cosine of the angle** between them

$$\text{similarity} = \cos(\theta) = \frac{A \cdot B}{\|A\|\|B\|} = \frac{\sum_{i=1}^{n} A_i \times B_i}{\sqrt{\sum_{i=1}^{n} (A_i)^2} \times \sqrt{\sum_{i=1}^{n} (B_i)^2}}$$

Jaccard Similarity

measures similarity between finite sample sets, and is defined as the size of the intersection divided by the size of the union of the sample set

$$J(A,B) = \frac{|A \cap B|}{|A \cup B|}. \qquad 0 \leq J(A,B) \leq 1.$$

The Pearson correlation

The Pearson correlation similarity of two users x, y

$$\text{simil}(x,y) = \frac{\sum_{i \in I_{xy}} (r_{x,i} - \bar{r_x})(r_{y,i} - \bar{r_y})}{\sqrt{\sum_{i \in I_{xy}} (r_{x,i} - \bar{r_x})^2 \sum_{i \in I_{xy}} (r_{y,i} - \bar{r_y})^2}}$$

MEASURING SIMILARITIES …. CONTD

Example :

Users	Product 1	Product 2	Product 3	Product 4	Product 5	Product 6	Average - User
Tom			3	5	4	1	3.25
Matt			3	4	4	1	3
Ben		4	3		3	1	2.75
Jade		4	4	4	3	1	3.2
Torri		5	4	5		3	4.25
Average-Prod		4.3	3.4	4.5	3.5	1.4	

Ben Jade Torri

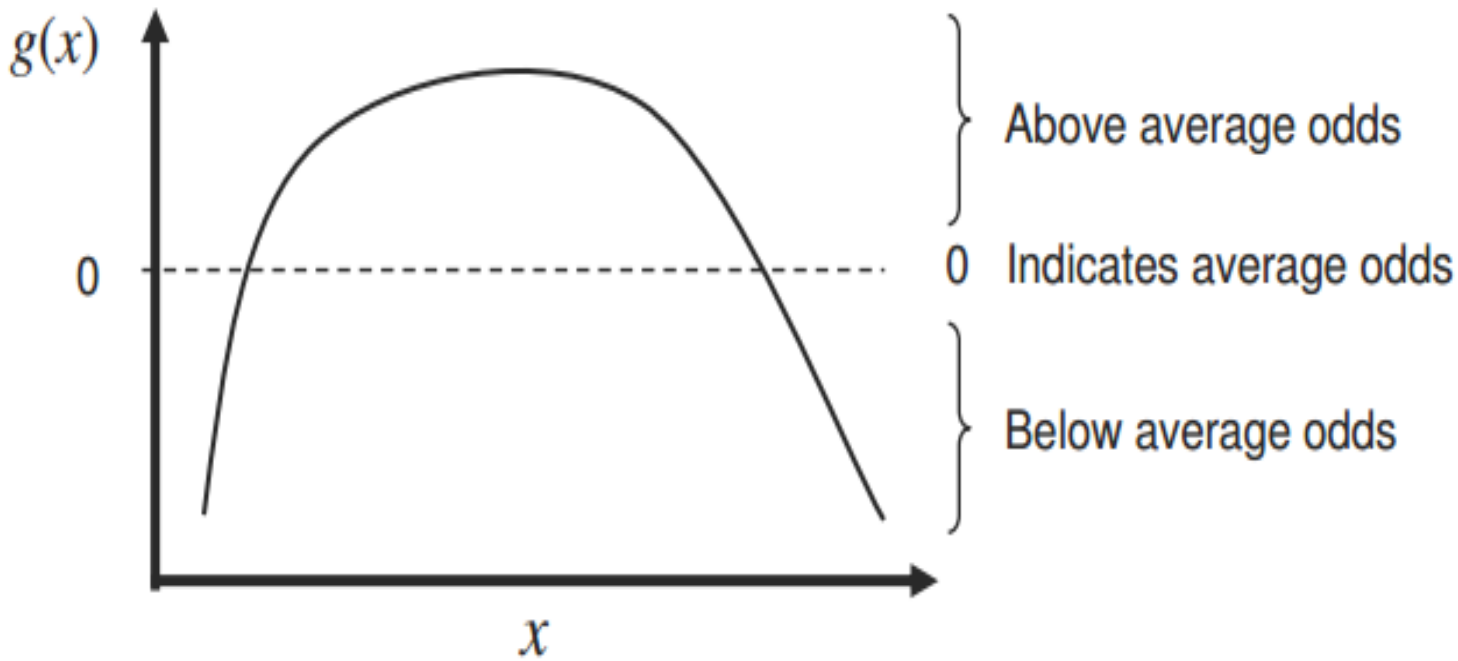
Similarity between Product 1 & 2

$$= \frac{(4-2.75)(3-2.75)+(4-3.2)(4-3.2)+(5-4.25)(4-4.25)}{\sqrt{(4-2.75)^2+(4-3.2)^2+(5-4.25)^2}\sqrt{(3-2.75)^2+(4-3.2)^2+(4-4.25)^2}}$$

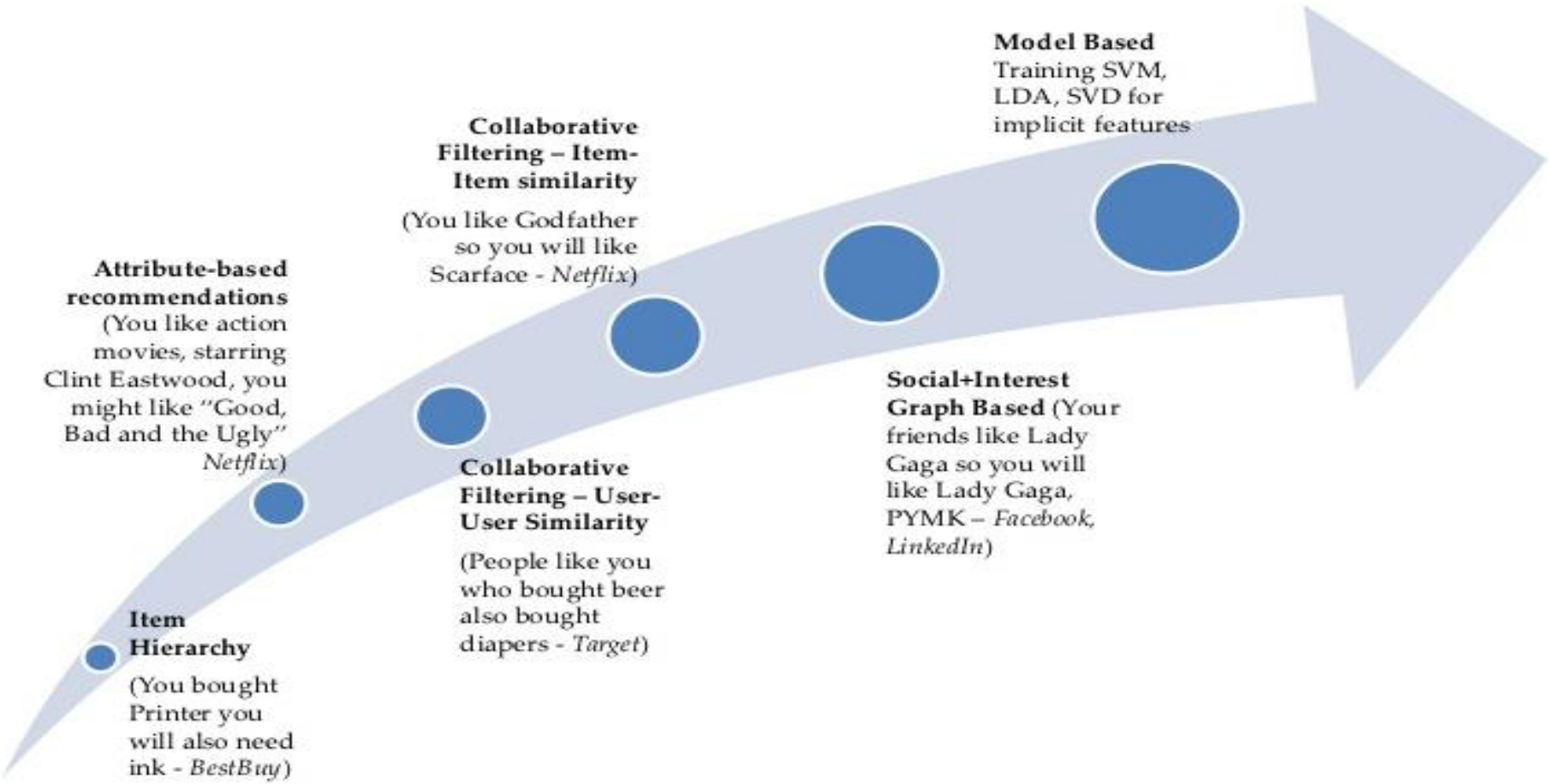
$$= \frac{0.7650}{\sqrt{2.765}\sqrt{0.765}} = \frac{0.7650}{(1.6628)(0.8746)} = \frac{0.7650}{1.4543} = 0.5260$$

BAYESIAN METHOD

We are looking for products or product groups that fall in the area that is ‘Above Average Odds’. This means that the product or product group is most likely associated with ‘Incremental basket’



RECOMMENDER APPROACHES



MEASUREMENT

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TEST & LEARN

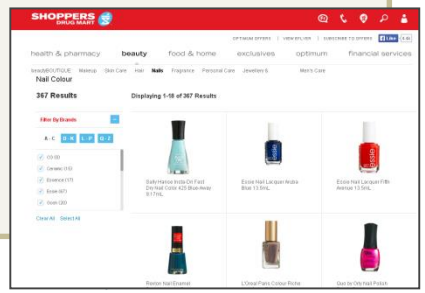
MEASURE

Effectiveness of Recommendations

- Evaluation of Predicted Ratings (Mean Average Error, RMSE)
- Evaluation of top-N reccos
- MAE
- Accuracy
- Precision and Recall (F1 Score)
- ROC Curves
- Test vs Control

Next Steps

- Incorporate New Methodologies into current Recommender Systems
- Enhance contribution of LifeTime Value Models
- Bundling of Product
- Feed Results to SDM portal:



CHALLENGES

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CHALLENGES

Problems with Collaborative Filtering method:

- **Cold Start**: There needs to be enough users already in the system to find a match
- **Sparsity**: If there are many items to be recommended, even if there are many users, the user/ratings matrix is sparse, and it is hard to find users that have rated the same items
- **First Rater**: Cannot recommend an item that has not been previously rated
  - New items
  - Esoteric items
- **Popularity Bias**: Cannot recommend items to someone with unique tastes
  - Tends to recommend popular items

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CHALLENGES

Problems with Content-based method:

- Requires content that can be encoded as meaningful features
- Users' tastes must be represented as a learnable function of these content features
- Unable to exploit quality judgments of other users
  - Unless these are somehow included in the content features

MAIN CHALLENGES

Sparsity of Data

Size of Data
(Data Computation)

SERVERS!

SERVERS!

SERVERS!

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