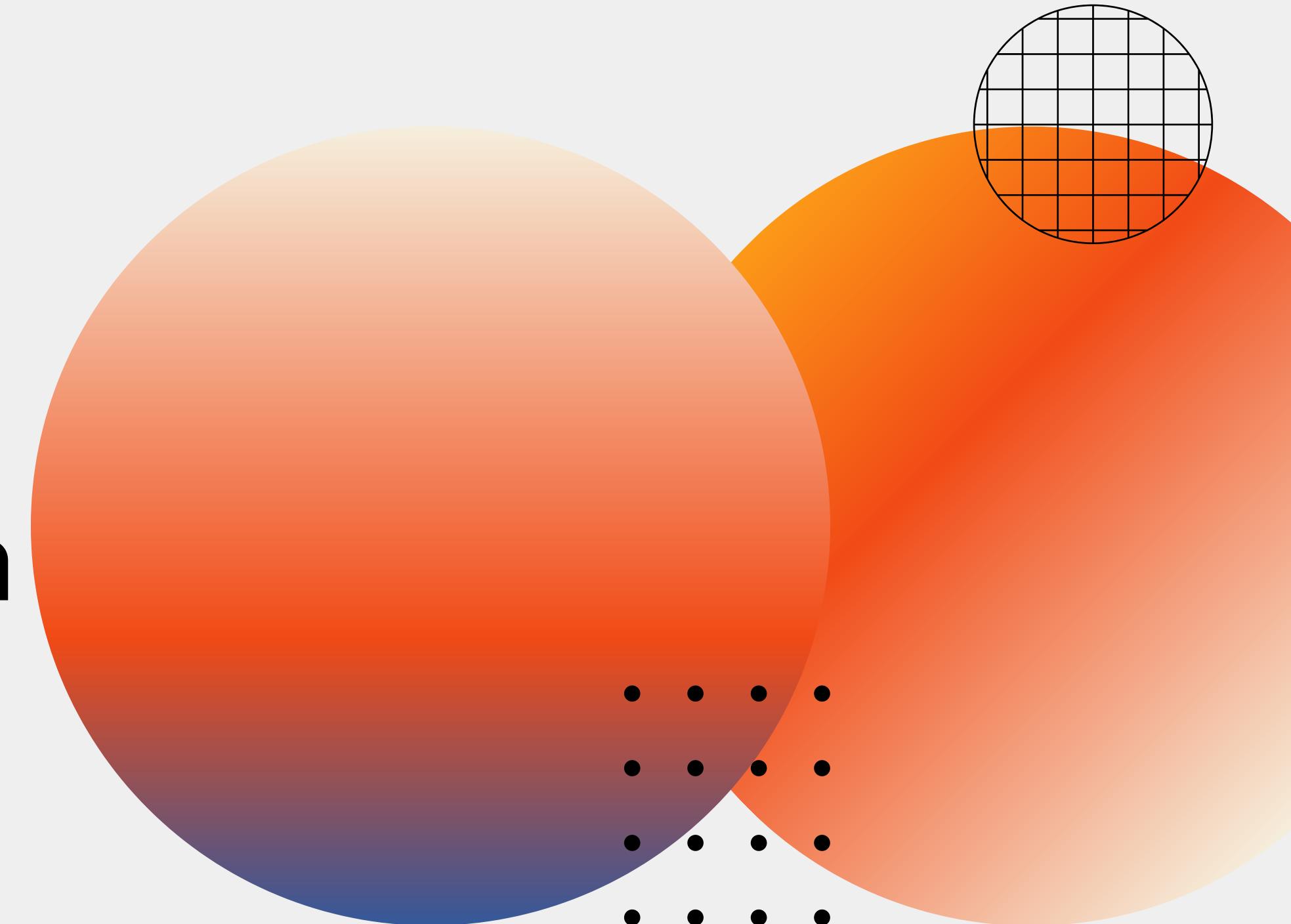


Amazon \* UCLA

# Item-to-item Recommendation System





# MEET OUR TEAM



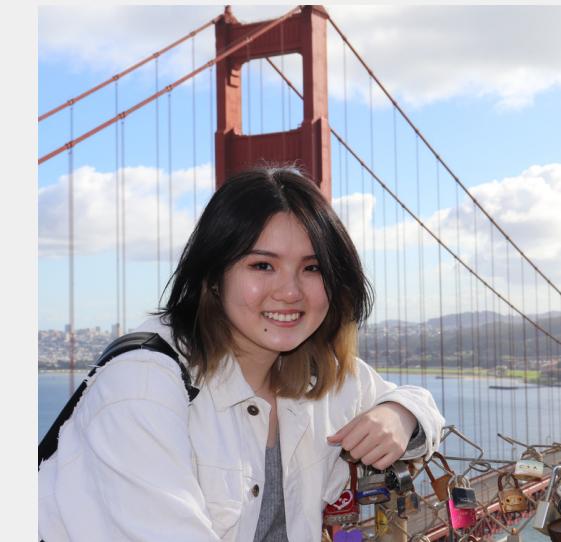
**Dexter Cai**

Business Strategist



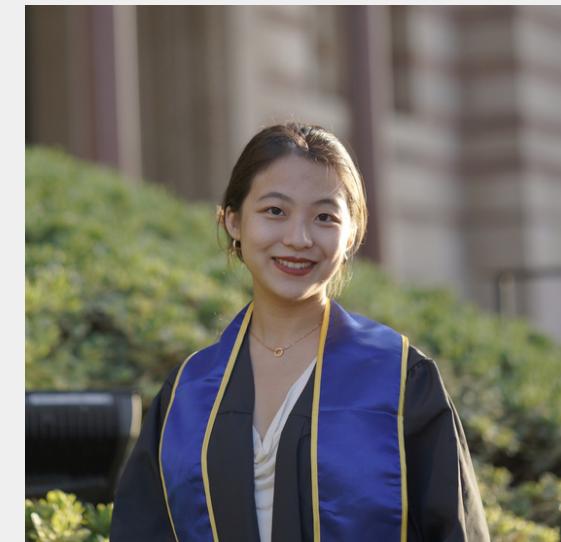
**Shuhan Lu**

Modeling Specialist



**Ashley Fang**

Modeling Specialist



**Harry Wang**

Visualization Specialist



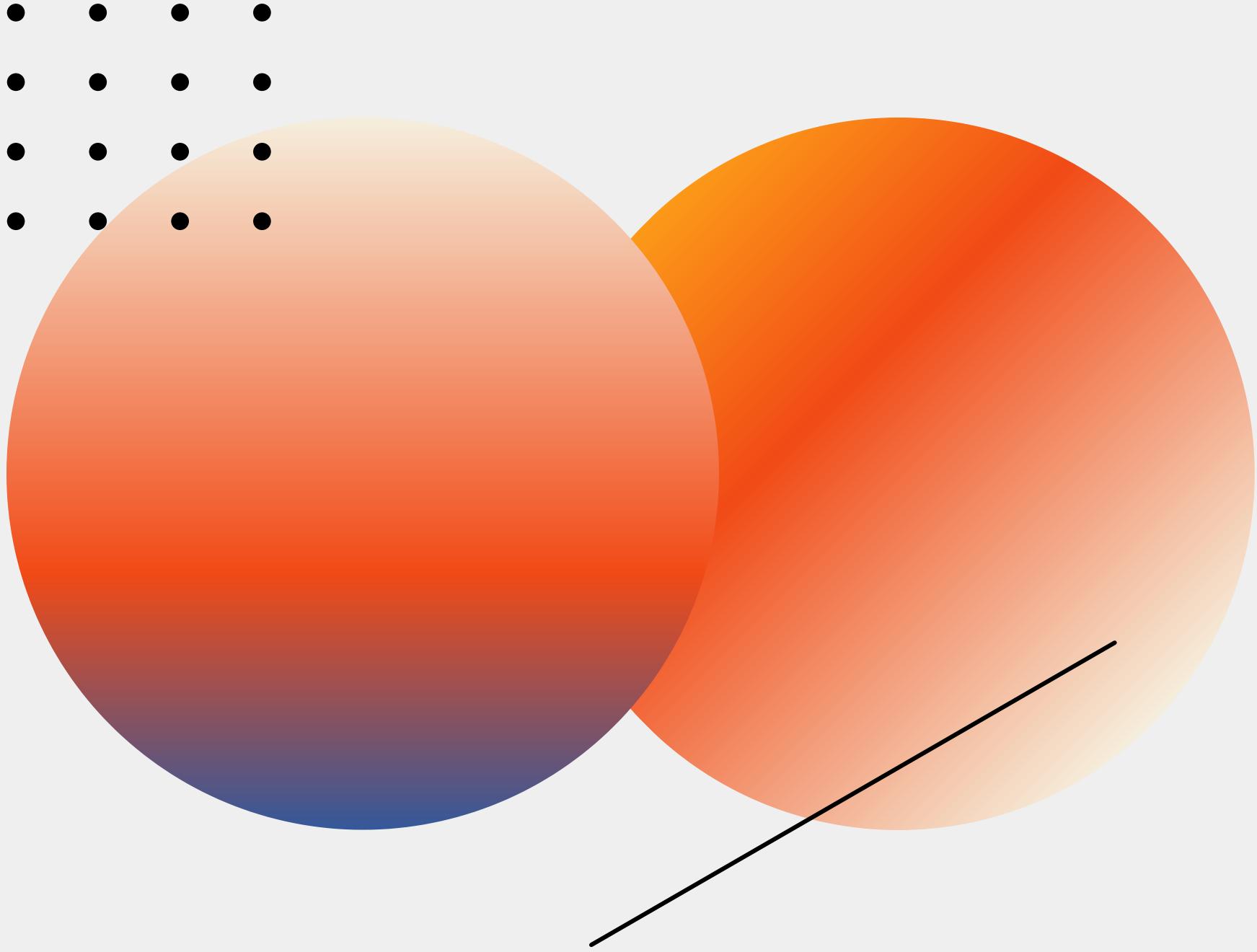
**Katherine Zhu**

Modeling Specialist

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# Our Vision





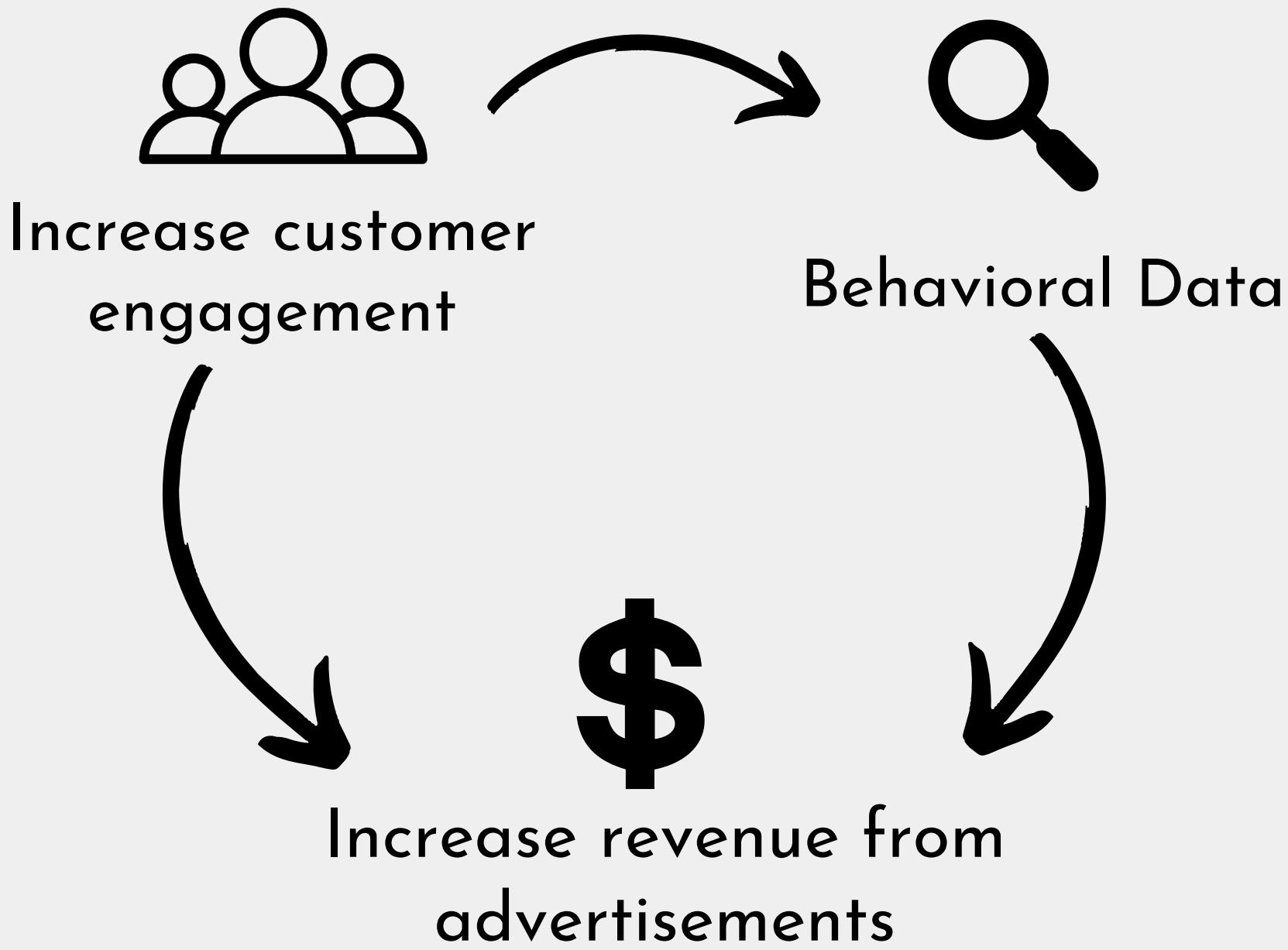
# Amazon Vision

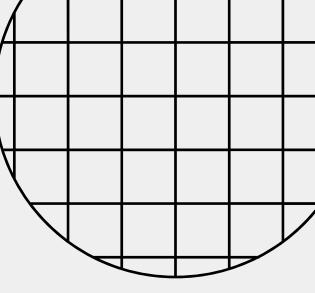
---

**"Always Long Term"**

**"Obsess with Customers"**

# Business Objectives





## **“4 stars and above”**

Based on customer reviews and ratings

## **“You might also like”**

Based on customer preference

# **Existing Amazon push types**

## **“Explore more from XX brand”**

Based on brand recommendation

## **“Products related to this item”**

Based on similarities

**Scenario-Adaptive  
Transparent**

---



# Our Process



# Exploratory Data Analysis

Total brands: 191

Most Common Brand

brand	count
AmazonBasics	3365
Stone & Beam	3166
Rivet	2721
365 by Whole Foods Market	2160
365 Everyday Value	2158
Ravenna Home	1048
Whole Foods Market	1032
Amazon Collection	946
find.	853
Solimo	755

Total product types: 391

Most Common Product Types

product_type	count
GROCERY	5619
SHOES	1507
CHAIR	1421
RUG	817
SOFA	777
HEALTH_PERSONAL_CARE	716
HOME_FURNITURE_AND_DECOR	649
WALL_ART	599
HOME	553
TABLE	499

Total product categories: 33

Most Common Product Categories

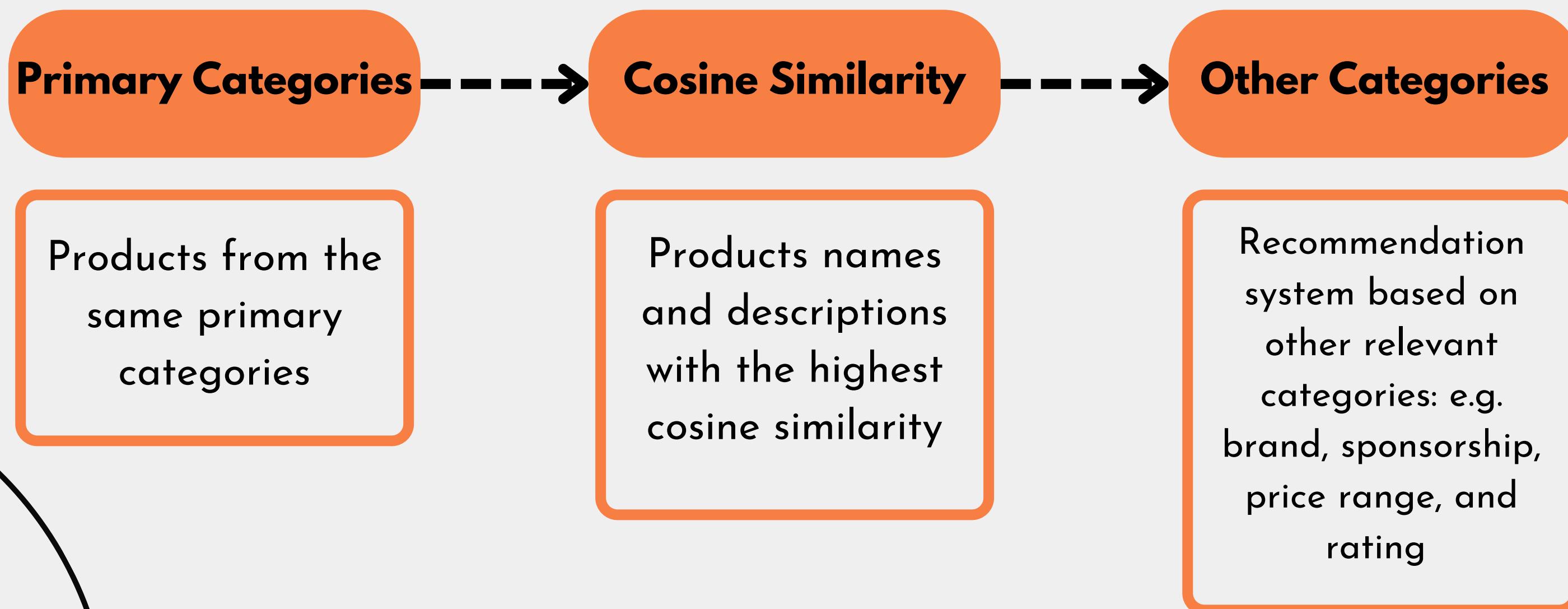
product_category	count
GROCERY_SNACK_BEVERAGE	7595
FURNITURE	4031
SHOES_CLOTHING_PERSONAL	2280
HOME	1506
HOME_DECOR	1310
MEDICATION_PERSONAL_CARE	1122
JEWELRY	1006
LIGHTING	983
BED_BATH	871
OFFICE_STUDY	432

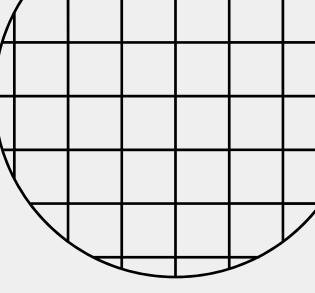


# Word Frequency of 'item\_keyword'

# Define Similarity

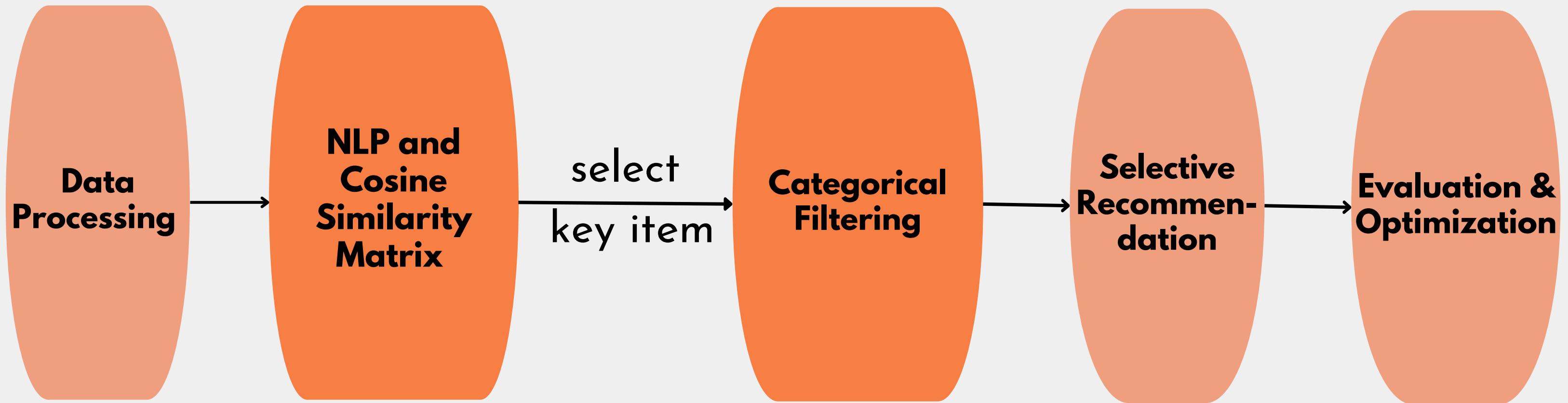
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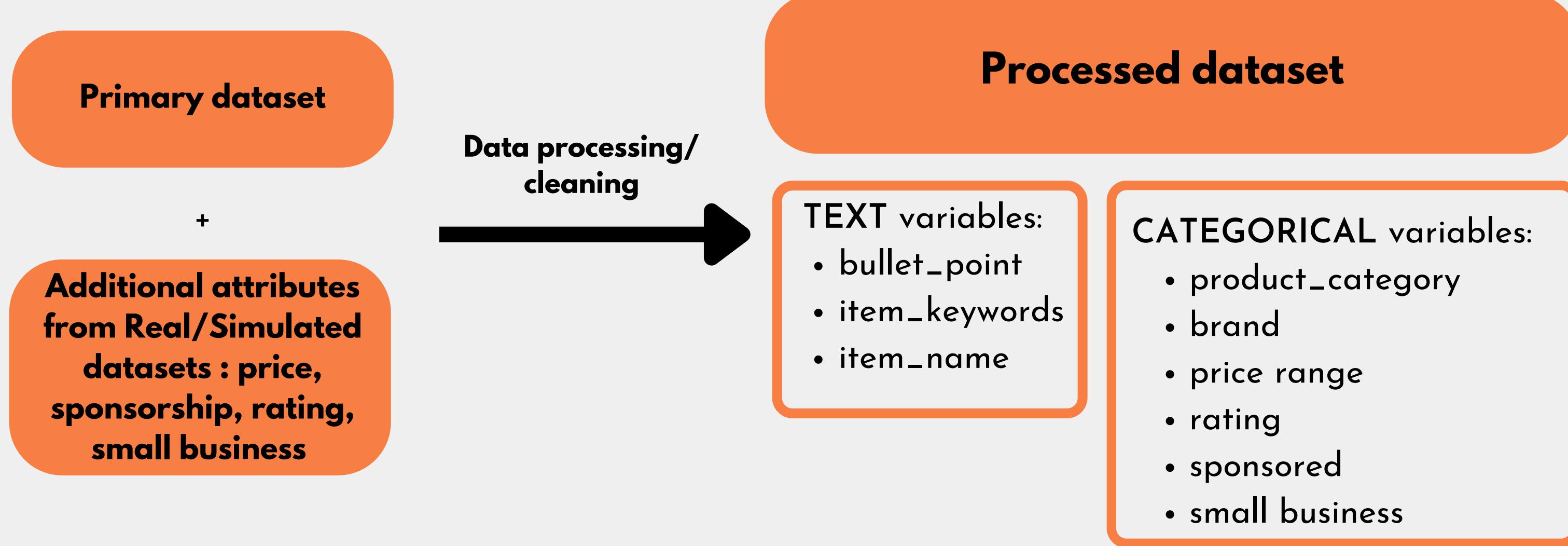
# Flowchart

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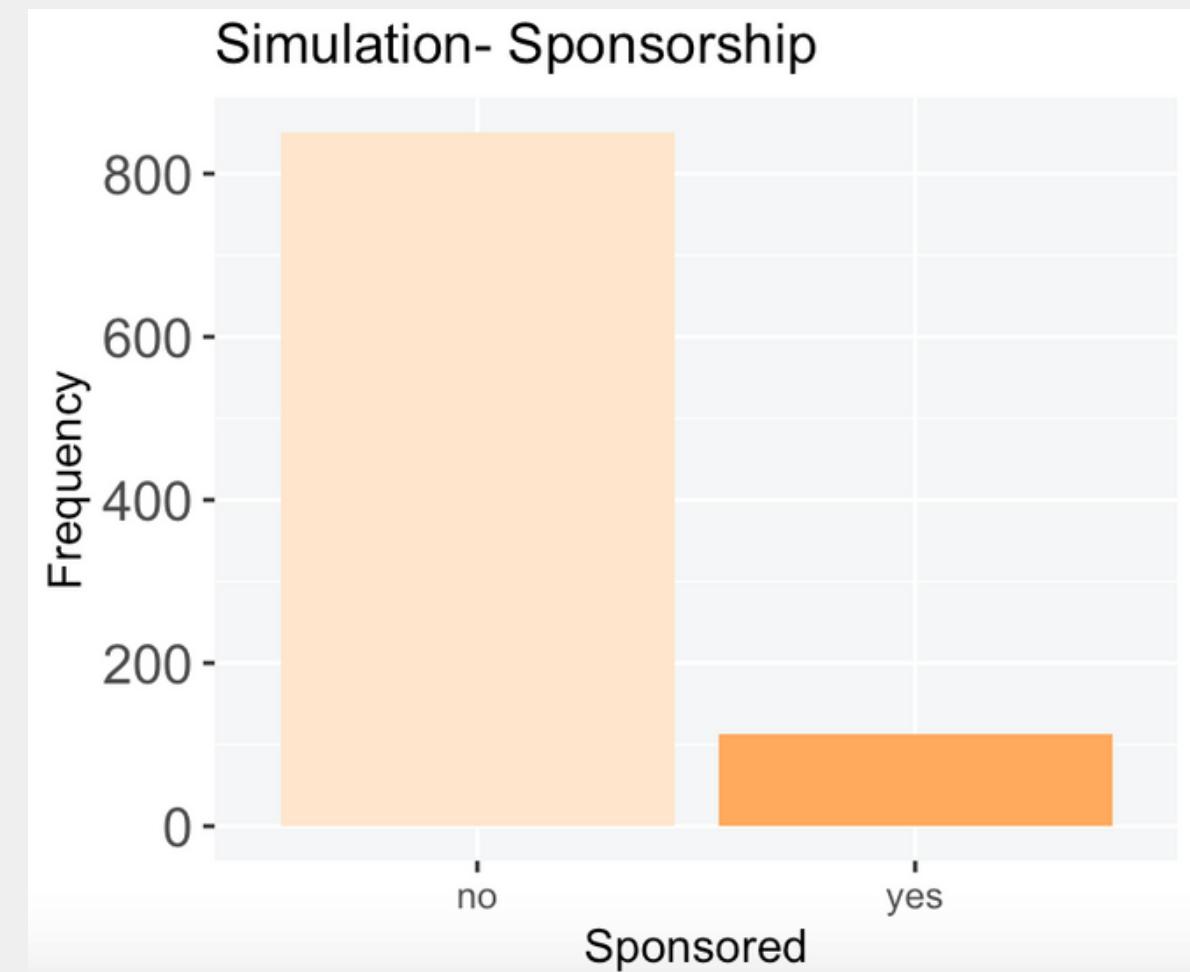
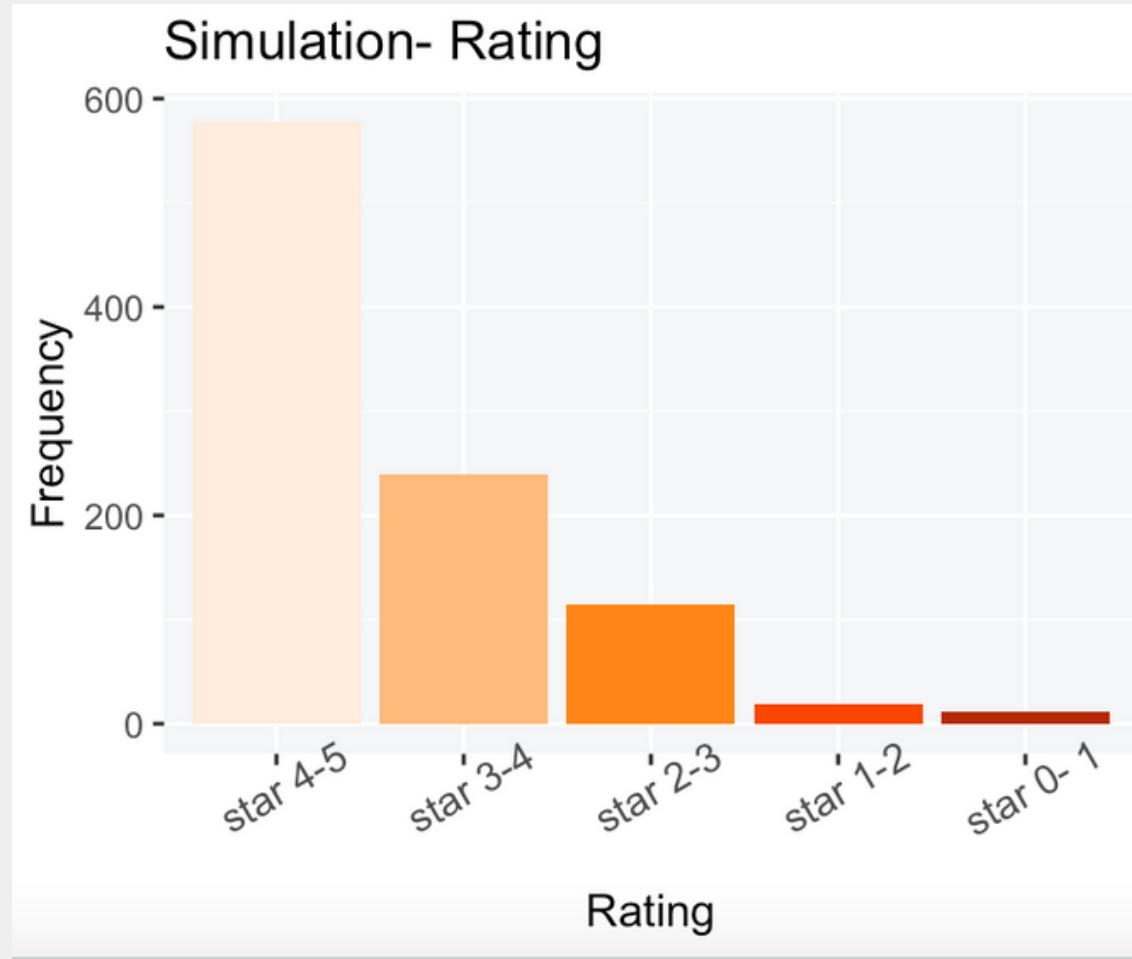


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• • •

# 1. Data Processing



# Simulated Variables



## 2. NLP and Cosine Similarity

For text variables:  
bullet\_point  
item\_keywords  
item\_name

**Group all products by product\_category**

**NLP preprocessing on text features**

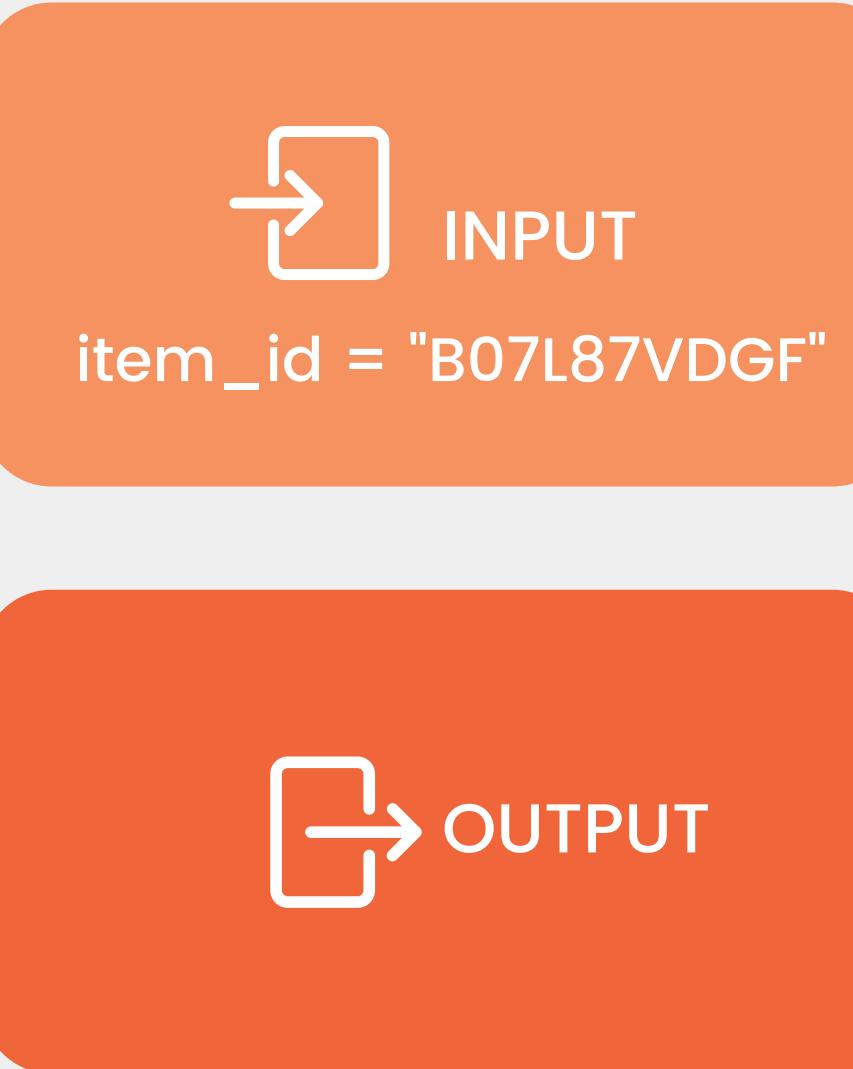
**Create document-term matrix:** frequency of terms that occur across all products in the same category

**Apply TF-IDF Transformation:** prioritizing terms with high importance

**Generate Cosine Similarity Matrix** of all products in a category: similarity is represented by a number between 0 and 1.

**Select key item**

**Rank other items based on cosine similarity index**



Similar Items

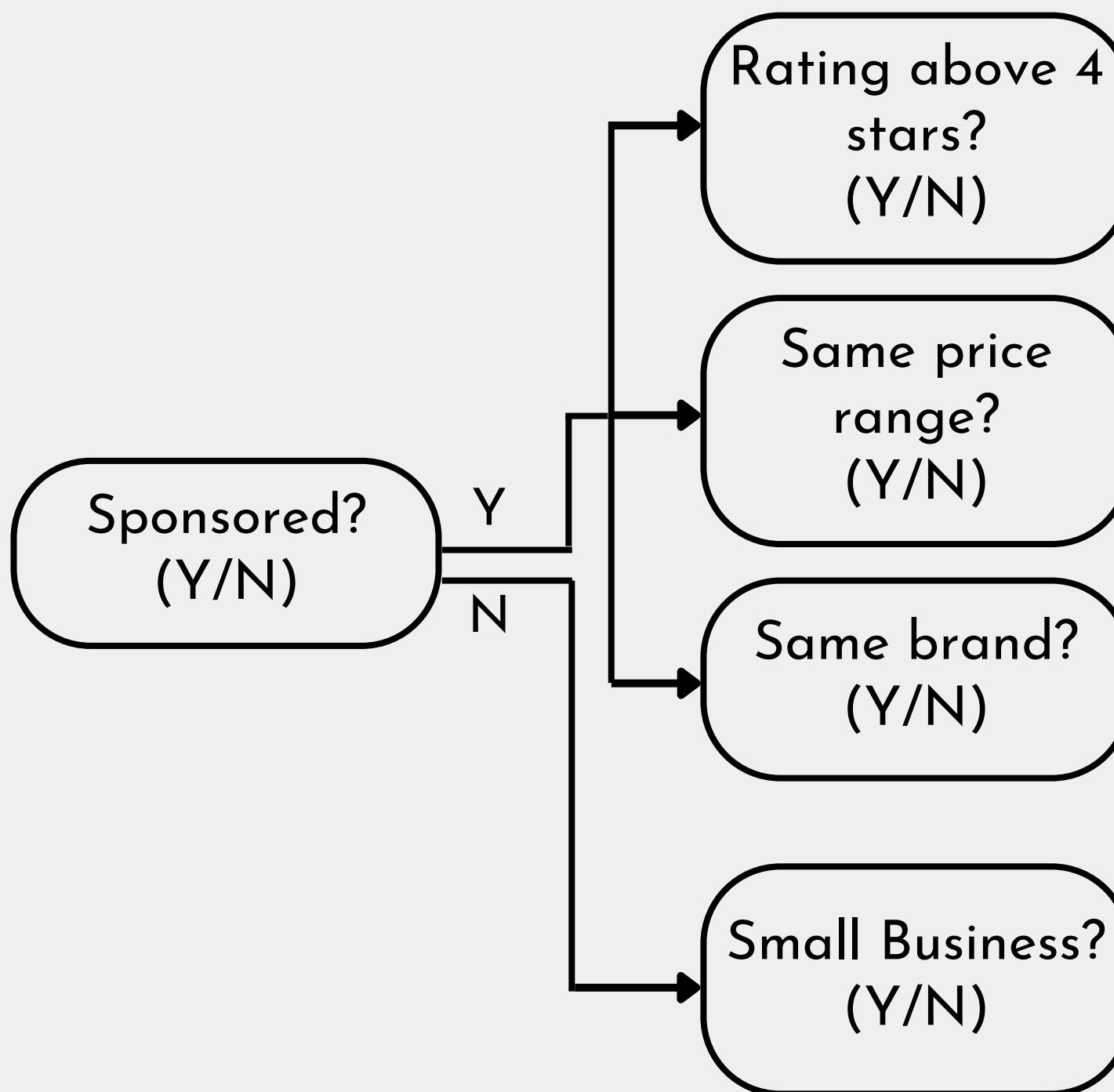
item_id	similarity	item_name	product_type	brand
<b>B07L87VDGF</b>	1.0000000	Rivet Polyester Grey Sofa	SOFA	Rivet
<b>B07L8FMH6M</b>	0.9864422	Rivet Polyester Grey Love seat Sofa	SOFA	Rivet
<b>B07KXZ22GQ</b>	0.8865966	Stone Beam Westcott Modern Westcott Sofa Fabric	SOFA	Stone & Beam
<b>B07KTJGC7H</b>	0.8653566	Rivet Edgewest Edgewest Left Facing Sofa Chaise Sectional	SOFA	Rivet
<b>B07KT88MGW</b>	0.8560962	Rivet Edgewest Edgewest Left Facing L Shape Sectional	SOFA	Rivet
<b>B07KXZR3XL</b>	0.8538801	Stone Beam Fischer Fischer Sleeper Fabric	SOFA	Stone & Beam
<b>B07KTJHHCP</b>	0.8520623	Rivet Edgewest Edgewest Left Facing U Shape Sectional	SOFA	Rivet
<b>B07KTJGC7R</b>	0.8519126	Rivet Edgewest Edgewest Right Facing L Shape Sectional	SOFA	Rivet
<b>B07KTKJ1W8</b>	0.8479373	Rivet Edgewest Edgewest Right Facing U Shape Sectional	SOFA	Rivet
<b>B07KTKXR5B</b>	0.8393206	Stone Beam Andover Andover Left Facing L Shape Sectional	SOFA	Stone & Beam
<b>B07KTL6NRF</b>	0.8353670	Stone Beam Andover Andover Left Facing U Shape Sectional	SOFA	Stone & Beam
<b>B07KTPQGM</b>	0.8352203	Stone Beam Andover Andover Right Facing L Shape Sectional	SOFA	Stone & Beam

### **3. Categorical Filtering**

For Categorical Features



## Sample Output



item_id	similarity	item_name	rating
B07L87VDGF	1.0000000	Rivet Polyester Grey Sofa	star 4-5
B07KXZR3XL	0.8538801	Stone Beam Fischer Fischer Sleeper Fabric	star 4-5
B07KTKJ1W8	0.8479373	Rivet Edgewest Edgewest Right Facing U Shape Sectional	star 4-5
B07KTL6NRF	0.8353670	Stone Beam Andover Andover Left Facing U Shape Sectional	star 4-5
B07KTKJXCR	0.8313241	Stone Beam Andover Andover Right Facing U Shape Sectional	star 4-5

## Sponsored & Same Brand

item_id	similarity	item_name	brand
B07L87VDGF	1.0000000	Rivet Polyester Grey Sofa	Rivet
B07KTJGC7H	0.8653566	Rivet Edgewest Edgewest Left Facing Sofa Chaise Sectional	Rivet
B07KT88MGW	0.8560962	Rivet Edgewest Edgewest Left Facing L Shape Sectional	Rivet
B07KTJHHCP	0.8520623	Rivet Edgewest Edgewest Left Facing U Shape Sectional	Rivet
B07KTJGC7R	0.8519126	Rivet Edgewest Edgewest Right Facing L Shape Sectional	Rivet

# Sample Output

## Sponsored & Highly rated

item_id	similarity	item_name	rating
B07L87VDGF	1.0000000	Rivet Polyester Grey Sofa	star 4-5
B07KXZR3XL	0.8538801	Stone Beam Fischer Fischer Sleeper Fabric	star 4-5
B07KTKJ1W8	0.8479373	Rivet Edgewest Edgewest Right Facing U Shape Sectional	star 4-5
B07KTL6NRF	0.8353670	Stone Beam Andover Andover Left Facing U Shape Sectional	star 4-5
B07KTKJXCR	0.8313241	Stone Beam Andover Andover Right Facing U Shape Sectional	star 4-5

## Sponsored & Same Brand

item_id	similarity	item_name	brand
B07L87VDGF	1.0000000	Rivet Polyester Grey Sofa	Rivet
B07KTJGC7H	0.8653566	Rivet Edgewest Edgewest Left Facing Sofa Chaise Sectional	Rivet
B07KT88MGW	0.8560962	Rivet Edgewest Edgewest Left Facing L Shape Sectional	Rivet
B07KTJHHCP	0.8520623	Rivet Edgewest Edgewest Left Facing U Shape Sectional	Rivet
B07KTJGC7R	0.8519126	Rivet Edgewest Edgewest Right Facing L Shape Sectional	Rivet

## Sponsored & Highly rated

4 stars and above

Sponsored

SUNLEI Convertible Sectional Sofa Couch L-Shaped Couch with Modern Linen Fabric 3...	Belfinn Convertible Sectional Sofa Couch with Chaise L Shaped Sofa Couch Reversible...	Sectional Sofa, L-Shape Sectional Couch with Reversible Chaise, Couches and Sofas w...	Esright 88.6" Convertible Sectional Sofa Couch with Ottoman, Modern Tufted Fabric L...
★★★★★ 135 \$359.99	★★★★★ 446 \$399.99	★★★★★ 369 \$349.00	★★★★★ 225 \$519.99

## Sponsored & Same Brand

Inspiration from this brand



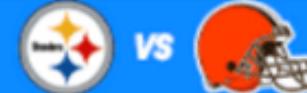
+ Follow

3 Reasons Why People Love THIS Modular Sofa: Simple Design, Prac...	Features of 3-in-1 Convertible Chair Bed# Sofa Chair: Great for reading...	HONBAY Modular Sectional Sofa for Your Living Room, add storage spa...

## Select the top 5-7 items:

1. With the highest Similarity Index
2. That satisfies certain categorical filters

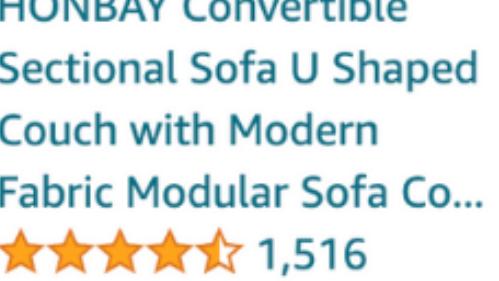
amazon prime Deliver to Xinhui Los Angeles 90024 Home & Kitchen ▾ HONBAY grey sofa  Hello, Xinhui Account & Lists ▾ Returns & Orders 

All Back to School Off to College Prime Video Groceries ▾ Prime ▾ Shopper Toolkit Health & Household  04 : 08 : 59

## Our Recommendations

Sponsored 



 HONBAY Convertible Sectional Sofa U Shaped Couch with Modern Fabric Modular Sofa Co...  \$1,399.99	 Diophros Sofa Bed, Convertible Chair 4 in 1 Multi-Function Modern Folding Ottoman G...  \$299.99	 HONBAY Reversible Sectional Sofa Modern Modular Sectional Couch with Chaise L Shape...  \$1,259.99	 HONBAY Square Ottoman Module for Modular Sectional Sofa, Storage Ottoman...  \$169.99	 DHP Paxson Convertible Futon Couch Bed with Linen Upholstery and Wood Legs - Navy Blue  \$338.42 	 Sectional Sofa, L-Shape Sectional Couch with Reversible Chaise, Couches and Sofas w...  \$349.00
--	--	--	---	--	--

Highly Rated 4.5/5 Highly Rated 4.3/5 Same Brand Same Brand Good Price  Small Business ▾

# Evaluation Metrics

## Recommendation System



Define Criteria for Accuracy



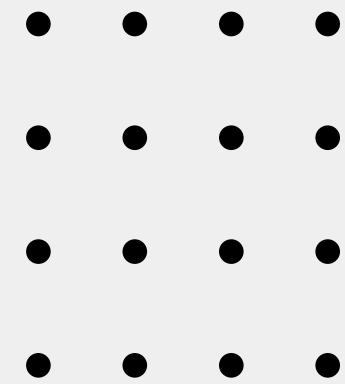
Quality Assurance

## Business

**Click-through Rate (CTR)**

**Conversion Rate**

**Revenue Growth**



# A/B Testing

\*Further collaboration with the product team

Suppose you want to buy a sofa. You browse on Amazon and found the sofa below. You cannot decide and want to see more options like this one.

Back to results



Amazon Brand - Rivet Cove Mid-Century Modern Tufted Apartment Sofa with Beech Wood Legs and Fabric Upholstery, 72"W, Dark Grey  
Visit the Rivet Store  
★★★★★ 456 ratings  
\$757<sup>79</sup>  
✓prime Scheduled Delivery  
Save up to 2% with business pricing. Sign up for free Amazon Business account  
Pay \$63.15/month for 12 months (plus S&H, tax) with 0% interest equal monthly payments when you're approved for the Prime Store Card.  
Size: Sofa  
Living Room Chair + Ottoman, 31.9"W  
Living Room Chair  
Living Room Chair + Leather Ottoman  
Loveseat  
Sofa

Roll over image to zoom in  
VIDEO 360°

## Version A

### Products related to this item

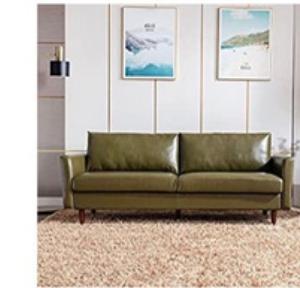
Sponsored



Mopio Chloe Futon Sofa Bed, Convertible Sleeper Sofa with Tapered Wood Legs, 77.5" ...  
★★★★★ 833  
\$368.99



Ottomanson Pantheon Collection, Sofabed, Brown  
★★★★★ 10  
\$777.78 ✓prime



Dreamsir 80" Faux Leather Sofa Couch, Mid-Century Modern Sofa with Solid Wooden Fr...  
★★★★★ 39  
\$546.99



GDFStudio Christopher Knight Home Evelyn Mid Century Modern Fabric Loveseat, Beige  
★★★★★ 59  
\$428.89 ✓prime



Amazon Brand – Rivet Midtown Contemporary Upholstered Sofa Couch, 92.1"W, Cream  
★★★★★ 165  
\$847.00  
✓prime FREE Delivery



POLY & BARK Neutral Fabric Sofa, Bright Ash  
★★★★★ 37  
\$1,599.00 ✓prime

### Products related to this item

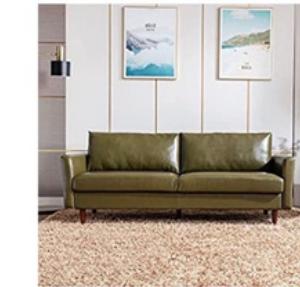
Sponsored



Mopio Chloe Futon Sofa Bed, Convertible Sleeper Sofa with Tapered Wood Legs, 77.5" ...  
★★★★★ 833  
\$368.99



Ottomanson Pantheon Collection, Sofabed, Brown  
★★★★★ 10  
\$777.78 ✓prime



Dreamsir 80" Faux Leather Sofa Couch, Mid-Century Modern Sofa with Solid Wooden Fr...  
★★★★★ 39  
\$546.99



GDFStudio Christopher Knight Home Evelyn Mid Century Modern Fabric Loveseat, Beige  
★★★★★ 59  
\$428.89 ✓prime

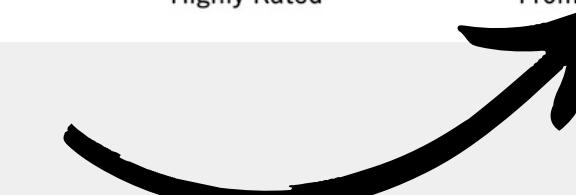


Amazon Brand – Rivet Midtown Contemporary Upholstered Sofa Couch, 92.1"W, Cream  
★★★★★ 165  
\$847.00  
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POLY & BARK Neutral Fabric Sofa, Bright Ash  
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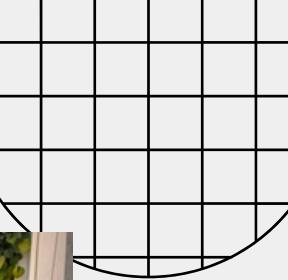
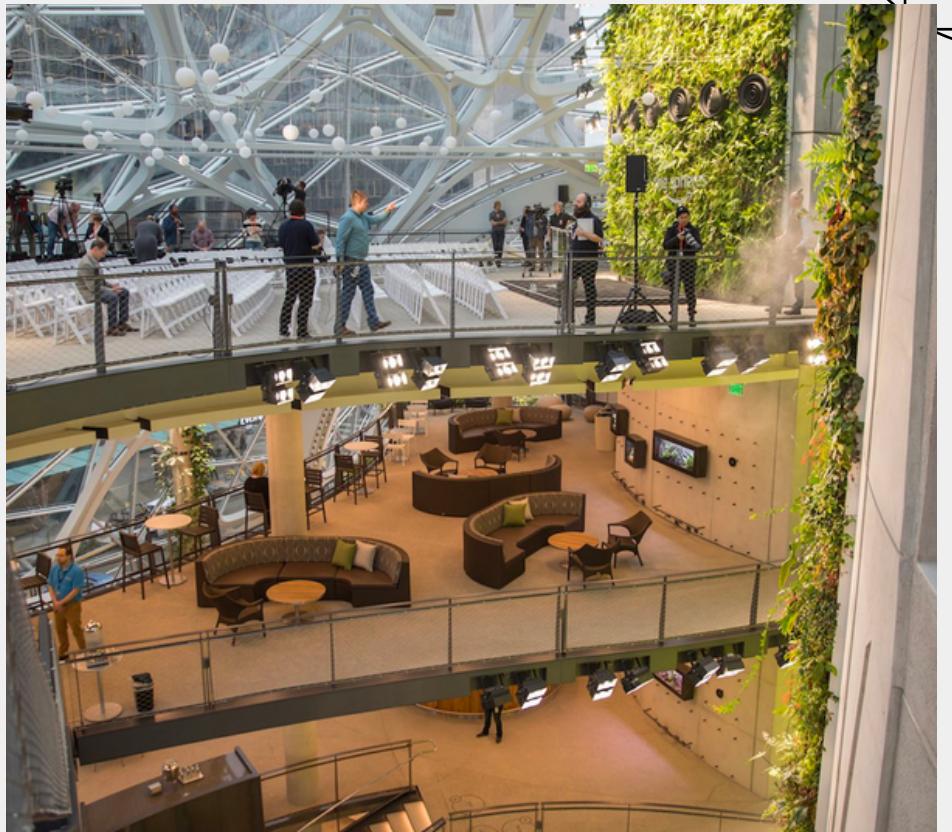
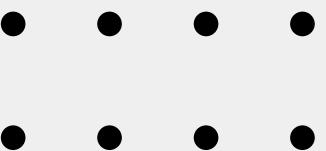
## Version B



# Outcomes

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Scenario-Adaptive  
Transparent



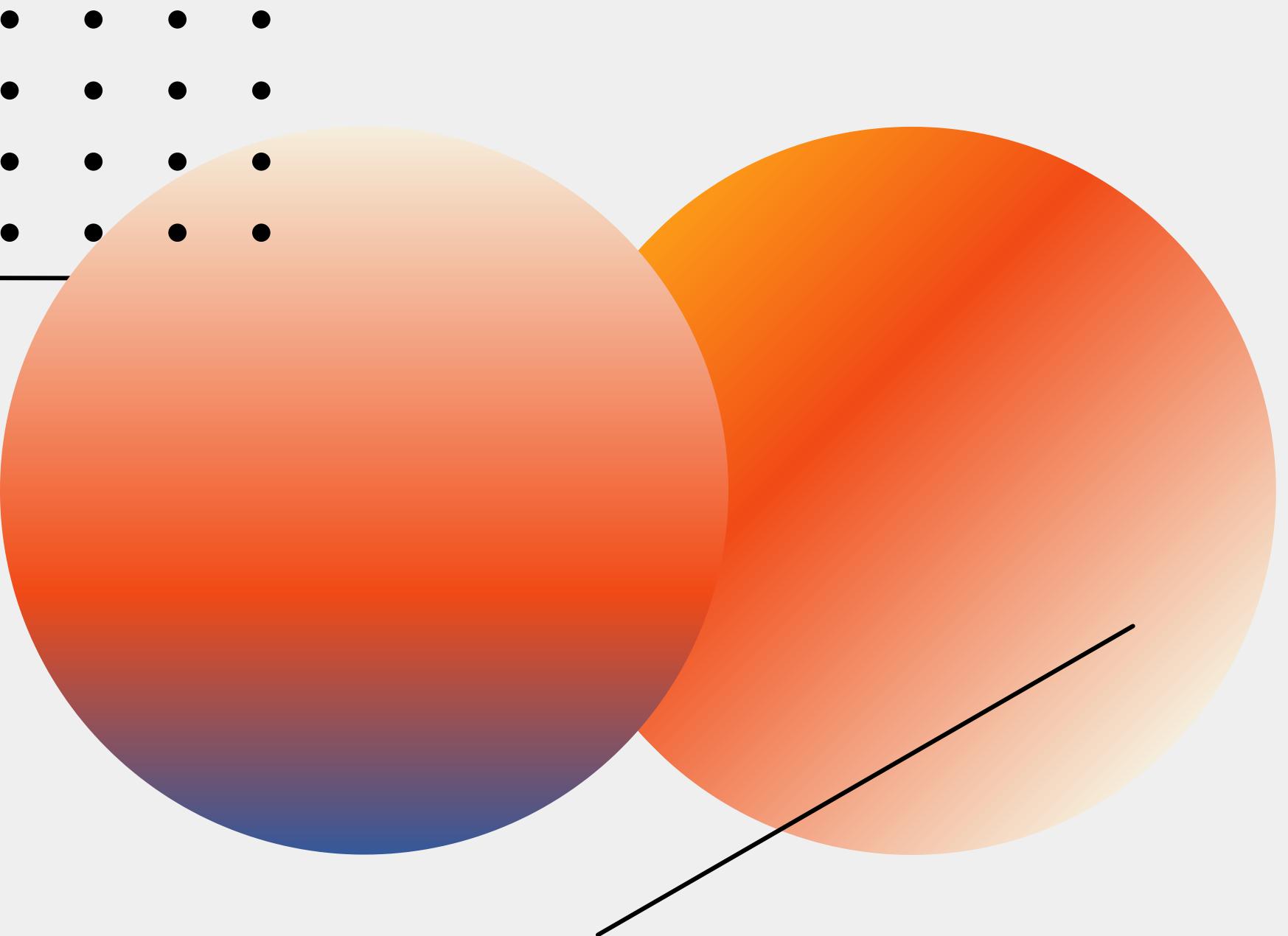
# Our Reflection

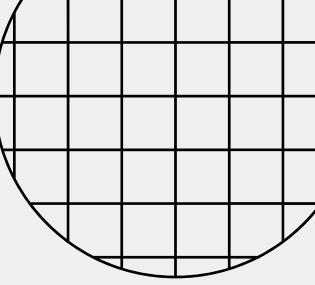


# Challenges

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- 1** Identifying important attributes
- 2** The mismatch between similarity and user preference
- 3** Scalability





## Incorporate more data

We want to incorporate real-life data on the attributes we simulated, image recognition data, and behavioral data after the feature is launched.

## Collaborate with other teams

We would love the opportunity to collaborate with the product team & ads team.

## Construct

With further collaboration and data, we want to construct a fully functional Hybrid-based recommendation system.



INCORPORATE



COLLABORATE



CONSTRUCT

# Insights on Future Optimization

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## Want to see increase in:

- Click-through Rate (CTR)
- Conversion Rate
- Revenue Growth

# References

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- [http://www.heikopaulheim.com/docs/swj2018\\_product\\_data.pdf](http://www.heikopaulheim.com/docs/swj2018_product_data.pdf)
- <https://towardsdatascience.com/understanding-cosine-similarity-and-its-application-fd42f585296a>
- [https://medium.com/@Kalimuddin\\_-/e-commerce-product-recommendation-system-content-based-a7cde00cce65](https://medium.com/@Kalimuddin_-/e-commerce-product-recommendation-system-content-based-a7cde00cce65)
- <https://medium.com/@amitdlmlai/book-recommendation-system-61bf9284f659>
- <https://towardsdatascience.com/the-best-document-similarity-algorithm-in-2020-a-beginners-guide-a01b9ef8cf05>
- <https://medium.com/analytics-vidhya/cosine-similarity-between-products-to-recommend-similar-products-3b94bf6e30ba>
- [http://ceur-ws.org/Vol-1378/AMW\\_2015\\_paper\\_10.pdf](http://ceur-ws.org/Vol-1378/AMW_2015_paper_10.pdf)
- <https://www.r-bloggers.com/2019/06/using-cosine-similarity-to-find-matching-documents-a-tutorial-using-senecas-letters-to-his-friend-lucilius/>
- <https://arxiv.org/pdf/2206.02631.pdf>



Amazon \* UCLA

# Thank you

We would love to hear your feedback!

