

Hack Session

Building Robust & Scalable **Recommendation Systems** for **Online Food Delivery**

Speaker

Raghav Bali
Staff Data Scientist @ Delivery Hero





- Staff Data Scientist @ **Delivery Hero**
- A decade-long journey of pioneering enterprise-level solutions. Harnessing Machine Learning, Deep Learning, Computer Vision, NLP and Recommendation Systems



Delivery Hero
2022 - Present



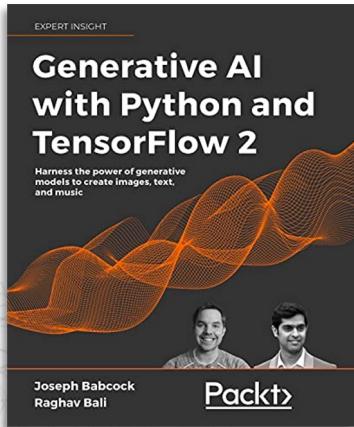
Optum
2017 - 2022



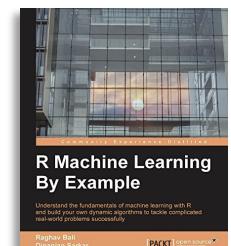
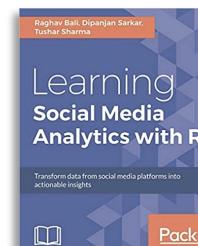
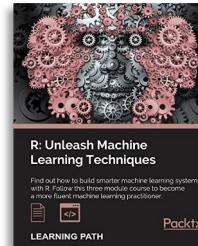
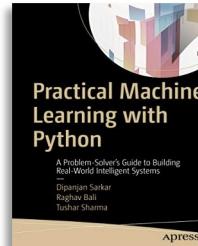
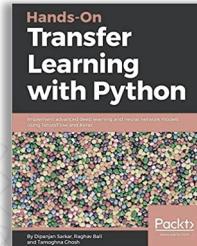
Intel
2015 - 2017



American Express
2014 - 2015



- Multiple **patents** in the field of mixed reality, deep learning, CV, NLP and Healthcare
- A number of **papers** at peer-reviewed conferences
- Well received **books** on Generative AI, NLP, Transfer Learning and more...



Agenda

Why Recommend?

- Popular Use-Cases
- Top Challenges

How to Recommend

- Key Concepts & Steps
- Different Approaches

Evaluate and Optimize Recommendations

- Key Metrics
- A/B Tests & Beyond

Robustness & Scalability

- Addressing Scale & Robustness
- Let Us Recommend

Why Recommend



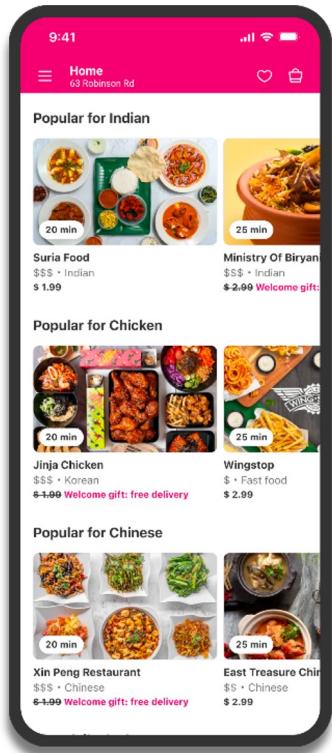
Why Recommend

- Preferences
- Discovery
- Choice Overload





foodpanda



talabat



Google News



Flipkart



DOORDASH

Popular Applications



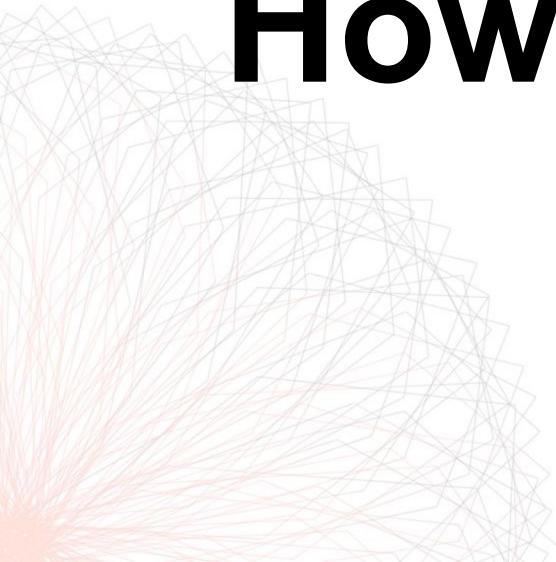
- E-Commerce
- Streaming Services
- Online Food Delivery
- Social Media Platforms
- News
- Travel Platforms
- Gaming Platforms

Top Challenges

- Data Availability
- Cold-Start
- Changing Preferences
- Changing Catalogue
- Evolving Categories
- Fairness and Long-tail
- ...



How to Recommend



Key Concepts



- Key entities:
 - user/customer
 - item/vendor
- Signals:
 - Implicit (clicks, impressions, etc.)
 - Explicit (ratings, reviews, surveys, etc.)
 - Context
- Fill the missing information with best estimates
 - Match key entities to each other (user-user, user-item, item-item)

- Batch Vs Online Recommendations
- Explore / Exploit Paradigm
- Content Vs Collaborative
- ...

Heuristics

- Business Rules
- Domain Knowledge
- Popularity

Linear

- Implicit features
- Matrix Factorization (SVD, NMF, ALS, SLIM)

Deep Learning

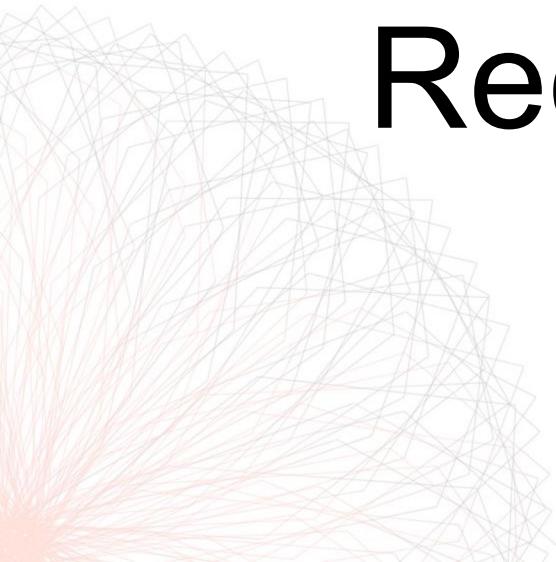
- Embeddings
- SAS-Rec, BART

LLM?

- More context and world understanding
- P5

Complexity

Evaluate & Optimize Recommendations



- Different metrics help us evaluate different aspects of a recommendation engine.

MRR

Mean Reciprocal Rank

MRR is the average of the reciprocal ranks of results for a sample of queries Q

MAP

Mean Average Precision

Average precision scores at each relevant item in the ranked list of recommendations

NDCG

Normalised Discounted Cumulative Gain

Relevance of recommended items and their ranking, placing higher emphasis on the top-ranked items

More

- Recall, Coverage, Diversity, Novelty...

A/B Tests and Beyond

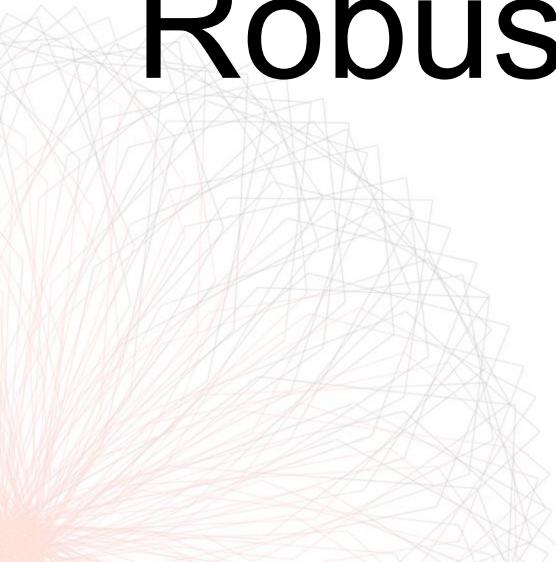
- **Offline Testing:** This involves using historical data to evaluate the performance of the recommendation engine, typically using metrics like precision, recall, MAP, and NDCG
- **Online Testing (A/B Testing):** In this method, two versions (A and B) of the system are compared by dividing the user base into two groups and measuring the impact on key metrics like, conversion rate, etc.



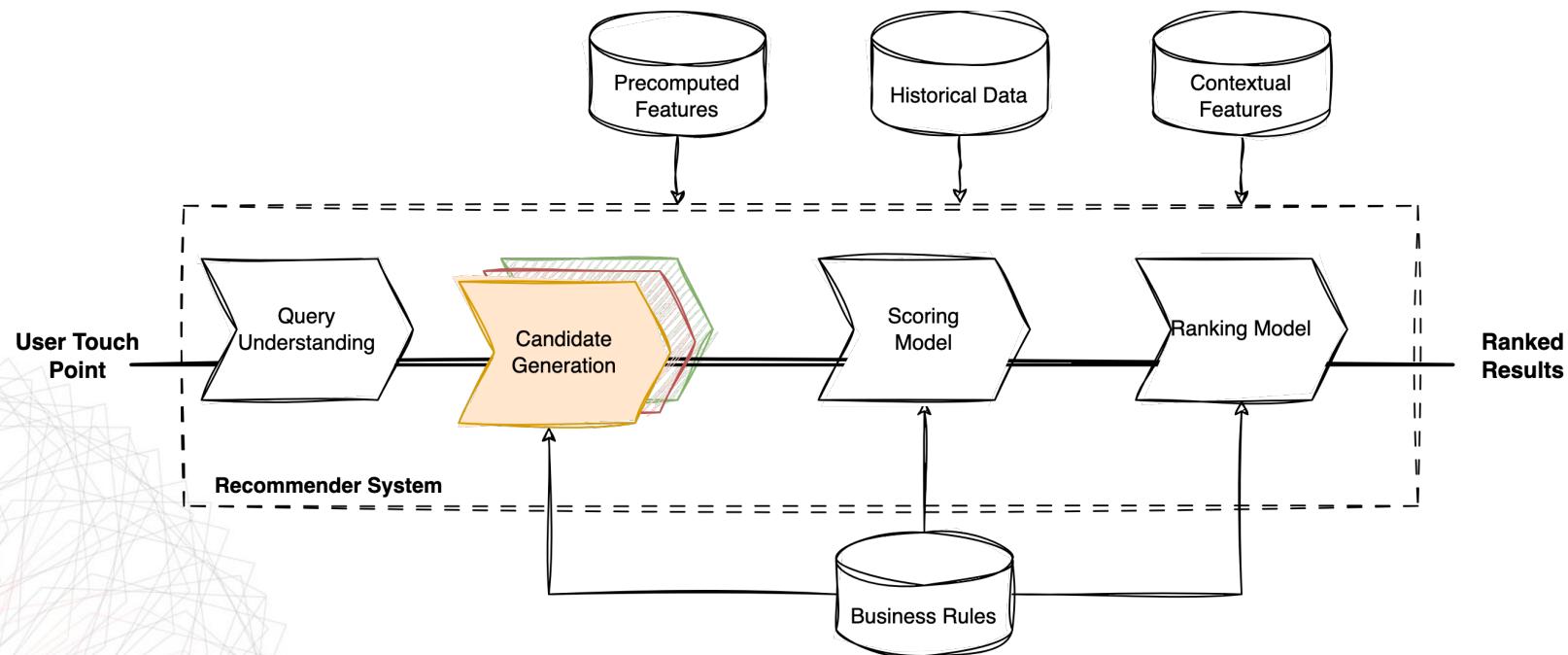
- **User Studies:** This involves gathering qualitative feedback from users about the quality of the recommendations, often through surveys or interviews.
- **Multi-Armed Bandit Testing:** This is a form of online testing where the system dynamically adjusts the proportion of traffic receiving different versions of the recommendation system based on their performance.



Robustness & Scalability

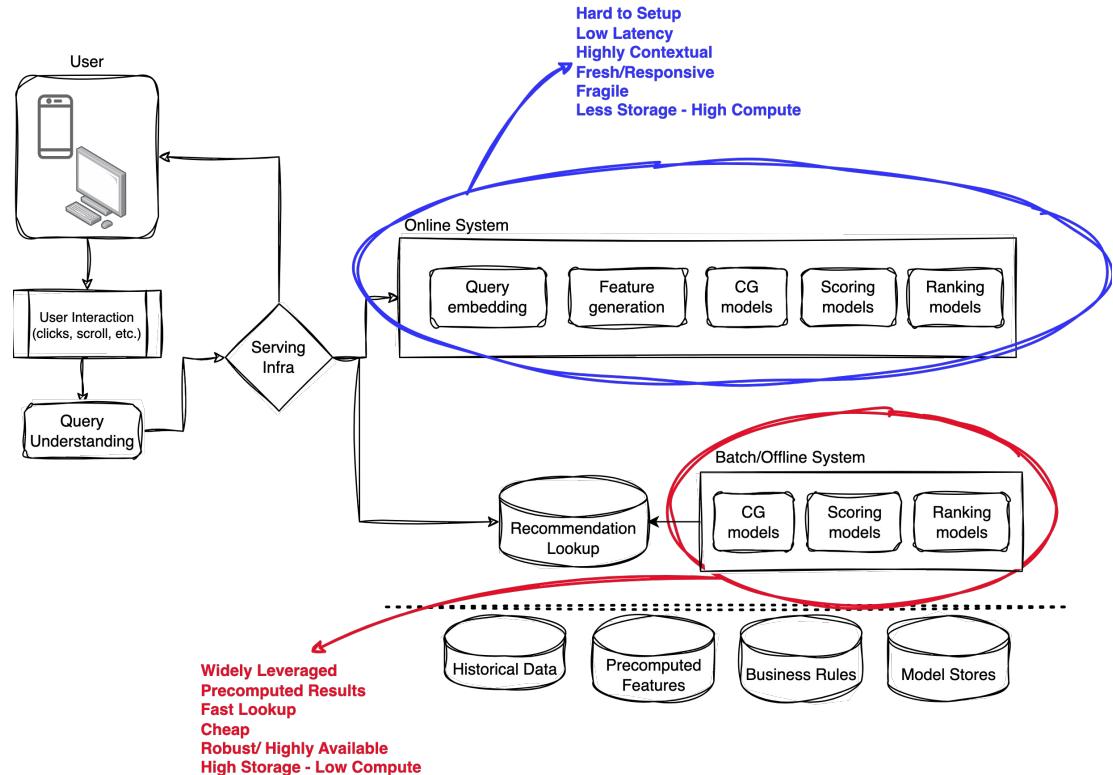


Overall Schematic

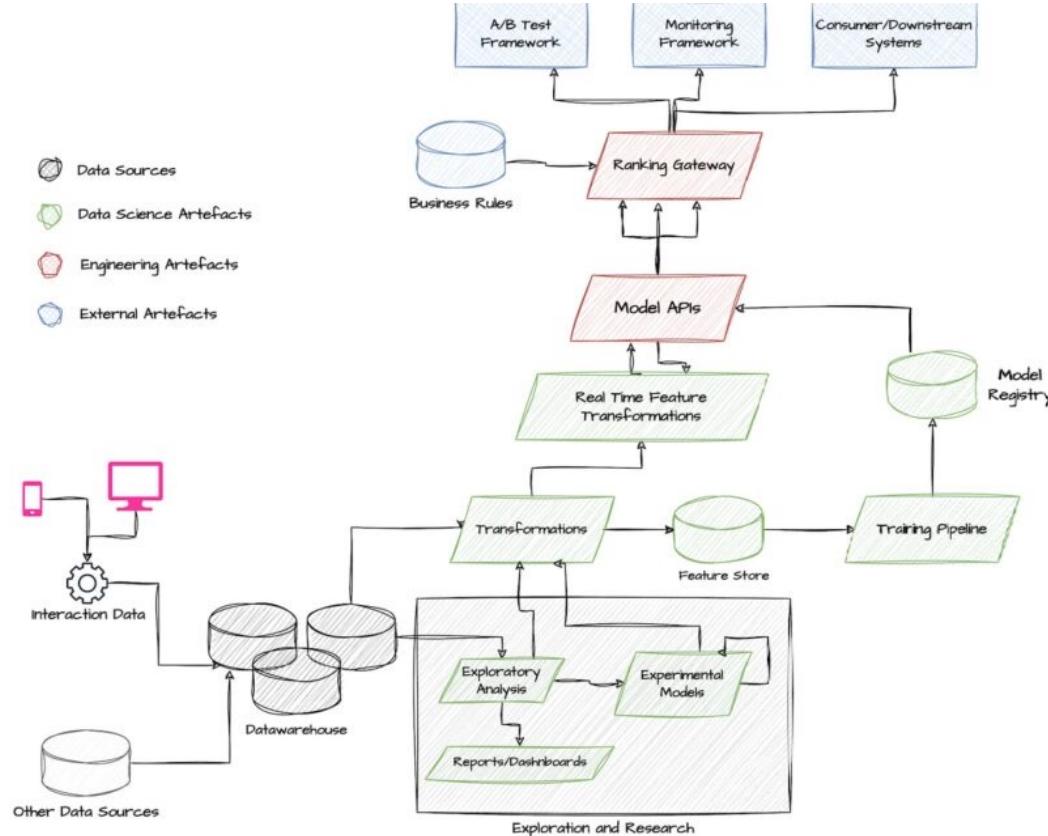


What Scale & Why Robust?

- **Scale:** Delivery Hero brands are serving **millions of customers** across **hundreds of cities** across the planet on a daily basis
- **Robust:** Recommendations & Ranking systems are key components for our apps. Their resilience and robustness ensure our customers get **best in class experience**



Reference System





Let Us
Recommend
Hands-On • Quick Demo

Thank You!