"What Do They Do Next?"

Recommendations with Action Classification

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About Macy's Inc

- USA's most iconic department store
- Founded in 1858, 166 years history
- 519 stores in USA & online ecommerce
- Offers fashion, beauty, home essentials
- Annual revenue of $23B in 2024

Problem Statement

Macy's Next Best Action initiative aims to recommend highly-engaged customer actions—such as credit signup, loyalty upgrade, or channel opt-in—based on each user's behavioral signals. Predicting what customers will do next enables smarter engagement and personalized growth.

Random guess

Marketing News

Predict Probabilities of taking highly-engaged actions

Combine with estimated causal CLV uplift of each action

- Align targeting with actual journeys
- Enable Data-Driven Personalization
- Drive higher-value engagement

Data

Bounty Actions
email_optin, sms_optin, loyalty_signup, app_download, creditcard_signup, tier_upgrade

Purchase Actions
First_purchase, second_purchase, first_reward, first_coupon, cross_shopping

Online Activities
Browse_page, Add_to_bag

Campaign Data

5-Year Time Stamp

Customer Journey Construction

19M Customer Journeys

Top 10-15 common journeys

Top 10-15 common journey types

11 Types

Categorization

- **Growth** — Engaged but never purchased
- **Conversion** — Completed 1st purchase, but no repeat purchase / credit card
- **Repeat Purchase** — Made 2+ purchases
- **Dormant Card Holders** — Credit card holders who never upgraded or became inactive
- **Credit-Driven Tier Advancement** — Credit card users who upgraded to higher loyalty tiers
- **Drop-off** — Showed intent but never purchased
- **Deal Seeker** — Used coupons on >80% purchase
- **Category Expander** — Completed ≥ 2 cross-category purchases
- **Campaign Driven** — Triggered purchases by campaign
- **Omnichannel** — Interacted via multiple channels
- **High-value** — Performed multiple high-value actions

Analysis

Labels

6 Highly-Engaged Action

- Email Opt-in
- SMS Opt-in
- App Download
- Propcard Signup
- Cobrand Signup
- Tier Upgrade

Methodology

Data Loading

Features

Purchase Related
Recency, frequency, monetary, discount usage

Online Activities
Search, browse, view, clicks, omnichannel flags, cart

Segmentations
Channel, loyalty tier, journey types, days_since...

124
Features

Preprocessing

Handle Missing Value
Fill in NA value with 0;
Remove rows ~0.2%

Prevent Data Leakage
Create dictionary to mask out invalid labels per row per column

Correct Data Type

One-hot Encode

93%
Skewness reduced

Forecast Modeling

Baseline (Random Guess)

V.S.

ML Modeling Approach
Binary: 6 XGBoost models
Multi-label: XGBoost (Baseline, tune parameter, classifier chain, focal loss), Neural Network

Model Selection
Multi-Label Classifier Chain

Multi-Label Classifier Chain
Best Model

Enhancement

Rank Probability under each customer

Predict Multiple Possible Actions Per Customer

Dependent Target Actions

Data-Driven Model

53%
Performance Improved

Recommendation

CLV Uplift Per Action

MAX(P(action_i) × ΔCLV)

Preferred Next Action Prediction

Customer History

Propensity Model

Recommendation

Interpretation

Next Best Action
Recommended to Each Customer

Modeling Results

Best Model

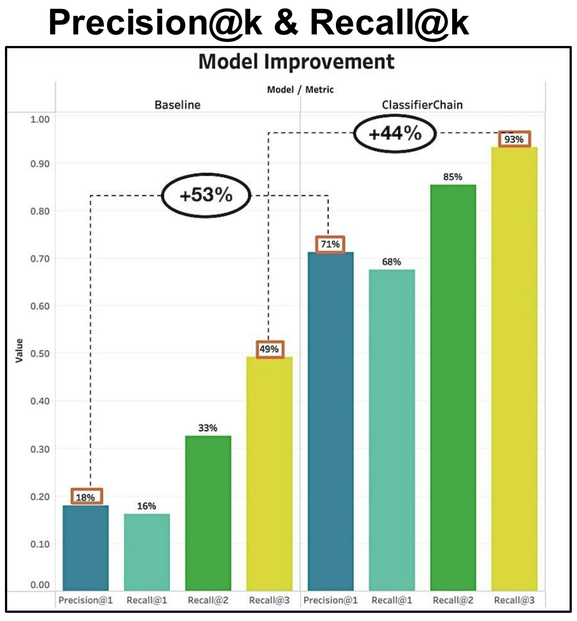
71% Precision@1 ↑ **+53%** Over Baseline

93% Recall@3 ↑ **+44%** Over Baseline

$30 CLV Uplift ↑ **+296%** Over Baseline

Our Best Model: XGBoost Classifier Chain
Baseline: Random Guess
Target: 6 highly-engaged actions
Customer Level: All customers ~ 50m
Quarter: 2025.05 (30d) & 2025.0506 (60d)

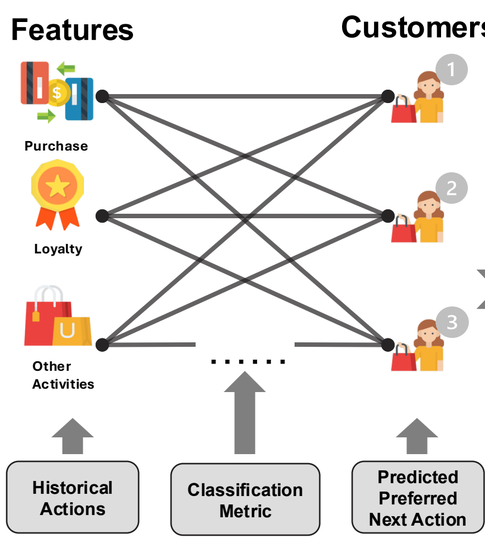
Precision@k & Recall@k



Top Features

1. Days_since_loyalty_signup
2. Recency
3. Days_since_app_download
4. Is_dormant_card_holder
5. Days_since_email_optin

Action Recommendations



Example

Actions	Probability	Rank
Download App	69.11%	1
Opt-in SMS	30.42%	2
Upgrade Loyalty tier	11.57%	3

$$CLV\ Uplift\ for\ Action_i = \Delta CLV_i$$

$$Probability\ of\ Taking\ Action_i = P(Action_i)$$

$$Expected\ Value\ of\ Action_i = P(Action_i) \times \Delta CLV_i$$

Recommended Action:

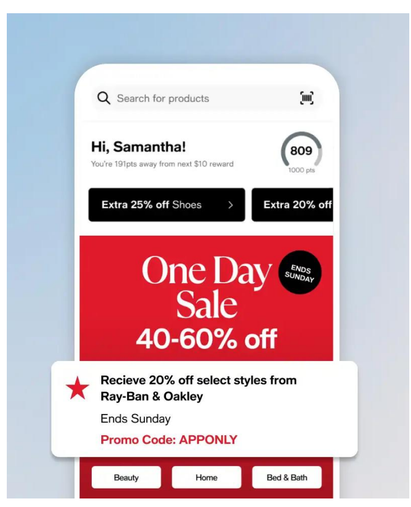
$$MAX(P(Action_i) \times \Delta CLV_i)$$

Business Use Case

Initiate Data-Driven Personalized Marketing Startegy

- Power personalized journeys by surfacing the most relevant next action for each customer
- Use model predictions to filter customers eligible for credit card offers before running acquisition campaigns
- Trigger timely omnichannel nudges (e.g., app download prompts) for users close to full-channel activation
- Tailor message framing based on the predicted action (e.g., promote cross-category variety vs. loyalty benefits)

Business Impact



Personalized Customer Engagement: Recommend the most relevant marketing action (e.g., app download, loyalty upgrade, or credit card signup) for each customer based on their journey and behavior.

Marketing Campaign Optimization: Predict which customers are most likely to respond to each type of campaign (email, SMS, app push) and allocate resources accordingly.

Customer Loyalty Tier Advancement: Identify which customers are likely to advance to higher loyalty tiers (Gold, Platinum) and what actions influence that upgrade.

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