Dynamic Contextualization for Starbucks Orders

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Problem Statement

Starbucks recently deployed a new product recommendation system on their drive-thru screens at 4,000 Starbucks locations. This recommendation system has been in use for the last year. Now the company would like to do a redesign of the interface and has tasked a UX team to refresh the screens. The ultimate goal of this project is to both optimize the conversion rate of Starbucks customers and to better communicate why the customer should purchase the items of interest to increase the likelihood of the product being purchased. The new design recommendations include more dynamic content to increase screen engagement and sales. The hypothesis is that if better communication is provided through headlines that show the customer why they are seeing particular products, there will be a higher revenue.

DATA USED:

> **ACTION REWARDS**

Maps impressions to successful conversions

> **WEATHER: store-hour-level**

Normalized weather features per seasonality

> **STORE**

Store level features such as number and location

> **PRODUCT**

Product features such as product type, name, ingredients and flavor profile

Project Goals

- Determine context labels to requesting store
- Predict optimal headline choice
- Ensure product recommendation alignment with chosen headline

Feature Vectors

INPUTS
requesting store, time, weather, 4 products

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CONTEXT ELEMENTS
{preferred mode}
{weather state}
{store city}
{daypart}

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STRING TEMPLATES
"{weather state} in {store city}"
"{daypart} {preferred mode}"

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SUNNY IN SEATTLE | AFTERNOON TREAT

Context Element Mappings

The four context element keys are determined based on a set of rules displayed below. The "preferred customer mode" key is assigned to the value if the product is above the 50th percentile of the distribution ie. a product is a "treat" if it surpasses the 50th percentile of calories of all the products. This same logic applies to products that are a "Treat" or "Boost" when looking at the sugar and caffeine distributions respectively. Cognitive dissonance is taken into consideration to ensure that the headlines align with the products ie. model will only recommend hot drinks when the weather is chilly and iced drinks when it is sunny.

Context Element Key	Context Element Value	Product Discordancy Notes
Hour store_city	{store num mapping}	
weather_state	Sunny	No hot drinks
weather_state	Chilly	No iced drinks
weather_state	Snowy	No iced drinks
weather_state	Rainy	No iced drinks
weather_state	Pleasant	
daypart	Morning	
daypart	Lunch	
daypart	Afternoon	
daypart	Evening	
preferred_customer_mode	Light Pick-Me-Up	Calorie threshold/weight potential
preferred_customer_mode	Treat	Sugar threshold/weight potential
preferred_customer_mode	Boost	Caffeine threshold/weight potential
preferred_customber_mode	Flavor	

Addressing Cold Start

There is no historical data on the performance of these dynamic contextualized headlines since they haven't yet been pushed to production yet. We used Thompson Sampling which utilizes a random uniform distribution to create random probabilities for each headline. The prior is set to an optimistic prior and we observe how quickly we can converge to a headline that produces the most incremental ticket.

Multi-Armed Bandits

The multi-armed bandit problem models an agent that wants to simultaneously acquire new knowledge (exploration) and optimize decisions based on existing knowledge (exploitation).
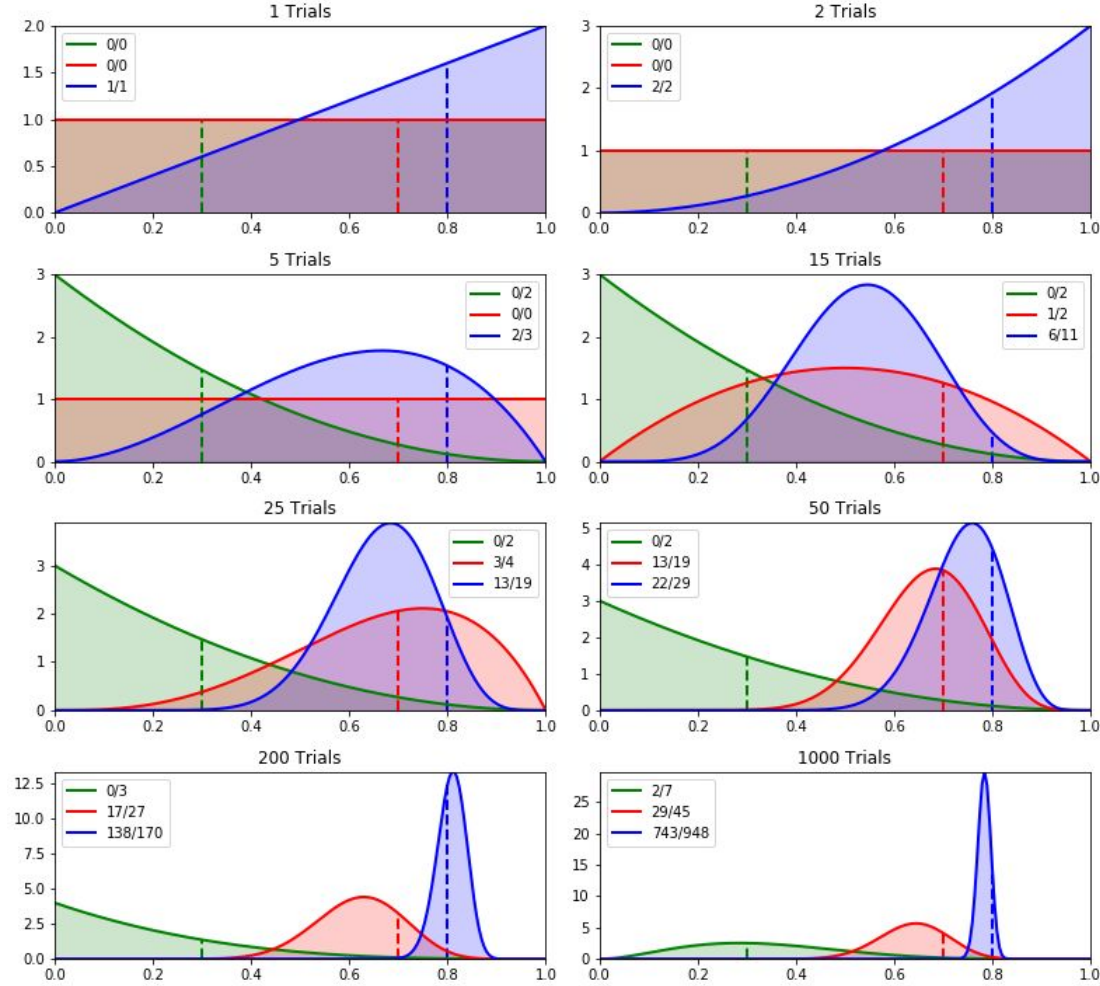
The information (customers purchasing or not) gained from the data gathered will shift the distribution in different ways to reflect an accurate reward model.

Headlines

We utilized the product features to create 11 potential headlines and then employed our implementation of multi-armed bandits to choose the best headline for conversion rate.

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Headline 0 was displayed 49.0 times
Headline 1 was displayed 95.0 times
Headline 2 was displayed 34.0 times
Headline 3 was displayed 57.0 times
Headline 4 was displayed 650.0 times
Headline 5 was displayed 33.0 times
Headline 6 was displayed 57.0 times
Headline 7 was displayed 1605.0 times
Headline 8 was displayed 119.0 times
Headline 9 was displayed 125.0 times
Headline 10 was displayed 176.0 times

Overall Conclusion: The best headline to display is headline "Sunny Treat"!
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