



HOW SHOULD BOSTON RESTAURANTS ALLOCATE CONTENT CREATION RESOURCES ACROSS SOCIAL MEDIA PLATFORMS?

15.072 Advanced Analytics Edge – Final Project

Team Members:

Jason Jia, Stephanie Sha, Maria Besedovskaya, Pavena Vongkhammi

PROBLEM AND MOTIVATION



- Key Question: How should Boston restaurants allocate content creation resources (e.g. time, effort, number of posts) across Instagram, Facebook and TikTok?

Current distribution
of accounts:



100%

Time spend
by creators:

~60%



96%

~30%



49%

~10%

Social media is an amazing tool for marketing:
promotion, advertising, building a brand

Very labor-intensive
(need time-saving, simple recipes)

Trial and error approach
“Currently try weird things on TikTok, but
basically ignore it”

DATA – ENGAGEMENT METRICS



96 restaurants in Boston area

April 2023 – September 2023 (6 months)

Instagram

Facebook

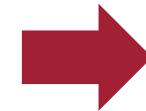
TikTok

Likes

Views

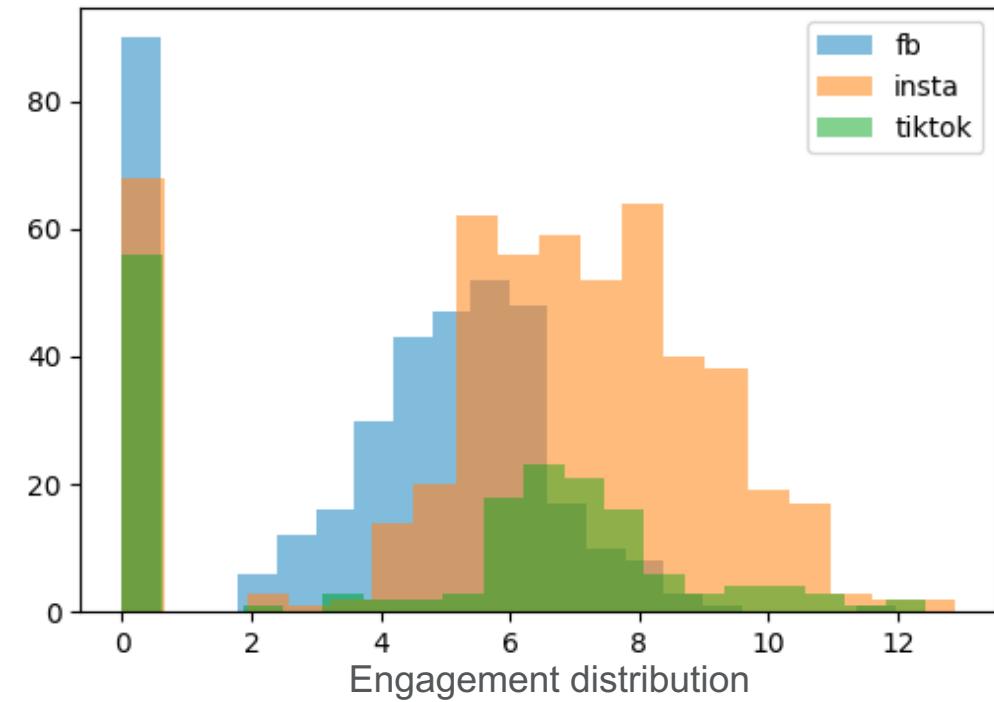
Comments

Followers



Divide into quantiles for classification

$$\text{OverallEngagement} = \log(\text{views} + 5 * \text{likes} + 10 * \text{comments} + 1)$$



METHODS – CLASSIFICATION MODEL



Data Transformation

Restaurant	Insta like Apr 2023	Insta like May 2023	Insta like Jun 2023	...
Life Alive Organic Cafe	262.40	147.0	235.0	
Meimei dumplings	254.80	230.8	167.2	
Moona	58.66	53.0	43.8	

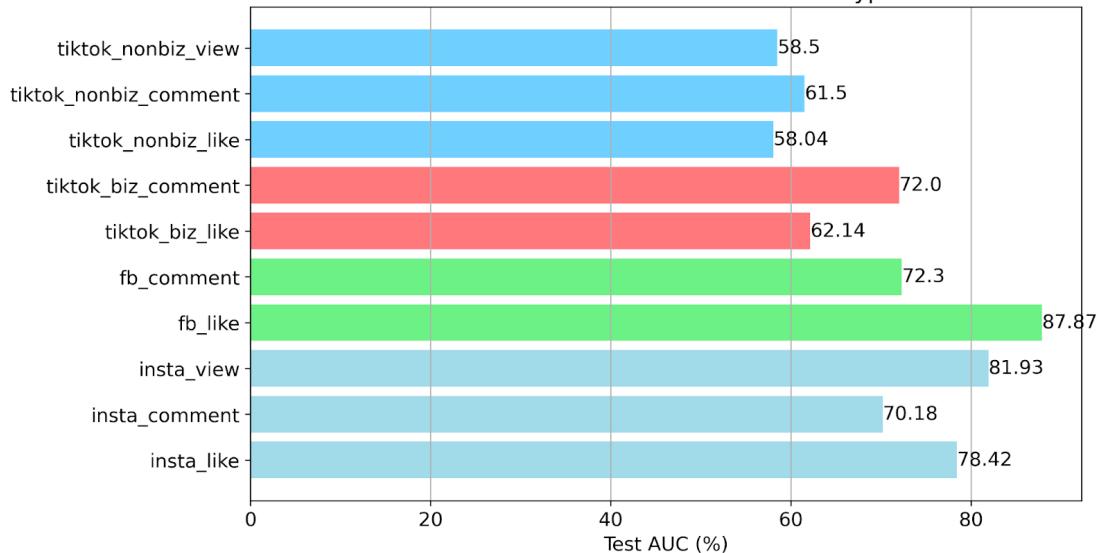


Restaurant	Insta like month m	Insta like month m+1	...
Life Alive Organic Cafe	(181.1, 7864.8]	(67.2, 181.1]	
Life Alive Organic Cafe	(67.2, 181.1]	(181.1, 7864.8]	
Life Alive Organic Cafe	(181.1, 7864.8]	(181.1, 7864.8]	
Life Alive Organic Cafe	(181.1, 7864.8]	(67.2, 181.1]	
Life Alive Organic Cafe	(67.2, 181.1]	(67.2, 181.1]	
:	:	:	

Target variable

CatBoost Model Performance

Test AUC Scores for Different Model Types



Results



70-80% AUC for Instagram



72-88% AUC for Facebook



60-72% AUC for TikTok

METHODS – MULTI-ARMED BANDITS



METHODS – MULTI-ARMED BANDITS



Purpose

Get the optimal distribution of content creation resources across Instagram, Facebook and TikTok

Core Idea

Rewards are uncertain, but we get to see them after taking an action. We use observed rewards to estimate “true rewards” (action values).

Exploration vs Exploitation

The bandit chooses the action with the highest estimated action value most of the time ($1 - \epsilon$) but chooses a random action a small fraction of the time (ϵ).

Non-Stationary Action Values

The reward is drawn from a uniform distribution with bounds of action value $+/- 0.5 * SD(\text{quantile})$. This also becomes the updated action value.

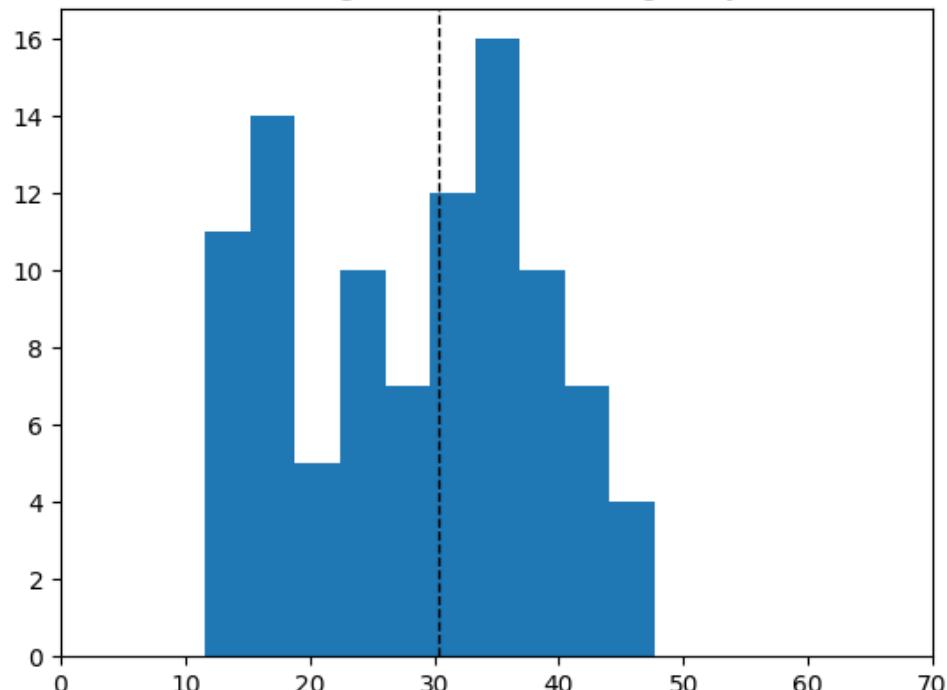
KEY FINDINGS (1/3)

Overall engagement can be significantly improved.



- Restaurants should strongly consider **posting more on TikTok** even if it comes at the expense of posting less on Instagram and Facebook, because it can improve overall engagement by **30%** on average.

Distribution of % improvement in overall engagement moving from baseline to ϵ -greedy



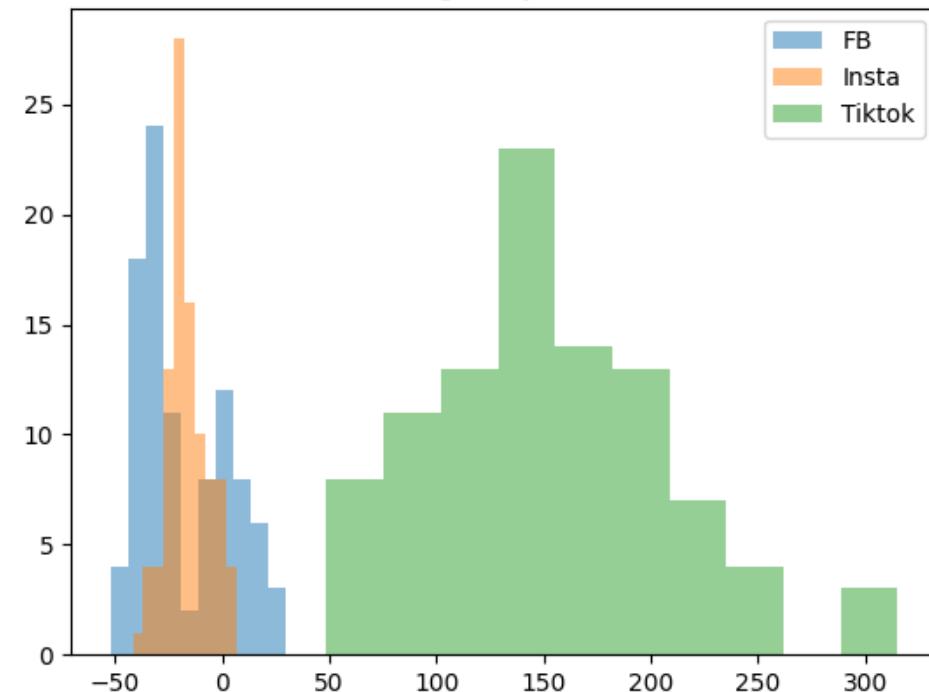
KEY FINDINGS (2/3)

Restaurants should consider using TikTok a lot more.



- The epsilon-greedy also recommends **spending 152% more resources on TikTok**, 16% less resources on Instagram and 18% less resources on Facebook relative to baseline, on average.
- This gives an average optimal distribution of resources of **50.2%** on Instagram, **24.6%** on Facebook and **25.2%** on TikTok.

Distribution of % difference in action counts between ϵ -greedy and baseline

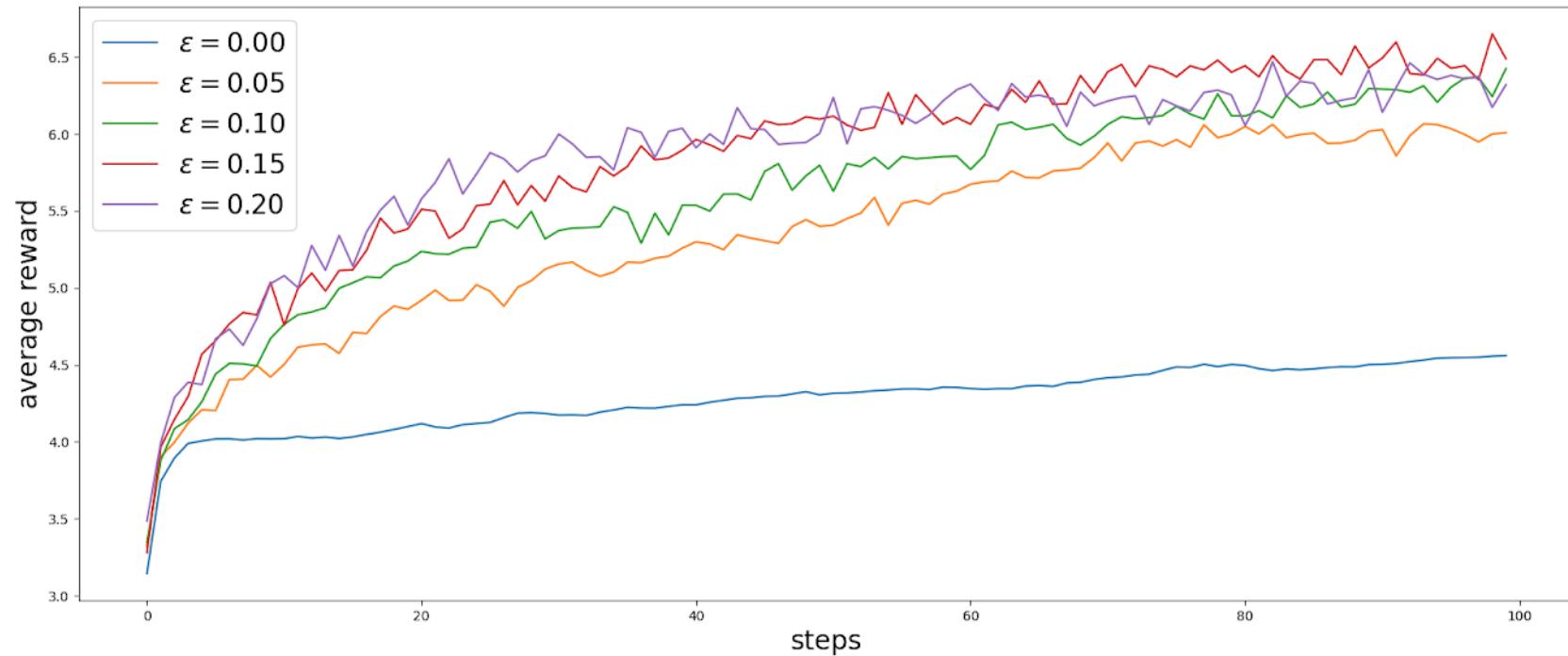


KEY FINDINGS (3/3)

Restaurants should try out different social media platforms.



- The optimal strategy typically gives $\epsilon \in [0.1, 0.15, 0.2]$, which means restaurants should try out different social media platforms from time to time!



WEB INTERFACE TOOL

Deploy 

Enter your restaurant's name

Upload a file with last month of views, comments and like on Instagram, Facebook and Tiktok

 Drag and drop file here
Limit 200MB per file

[Browse files](#)

Enter your current Instagram follower count

0  

IMPLICATIONS



“Spending more time creating content on TikTok relative to Instagram and Facebook can significantly increase overall engagement”

Restaurants

- Older audience
- Less resources for video creation



Should try other strategies

- Younger audience
- Already create video content



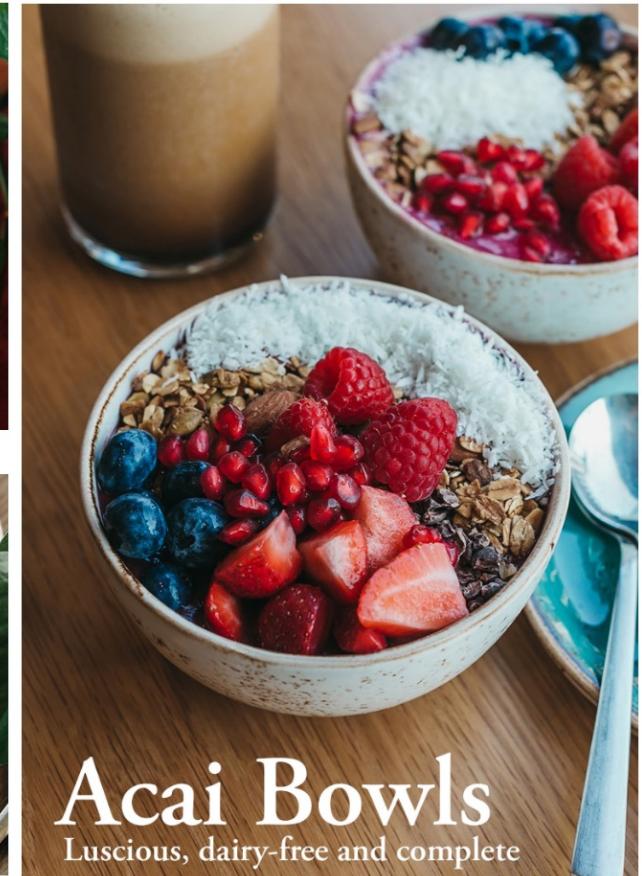
Future success!



LIFE ALIVE ORGANIC CAFE – LOCATION



LIFE ALIVE ORGANIC CAFE – MENU



LIFE ALIVE ORGANIC CAFE – MARKETING



LIFE ALIVE ORGANIC CAFE – INSTAGRAM



lifealivecafe Following Message +∞ ...

2,761 posts 28.3K followers 905 following

Life Alive Organic Cafe

Restaurant
Eat positive. Live positive.
An all-day urban oasis serving organic whole food artfully prepared from scratch.
www.lifealive.com/order-online + 2

Followed by [portoboston](#) and [eishna.r](#)

Autumn Press Beverages Nourishment Wellness 2 Cafes Summer

POSTS REELS TAGGED



LIFE ALIVE ORGANIC CAFE – FACEBOOK



 Life Alive Organic Cafe
13K likes · 13K followers

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Intro

Life Alive is here to provide satisfying, energizing and delightful nourishment in a cozy and invitin

[Page](#) · Vegetarian/Vegan restaurant
[\(617\) 354-5433](#)
[info@lifealive.com](#)
[twitter.com/lifealivecafe](#)
[lifealive.com](#)
[Price range](#) · £
[Rating](#) · 4.2 (830 reviews)

Photos

[See All Photos](#)



 Life Alive Organic Cafe Yesterday at 07:40 · [...](#)
Welcome December! It's officially cozy season. Wrap yourself in the cozy embrace of our seasonal lattes.
Experience the warming notes of our new Chai Latte, made with aromatic spices. Or indulge in the oh-so-smooth Butternut Spice Latte—It's a celebration of positive eating in every sip.
Enjoy hot or iced



[Like](#) 4 [Comment](#) [Share](#)

[Write a comment...](#)

LIFE ALIVE ORGANIC CAFE – TIKTOK



lifealivecafe

Life Alive Organic Café

Follow



55 Following 390 Followers 755 Likes

We're here to renew your energy & connection to life through vibrant nourishment

Videos

Liked



▷ 3031

How the beloved Swami ...



▷ 2682

Lover Bowl #lifealive ...



▷ 3821

Coconut coffee ☕️ ☕️ ...



▷ 796
Spooky Pumpkin Sp...

New Spooky Pumpkin Sp...



▷ 718
Let's make a butternut
spice latte!

Starting October 3rd

LIFE ALIVE ORGANIC CAFE – MARKETING TEAM



Kaitlyn Mailly · 3rd

Wherever you are, be all there.

Suffolk County, Massachusetts, United States · [Contact info](#)

71 connections



Institute for Integrative
Nutrition



Kaitlyn Mailly

Wherever you are, be all there.

 Cafe Manager

Life Alive Cafes · Part-time

Oct 2019 - Present · 4 yrs 3 mos

Boston, Massachusetts, United States



Jason Jia

November 30, 2023 at 6:56 AM

Re: Afternoon chat - thank you! + Collaboration between Life Alive and MIT students

To: Kaitlyn Mailly, Cc: Stephanie Sha, Pavena Vongkhammi & 1 more

[Details](#)

Hi Kaitlyn,

Sure! We are looking at the number of views, likes and comments on Facebook, Instagram and Tiktok, as well as 'overall engagement' which we defined as roughly proportional to 1x number of views + 5 x number of likes + 10 x number of comments.

Best wishes,
Jason

[See More from Kaitlyn Mailly](#)



Kaitlyn Mailly

December 1, 2023 at 2:38 PM

Re: Afternoon chat - thank you! + Collaboration between Life Alive and MIT students

To: Jason Jia, Cc: Stephanie Sha, Pavena Vongkhammi & 1 more

[Details](#)

Hi Jason,

Thank you for sharing this. The team is onboard for us to work together! It will just be me involved for now.
Let me know how you envision us moving forward.

Best,
Kaitlyn

[See More from Jason Jia](#)



Potential future collaboration with Life Alive Organic Café

- Pitched our findings to Kaitlyn Mailly, the social media coordinator of Life Alive Organic Cafe
- Kaitlyn expressed strong interest in our project as her team is also considering ramping up activity on **TikTok** relative to Instagram and Facebook, which currently serve as their main social media channels.
- Currently discussing how we can further collaborate with the marketing team on this problem
- More to come!





APPENDIX

METHODS – MULTI-ARMED BANDITS (1/2)



- We first get overall engagement quantiles for each of the social media platforms: 4 for Instagram, 4 for Facebook and 3 for TikTok. We also get their standard deviations. We then read in the final predicted probabilities for the number of likes for the month t+1 (as a proxy for overall business engagement), and use them as initial probabilities to the model.
- We use a 3-armed bandit problem where the arms represent Instagram, Facebook and TikTok respectively. Taking an action here can be interpreted as creating a post on the selected social media platform, or more broadly a unit of content creation effort.
- We get an initial action value by first drawing a quantile using the initial probabilities of being in each quantile, then draw an overall engagement number randomly from the list of overall engagement numbers in that quantile. Since numbers with higher frequency appear multiple times in the list, we maintain the relative probabilities in the quantile.

METHODS – MULTI-ARMED BANDITS (2/2)



- Then, when action A_t is selected at time step t , a reward R_t is drawn uniformly from bounds $[Q^*(A_t) - SD(\text{quantile of } Q^*(A_t))/2, Q^*(A_t) + SD(\text{quantile of } Q^*(A_t))/2]$. If this is negative, we floor it at 0. This also becomes the true action value at the next time step.
- The action values are estimated with a constant step size =0.1 rather than using a sample average, because the action values are non-stationary and we want to put more emphasis on learning from more recent rewards: $Q_{t+1} = Q_t + (R_t - Q_t)$.
- The action is selected using the epsilon-greedy method: select the action with the highest estimated action value ($1-\epsilon$) of the time, and a random action ϵ of the time.
- We use 100 time steps and keep track of the average reward of 500 runs of this model for each restaurant over time. We try out epsilons in the range $[0, 0.05, 0.1, 0.15, 0.2]$.