

Optimizing AI-Generated Content for Enhanced Digital Outreach to Food-Insecure Hispanic Communities



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Abstract

Food insecurity significantly impacts the U.S., with 10.2% of households affected in 2021, and 17% of these being Hispanic¹. The issue persists, especially in New York City, where nearly 29% of food-insecure households are Hispanic². Our research explores the use of GPT models (GPT-3, GPT-3.5, and GPT-4) to bridge the gap between food organizations and the Hispanic community via AI-generated content. We manipulated tonality, temperature, and token count to generate varied content and employed techniques like Jaccard Similarity, Doc2Vec, BERT embeddings, and Pearson Correlation Coefficient for analysis. Visual tools such as UMAP and heat maps helped in content assessment. The goal is to tailor messages effectively for various online platforms, ensuring resonance with specific audiences. Plans for real-world feedback include a comprehensive survey targeting the Hispanic community to evaluate AI-generated tonality reception. This will guide the development of an AI chatbot connecting food organizations with the Hispanic community. While our focus is on the Hispanic demographic, our approach holds potential for broader digital outreach across different communities and sectors.

Introduction

Food insecurity remains a pressing challenge in the US, with the Hispanic community bearing a disproportionate burden. In our interconnected era, the power of effective communication through platforms like social media is undeniable. The potential of Artificial Intelligence (AI), especially the Generative Pretrained Transformer (GPT) models, offers a hope for enhanced outreach to communities in need. With their adept text-generation capabilities, these models are suitably equipped to produce content tailored for diverse platforms, from detailed websites to engaging social media posts. This research explores AI's capabilities by combining textual analytics and anticipating the insights from a future comprehensive survey targeting the Hispanic community. Together, these efforts aim to bridge the gap between essential food resources and those in need.

Background

In the age of digital communication, the evolution of Artificial Intelligence (AI) models has transformed the way content is generated and tailored. Generative Pre-trained Transformers (GPT) are at the forefront of this technological advancement. Originating from the broader family of transformer models, GPT's design enables it to produce human-like text based on the patterns it identifies from vast amounts of data it's trained on. With versions of GPT evolving from GPT-3 to GPT-4, the enhancements in text generation and understanding have been substantial. These models, equipped with adjustable parameters like tonality, temperature, and token count, offer unparalleled customization in content creation. As the digital realm becomes a primary source of information for many, the capability of GPT models to effectively bridge communication gaps holds significant promise for diverse applications.

Methodology/Approach

- Problem Identification:** addressed the communication gap experienced by food-insecure Hispanic communities, focusing on effective AI-driven communication tools to bridge this gap.
- Data Collection:** Extracted 25 diverse social media posts from platforms like Instagram, Twitter, and Facebook, and some from general information websites. These posts served as real-world examples to analyze and enhance using AI models.
- GPT API Integration:** Developed a Python script to connect to the GPT models (GPT-3, GPT-3.5, and GPT-4) using an API key. This allowed for a comparative approach to evaluate the capabilities and effectiveness of different GPT versions.
- GPT Model Text Generation:** Using the API-connected script, transformed each original post into three different tonalities (simpler, empathetic, persuasive) across the three GPT models.
- Customization of GPT Settings:** Adjusted features like token count and text temperature for each GPT model, producing variations of each post, creating content tailored to different audience segments.
- Textual Comparison Techniques:** Employed techniques such as Jaccard Similarity, Doc2Vec Embeddings, BERT Embeddings, Cosine Similarity, and Pearson Correlation to understand the effectiveness and resonance of AI-generated content versus the original posts.
- Visualization of Text Embeddings:** Utilized UMAP methodology, along with heatmaps, to visualize the text embeddings, highlighting the semantic differences and similarities between outputs from different GPT models.
- Real-world Application & Chatbot Development:** A chatbot, currently in the developmental phase, will be fine-tuned based on insights from the textual comparison of this research and the results of the upcoming survey. The goal is to enhance user engagement and tailor the chatbot's communication style to resonate better with the target Hispanic communities.

Results/Discussion

Textual Variability Across Models

All three GPT models demonstrated high adaptability in generating content across the chosen tonalities. However, GPT-4, given its advanced architecture, exhibited nuanced language patterns and a slightly higher alignment with the desired tones. Important to note, that while GPT-4 Model produces the best results, it is significantly slower than GPT-3.5. The speed of the text generation is significant for developing a chatbot.

EXAMPLE 25
original -> Choosing what we eat is essential for everyone. And our participants have their own choice of a variety of fresh offerings, with a wide range of beautiful produce and quality protein available!
simpler -> Picking our food is important for us all. Our members can pick from many fresh options, with lots of different fruits, veggies and meats to choose from!
empathetic -> We completely understand that making food choices is an important task for all of us. Hence, we want you to know that our participants are offered a vibrant selection of fresh foods. They can select from an expansive variety of wonderful produce and top-quality proteins that are available!
persuasive -> Making mindful choices about our food is absolutely critical for us all. We're delighted to offer our participants an enticing array of fresh options to select from. Imagine a smorgasbord of lush, vibrant produce and premium protein selections right at your fingers. Your power to choose has never been this colorful and delicious. Dive in!

Twitter Post

EXAMPLE 19
original -> Forced to retire early, Centeno is one of many CalFresh recipients who will experience a drastic decrease in their benefits because of the ending of emergency allotments at the end of March. Wealth disparities in California continue to widen since the recent impact of inflation, and individuals like Centeno, who live on fixed incomes, struggle to make ends meet. Read this San Francisco Chronicle here: <https://loom.ly/3D78W4>
simpler -> Centeno, who had to retire early, is among the many people receiving CalFresh who will see a big cut in their benefits when the emergency support ends in March. The rich-poor gap in California keeps growing because of recent inflation. This makes life really hard for people like Centeno who have set incomes. Check out the full story in the San Francisco Chronicle here: <https://loom.ly/3D78W4>
empathetic -> Centeno, like many others obligated to take early retirement, is among numerous CalFresh beneficiaries who are facing potential hardship due to the impending cessation of emergency allotments as we approach the end of March. Unluckily, we are witnessing an unwelcome trend in California where wealth disparities are intensifying - a situation made worse by recent inflationary pressures. This hits hard for people like Centeno who rely on fixed incomes while battling to cover their daily costs of living. For further insight on this pressing issue, do take a moment to read this San Francisco Chronicle article here: <https://loom.ly/3D78W4>. Together, we may shed light on this struggle and help support those most affected.
persuasive -> As an untimely retirement cast its shadow on Centeno, he emerges as one of numerous CalFresh beneficiaries soon to be hit hard by the termination of emergency allotments following March's end. From this date, these life-sustaining benefits will deteriorate significantly. Amidst the escalating waves of inflation, wealth disparities persistently intensify in California, consequently pushing individuals like Centeno - those surviving on fixed incomes - onto a tightrope as they grapple to meet their basic necessities. Let's shine a spotlight on their plight. Explore the subject further in this compelling San Francisco Chronicle article at: <https://loom.ly/3D78W4>. Your cognizance can inspire a difference.

Facebook Post

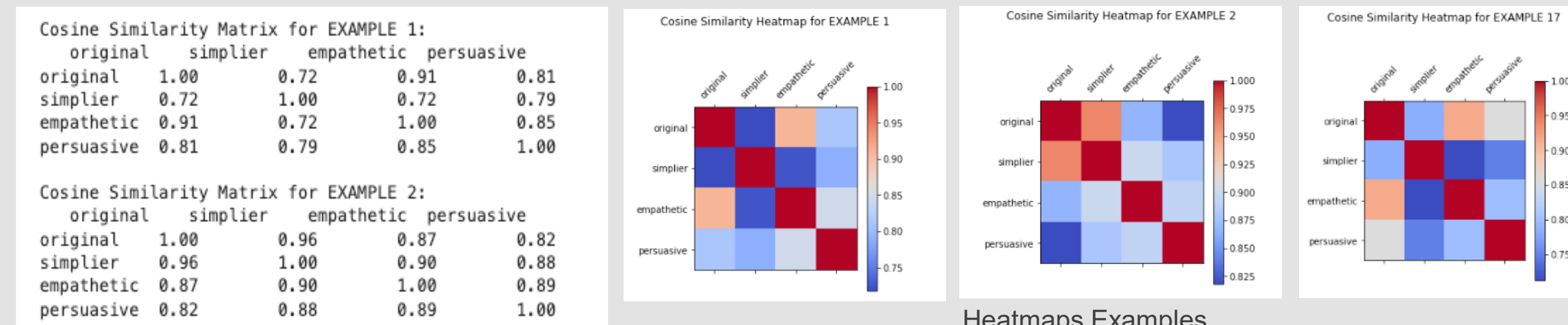
EXAMPLE 12
original -> Right now, millions of New Yorkers are struggling to feed their families as the costs of food, rent, utilities, and other necessities remain at near-record highs. Not only are grocery prices continuing to rise, but families receiving SNAP have seen major cuts to their benefits as federal pandemic-era increases expired earlier this month. Our leaders in Albany have less than a week left to pass the state budget, and it's crucial that they fully fund hunger relief programs that will help bridge the gap for our neighbors experiencing food insecurity. Stand with City Harvest and @feedingnys - Join us in calling on our NYS representatives to help feed our neighbors. Head to the link in our bio. #WeAreCityHarvest
simpler -> Currently, many people in New York are finding it hard to afford food and other basic needs because prices are very high. On top of that, the government has recently reduced the SNAP benefits. There are just a few days left for our leaders in Albany to approve the new state budget. It's very important they set aside plenty of money for programs that help people who can't afford food. Please support City Harvest and @feedingnys by asking our NYS representatives to help out. Visit the link in our bio for more information. #WeAreCityHarvest
empathetic -> At this very moment, the hearts of millions of New Yorkers are heavy. They are faced with the distressing challenge of providing food for their loved ones, amidst rising costs of food, rent, utilities, and other essential needs that remain brutally high. In an unfortunate turn of events, grocery prices are steadily climbing and, adding to the hardship, families dependent on SNAP have recently experienced substantial cuts to their vital benefits following the expiration of federal increases earlier this month.
persuasive -> In the crucial hub of Albany, our leaders are counting down the days, less than a week, to finalize the state budget. It's of utmost importance that they make the compassionate choice to fully support hunger relief programs. These programs prove to be the beacon of hope in bridging the painful gap for our dear neighbors facing food insecurity. Together with City Harvest and @feedingnys, let's take a stand. - Please join our heartfelt plea to our NYS representatives and lend a helping hand in feeding our beloved community. The link in our bio is awaiting your supportive action. Stand with us. #WeAreCityHarvest.
persuasive -> In the midst of these turbulent times, countless New Yorkers find themselves grappling with unparalleled challenges. Escalating expenses for food, housing, utilities, and more have hit near-record levels, pushing our fellow citizens on the brink. To add to their woes, families relying on SNAP have been hit with severe cutbacks in their benefits, following the expiration of federal pandemic-era increases earlier this month.
With less than a week at hand to finalize the state budget, the onus is on our trusted leaders in Albany to be the change these individuals desperately need. It is paramount that they prioritize the full funding of hunger relief initiatives. This vital move could provide a lifeline for our neighbors beset with food insecurity, bridging the widening gap.
Join hands with City Harvest and @feedingnys in our mission to eradicate hunger. Let us implore our New York State representatives to lend their support to our fellow New Yorkers in need. Please visit the link in our bio. As a stand for community solidarity, your action can make a difference. Lend your voice, because together, #WeAreCityHarvest.

Instagram Post

Figure 1: Variations in Text Tonalities Produced by the GPT-4 Model

- Adjusting token count influenced the length and depth of generated content. Shorter tokens led to more concise messages, while longer tokens allowed for in-depth exploration of the topic.
- Temperature adjustments unveiled a spectrum of content creativity. Lower temperature settings led to more predictable outputs, while higher temperatures led to more diverse and inventive content.

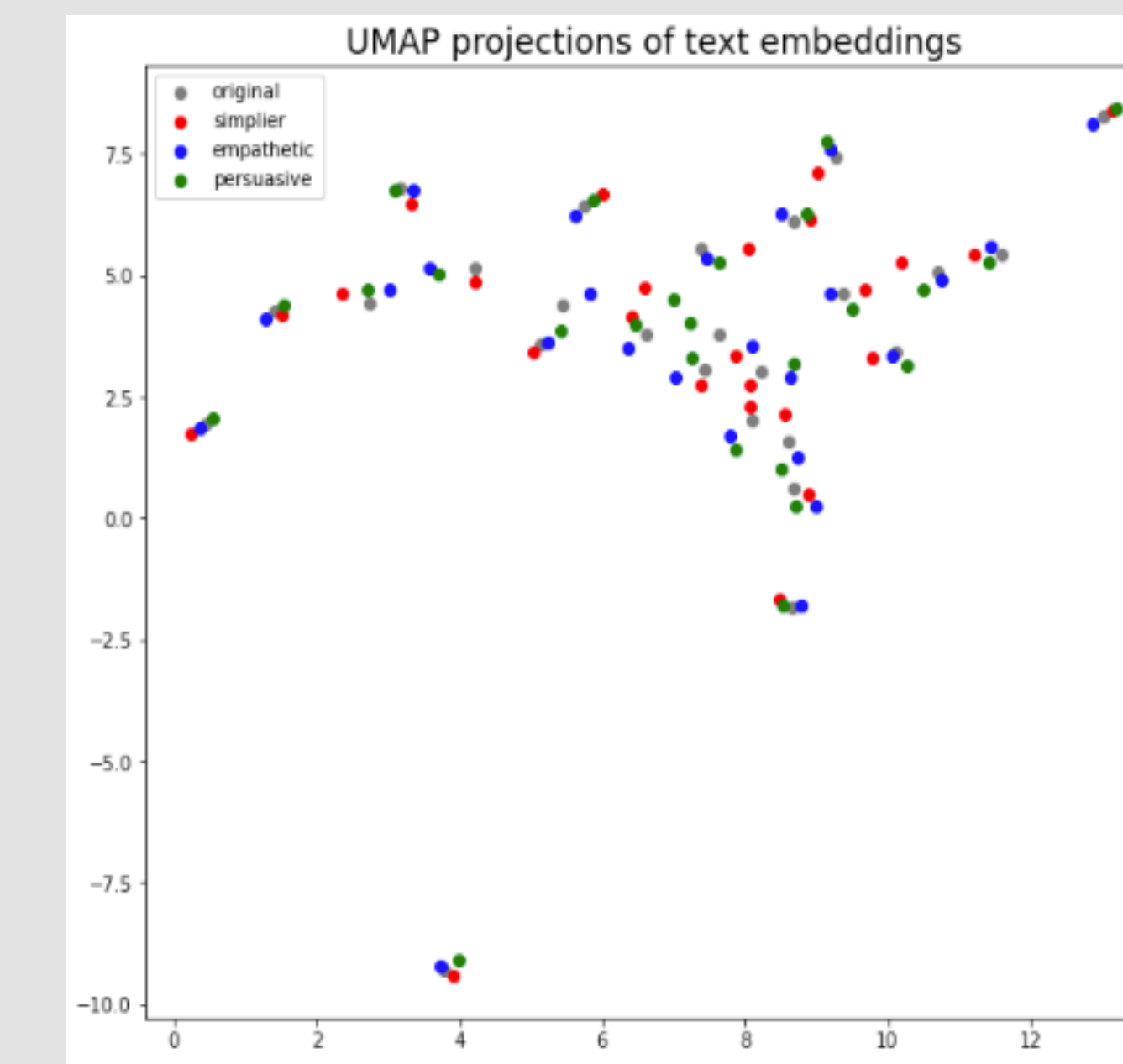
Analysis of the similarity



- For more than 50% of cases, the empathetic tone displayed the highest similarity to the original text, indicating that it retains much of the original content's meaning.
- The simpler tone, especially in the case of larger text samples, was usually differentiating from the original text the most.
- Pearson Correlation was used to indicate the similarities between the original text and its respective tonalities. Showing the similarity between 70% to 90% for all samples.

Figure 2: Numerical Analysis of Text Similarity Illustrated Through Heatmaps

Results/Discussion (Continue)



- Each point of the graph represents one of the text embeddings reduced to 2 dimensions.
- The position of each point in this 2D space is determined by its similarity to every other point.
- Each color represents one of the tonalities.
- The visual representation highlights varying degrees of similarity between text samples, with some samples displaying closer affinity than others.
- Text samples that were inherently similar in their original form maintained their similarity across tonalities.
- The persuasive tonality consistently exhibited high similarity across multiple samples, while the other two tonalities varied from sample to sample.

Figure 3: Visualization Using UMAP Projections

Conclusion

Analyzing various text tonalities revealed that the 'empathetic' tone often mirrors the original content closely, while 'simpler' versions tend to diverge more significantly. The results with 'persuasive' tonality varied, indicating its application might be more context-sensitive. Given the unique requirements of different social media platforms, tailored content generation approaches are essential. Twitter, with its emphasis on brevity, is best suited for a temperature of around 0.3, ensuring content clarity. In contrast, platforms like Instagram and Facebook, which accommodate lengthier content, benefit from temperatures ranging from 0.5 to 0.7. This range balances originality with consistency, with a leaning towards the 'empathetic' tonality. For comprehensive formats such as articles, a temperature setting of 0.7 offers an optimal blend of creativity and relevance. It's essential to adjust tonality, token count, and temperature harmoniously to platform constraints and audience expectations to ensure efficient communication.

Future Work

- Awaiting survey outcomes will provide clarity on the most effective tonality for our target demographic.
- Post-survey analysis, we plan to integrate its insights with our current research findings to create a chatbot tailored for the Hispanic community suffering from food insecurity.

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References

