Emotional Landscapes: Mapping
Sentiments Using Natural La
Processing

Xia Gao (Penn) and Eric Delmelle (Drexel, Penn)

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Motivation:

- **Role of Urban Parks:**
  - promoting *physical* activity
  - reducing *mental* health issues
  - offering a space for *community* engagement

- **Public Health Impact:**
  - green spaces reduce *stress*
  - mitigate *urban heat*
  - improve *air quality*

example of two extrem

Motivation:

- Limitations of Traditional Surveys
  - resource-intensive, time-consuming
  - results can become quickly outdated

- Leveraging Social Media Data
  - `real-time`
  - cost-effective
  - extensive data

- However, - can we capture public sentiment on park use and perceptions (?)
- is social media representative (!?)

Relevant Work

- Social Media in Urban Studies
  - Google Reviews, Twitter, and Instagram could be valuable data sources in urban
  - in the context of parks, it helps to understand visitor behavior and preferences

- sentiment and emotion analysis in urban spaces - natural language processing [NLP] interpret text data - derive public sentiment and emotional insights

Hugging Face

Research Questions

- What are the temporal, functional and spatial trends in emotional sentiments and v
  parks?
- What are the features frequently mentioned in reviews for different park visiting em
- **Methodology**: NLP algorithm to detect emotions
- **Data**: Google Reviews scraped for all parks in Philadelphia

Methodology

- **Sentiment Analysis**
  - *Hugging Face*'s NLP transformer models were used to classify sentiment as positive or negative
- **Emotion Analysis**
  - Categorize emotions into six types **Inspiration**, **Relaxation**, **Engagement**, **Discovery**, **Frustration & Annoyance**, and **Sorrow**
- **Data Processing**
  - Emotions categorized using `K-means` clustering to identify meaningful groups

Data

- **Source**
  - *Google Reviews* for Philadelphia parks, covering data from 2016 to 2024
- **Data Preparation**
  - Scraping with Outscraper, data cleaning and integration with PPR to remove du
    accuracyw
- **Review Filtering**
  - Only parks with over 25 reviews were analyzed, resulting in a sample of 92 parks

Data: spatial distribution of reviews

Data: temporal distribution (1)

Data: temporal distribution (2)

Data: What do these reviews look like?

review_datetime_utc	author_title	author_id	review_text	review_rating
04/13/2024 22:24:35	Matt Mccrum	103695489705227565879	Best trails in philly	5
04/12/2024 00:38:20	??	108101934735094350531	👍	5
04/10/2024 18:02:42	Pete Rhein	118156100062911374661	The best wilderness inside Philadelphia. A few hundred feet from the entrance and the city will disappear. There will be other Philadelphians enjoying it, but if you try a little you can get lost and alone. (That's meant to be posi	5
04/10/2024 16:41:18	K Sims	117218483857784577156		5
04/09/2024 18:05:42	BKDE93	102415647802740718 11		5
04				
04				
04	Wissahickon Valley Park in PA is a serene oasis with scenic trails along Wissahickon Creek. Nature lovers will appreciate its diverse landscapes and historic charm. Great for hiking, bi			
	There are a lot of really great trails here. A great place to take your dog as well			
04	Undoubtedly one of the best urban parks in the country! It feels like you're in the mountains and yet you're just minutes from the train station. What a gem!			
04	It is a great place to visit and an even better place to live! A diverse and accepting community.			
04	Beware, common place for robberies. Came back to my windows broken and my stuff gone.			
04	My car and other cars got broken into. Don't leave anything in your car cause your windows will get smashed and your stuff will get stolen.			
03				
03				
03				
03/29/2024 15:05:34	Grant Wise	116511380164676876113		5
02/27/2024 16:16:49	Stan Bailey	115752685075166063229		5
03				5
03				4
03				5
03				5
03				4
03			be there - walking, running, hiking	5
03				5
03				5
03				5
03				5
03				5
02				5
02				5
02			d unwinding amid lush greenery. A	5
02				5
02				5
02				5
01				1
02/20/2024 18:03:00	Miranda Burg	106871435478485371985	My car and other cars got broken into. Don't leave anything in your car cause your windows will get smashed and your stuff will get stolen.	1
02/18/2024 23:38:25	Nicholas F	110074995323527938318		5
02/18/2024 21:41:45	Allison Beck	113094145738603402686		4
02/18/2024 00:51:35	UPTOWNGORILLA MUZIK	103902883410521159643		5
02/13/2024 18:46:35	Armeno P	113280106445944134252	An absolute gem, one of the best parts of living in Philadelphia is having access to such amazing nature. Beautiful year round and full of biking and hiking trails.	5
02/11/2024 03:01:00	kelly brooks	103080696753391588425		4
02/09/2024 02:09:06	Bunyod Gozibekov	114619171940070336981	Incredible!	5
02/06/2024 15:56:43	Kaitlin Silver	101976595269761219035		5
02/05/2024 20:28:24	Jon Deutsch	108976875983725718174		5
02/05/2024 16:03:33	Jose Pozo	103497763635230745405		3
02/05/2024 01:07:49	Paul Butler	116510255677657262802	Preserved when Philadelphia was but a fledgling town to protect the water source for this soon to be great town, the park has been the focus of Philadelphians for generations. Many of the trails and buildings throughout the	5

02/25/2024 00:52:12	Kelsey Marbach	106203679903469218112
02/24/2024 15:20:19	Stephen Gross	104054778833587020358
02/22/2024 04:01:23	Millard Reeves	114806221153145731366
02/20/2024 20:08:43	Anna K.	103785513088177903224
02/20/2024 18:03:00	Miranda Burg	106871435478485371985
02/18/2024 23:38:25	Nicholas F	110074995323527938318

snapshot of reviews for Wissahickon Valley Park

Data: example from a frequent (?) contributor

Review from Anna K.

Data: example from a less frequent (?) contributor

Review from Miranda Burg

Sentiment Analysis

- **Sentiment Scoring Approach**
  - each review assigned a sentiment score (0-1 scale) and a sentiment label (positi
  - scores close to 0 indicating more neutral sentiment and scores near 1 indicating
- **Example**
  - "Unfortunately this park is not what it used to be the area has become a known there is police getting the areas trying to do what they can but has a lot of work taking your dog are children here lot of used syringes everywhere especially on **negative 0.97**

```
from transformers import pipeline

# Load the sentiment analysis pipeline
pipe = pipeline("sentiment-analysis", mode="distilbert-base-uncased-finetuned-

# Make sure all entries in the 'text' column are strings
#reviews_df['review_text'] = reviews_df['review_text'].astype(str)

# Apply the pipeline to each review
reviews_df['review_predictions'] = reviews_df['review_text'].apply(lambda x: pi

# Extract the label and score from the predictions
reviews_df['review_label'] = reviews_df['review_predictions'].apply(lambda x: x
reviews_df['review_score'] = reviews_df['review_predictions'].apply(lambda x: x
```

Distilbert

Temporal variation of sentiment scores

Aggregated scores per park

Emotion Analysis (1)

- **Plutchik model**

- **Emotion Categorization Process**
  - pretrained model from Hugging Face ("`roberta-base-go_emotions`")
  - classify reviews into a broader range of emotions

Emotion Analysis (2)

Emotion Analysis (3)

Emotion breakdown per park type

Emotion mapping: discovery and sorrow

Emotion mapping: frustration & annoyance, inspirat

Discussion and Limitations (1)

- **Representativeness**
  - reviews may not capture the full demographic spectrum
  - overrepresentation of younger or tech-savvy individuals

- **Temporal Bias**
  - reviews are not always posted immediately after visits, potentially diluting real-

- **Single Platform Limitation**
  - using only Google Reviews could introduce bias
  - combining with data from other platforms (e.g., Instagram) may yield a broader

Discussion and Limitations (2)

- **Ethical Considerations**
  - Data was collected with respect to privacy, without identifying individual review

- **Contributor Weight/Reliability**
  - reliability of sentiment may vary between platform “super contributors,” who p
    a more balanced perspective, versus casual users who leave only one or two rev

🙏

thank you
delmelle@gmail.com