Geo-visualization of Hotspots of Citizens Dissatisfaction on Social Services Using Media Print: A Case Study of Fuel and Cash Scarcity in Nigeria.

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Abstract

The recent public dissatisfaction in Nigeria due to cash and fuel scarcity underscores the critical role of these resources in the modern economy, impacting various aspects of society like transportation, commerce, and daily living expenses. Existing research on citizen dissatisfaction relied on surveys, but this study employs geosemantics techniques to extract locations of social service dissatisfaction from social media data for efficient resource allocation. The method involves crawling and classifying social media content into three categories (dissatisfied, satisfied, or neutral). Using deep learning and a rule-based geoparsing approach, the study identifies locations mentioned in dissatisfied text in real time. This real-time insight from unstructured text aids in comprehending the complex economic, social, and spatial effects of resource scarcity, facilitating the government in developing effective resource allocation strategies to improve citizens' quality of life.

1. Introduction

In today's fast-paced digital landscape, social media platforms and news media have emerged as powerful tools for delivering real-time situational information. With the wealth of geographic data embedded in their messages, these platforms offer invaluable insights into user experiences, perspectives, and situational awareness [8]. The integration of spatial and textual analysis is crucial for comprehending human experiences documented in various forms, including print media, travel blogs, and social media [3].

Geosemantics is a concept that involves contextual information in text related to a location, refining location references, and associating time or sentiment with incidents at the reported location. It aims to enhance understanding and analysis of location-based data by incorporating semantic context [9]. Geosemantics process involves two main process which are toponym recognition, which deals with recognizing place names in text in various forms, such as news, tweets, and Wikipedia [2] and geocoding (toponym resolution) transforms place names into coordinates [1].

One of the practical applications of this lies in addressing citizen dissatisfaction by pinpointing hotspot locations where people express dissatisfaction with social services. Identifying areas affected by resource scarcity can be instrumental in improving public services and resource allocation [6]. Analyzing these hotspots(places with high count of dissatisfaction mention)locations on social media platforms offers a multitude of advantages, including gauging public sentiment, enhancing crisis management, and informing evidence-based policy-making [4].

This paper explores the use of geosemantics in getting citizens dissatisfaction, through the use of social media and news media which aids in comprehending the complex social, and spatial effects of resource scarcity, facilitating the government in developing effective resource allocation strategies to improve citizens' quality of life as outlined by Sustainable Development Goals (SDG) 8 and 16 in creating improved economy and peaceful country.

2. Related Literature

We critically examine three seminal studies focusing on citizen dissatisfaction, each approached within distinct contexts. Koech et al. [7] conducted a meticulous spatial analysis of the 2013 Gauteng City-Region Observatory Quality of Life survey to identify geographical patterns of discontent with local government performance. Chatterjee and Suy [5] introduced a method for calculating a satisfaction score based on e-service usage and satisfaction ratings, offering potential for assessing e-government concerns and enhancing service quality. Meanwhile, Cardone et al. [6] employed Geographic Information Systems (GIS) and Twitter data to identify discomfort hotspots during heatwaves, revealing intriguing spatial patterns of unease. However, these studies share a common limitation—the absence of a precise method to ascertain geospatial coordinates associated with citizen dissatisfaction. This critical gap has galvanized our ongoing research, which seeks to augment geosemantic analysis by integrating location-specific markers of discontent, aiming to provide a more precise, nuanced understanding of citizen sentiment in diverse scenarios.

3. Methodology

1. Data Acquisition and Preprocessing

The process of data acquisition and preprocessing was a crucial initial step in this study. We collected 1,834 articles from the Vanguard Nigeria news website, spanning from January 1st, 2016 to March 2023, using the Beautifulsoup library and targeted keywords "Fuel scarcity" and "Cash scarcity." The initial platform for data acquisition was twitter but due to the scraping ban, we had to make use of Vanguard Nigeria news paper website which is a reputable news outlet known for its coverage of significant events in Nigeria. However, it's essential to acknowledge that the data collection was limited to articles available on this specific website, which may not capture all relevant information or sentiments on the subject.

2. Text Classification

Text classification using the SentimentIntensityAnalyzer, an NLTK Vader tool, was employed to categorize news articles into three distinct sentiment categories: Satisfied, Neutral, and Dissatisfied. The choice of Vader (a pretrained model) was motivated by its proven reliability in analyzing text data, especially in the social media domain. After the classification. The text with Dissatisfaction category was then focused on for further analysis. Additionally, the accuracy of the text classification done largely depends on the accuracy of the pretrained model itself.

3. Geoparsing

Geoparsing, the process of recognizing and resolving place names in texts to corresponding location coordinates, was a fundamental component of our research. It involved two key steps: toponym recognition and toponym resolution. Toponym recognition utilized Parts of Speech (POS) tagging and Dependency-Based Named Entity Recognition (NER) through the Spacy library to extract place names from unstructured text. Toponym resolution, or geocoding, assigned these place names to correct spatial coordinates using the OpenStreetMap Nominatim Geocoding service provided by the Geopy library. This approach was chosen for its accuracy and utilization of geospatial data sources. However, it's important to note that geoparsing may face challenges in resolving ambiguous place names or locations not present in geospatial databases, potentially leading to inaccuracies in the geographical mapping of sentiment.

4. Visualisation

Visualization, conducted using the folium library, was employed to provide a more accessible and intuitive representation of geographical coordinates. This step allowed us to visually explore the data and gain insights into the spatial distribution of sentiments. Visualization is a valuable tool for knowledge representation.

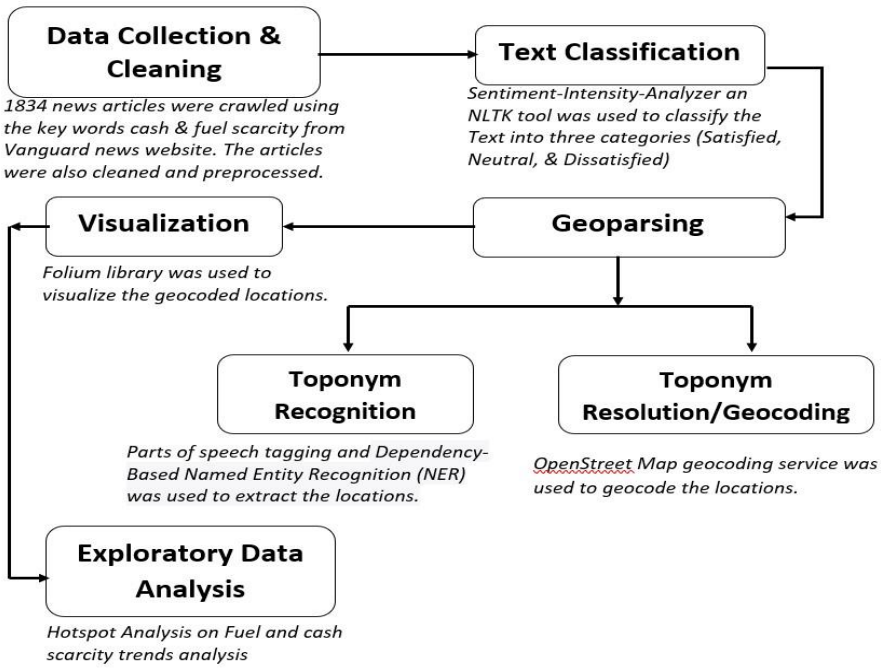

Figure 1: Methodology Workflow

Table 1: Sample of Dataset After Geoparsing

State	Title	Content	Date_Published	Classification	Locations	Latitude	Longitude
Abuja Federal Capital Territory	Petrol queues resurface in Abuja over fear of price hike, scarcity	Long queues have resurfaced in Abuja filling states as motorists struggle to purchase Premium Motor Spirit, also known as petrol.	2021-11-15	Dissatisfied	Abuja	9.0643305	7.4892974
Kaduna	Hajj 2019: Aviation fuel scarcity disrupts transportation of Nigerian pilgrims	The ongoing transportation of Nigerian pilgrims from Saudi Arabia has been disrupted due to the scarcity of aviation fuel (Jet A1) in the domestic market.	2019-08-30	Dissatisfied	Kaduna	10.3825318	7.8533226
Lagos	Fuel Scarcity: Lagos bans indiscriminate queues at petrol stations	The Lagos State Government on Wednesday said it would no longer allow indiscriminate parking of vehicles on the road networks across the state on the basis of queuing up for Premium Motor Spirit otherwise known as fuel, just as it threatened to sanction any erring filling stations and motorists who flout the directive.	2016-04-06	Dissatisfied	Lagos	6.4550575	3.3941795

4. **Results and Conclusions**

We carried Hotspot analysis which revealed that Lagos state was the epicenter of dissatisfaction, boasting the highest count of dissatisfied text. This can be attributed to Lagos' prominent position as the nucleus of economic and industrial activities within the country. These findings carry profound implications for governmental resource allocation strategies, signaling the imperative to focus efforts on Lagos in particular. By directing resources and initiatives strategically, the government can elevate the quality of social services and, in turn, bolster citizen satisfaction on a nationwide scale.

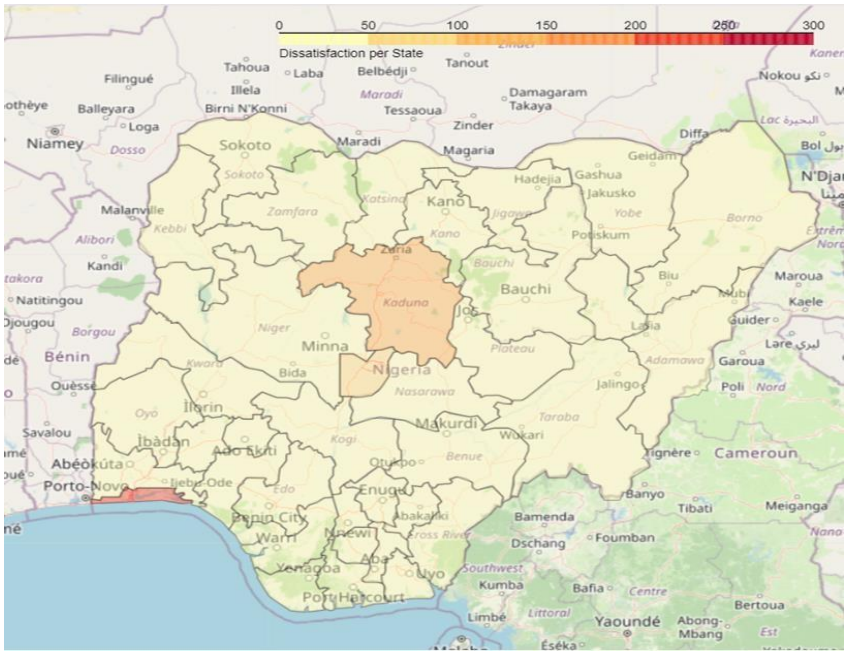

Figure 2: Result of hotspot analysis showing Lagos as the state having the highest citizens dissatisfaction

The yearly trend analysis of citizens dissatisfaction over fuel and cash scarcity reveals that dissatisfaction reached its peak in the first quarter of 2023, likely influenced by the 2023 elections and the redesign of the naira note, while also showing a pattern of decreasing dissatisfaction in the first quarters of 2016 to 2019 followed by an increase in the last quarter of those years, highlighting the importance of timely government response to societal needs during periods of scarcity, with dissatisfaction in scarcity persisting from the first quarter of 2022 to the second quarter of 2023.

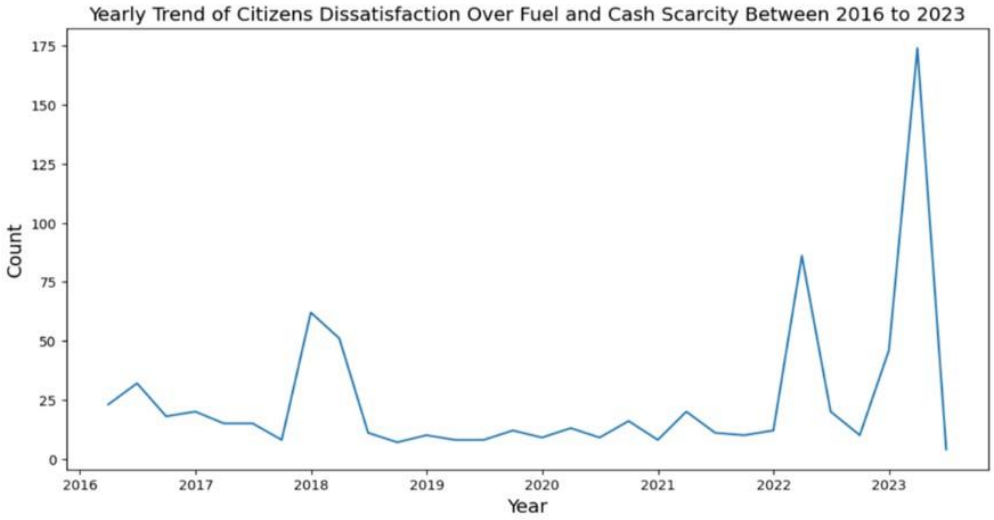

Figure 3: Showing the yearly and quarterly trend of citizens dissatisfaction over fuel and cash scarcity

Our research methodology was able to extract locations from approximately 70% of the news articles studied. Using the location extracted, we identified the hotspot location using the number of times a location was mentioned. This project has shown the possibility of getting real-time insight from unstructured text which aids in comprehending the complex social, and spatial effects of resource scarcity, facilitating the government in developing effective resource allocation strategies to improve citizens' quality of life as outlined by Sustainable Development Goals (SDG) 8 and 16 in creating improved economy and peaceful country.

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