

# **The Pathfinder: AI-Enhanced Geospatial Big Data Profiling for Investment Optimization harnessing a DSS**

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## **Abstract**

In the current scenario, global markets present significant challenges for identifying optimal investment areas, especially in today's data-driven environment. This study investigates the integration of geospatial big data with artificial intelligence (AI) to refine the selection process for investment opportunities, particularly in the realm of international marketing. Traditional investment methods often rely heavily on broad economic indicators, which can overlook critical insights derived from consumer sentiment and regional variations. By employing cutting-edge machine learning techniques, this research analyzes diverse data sources, including user reviews, product descriptions, and images, to assess sentiment and evaluate the potential of various investment areas. The approach focuses on extracting actionable insights from sentiment analysis to identify regions with promising investment prospects and to predict high-return opportunities more accurately. The study introduces a novel decision support system (DSS) designed to enhance investment strategy formulation. This DSS utilizes the integrated geospatial and sentiment data to provide a comprehensive tool for international marketers and investors. It offers detailed analyses of consumer sentiment trends and regional investment potentials, enabling users to make more informed and strategic investment decisions.

## **Keywords**

Artificial Intelligence, Big Data, Decision Support Systems, Geospatial Analysis, Innovation, Technology Marketing.

## **Introduction**

In the dynamic and highly competitive arena of international marketing, pinpointing optimal investment areas is increasingly complex due to the multifaceted nature of global markets. The task of identifying the most lucrative locations for investment is

fraught with challenges, primarily because traditional analysis methods often fail to capture the nuanced preferences and behaviors of consumers. As markets evolve and consumer expectations shift, investors and marketers face the pressing need to integrate more sophisticated approaches to accurately gauge potential investment opportunities. The contemporary global marketplace is characterized by a vast array of consumer preferences, which are influenced by various factors including cultural, social, and economic elements. This complexity is particularly evident in the food and beverage sector, which encompasses a wide range of establishments such as restaurants, bars, diners, and lounge bars. Each of these categories caters to different consumer tastes and expectations, making it challenging to evaluate investment potential using conventional metrics alone. In this complex landscape, traditional investment metrics fail to capture the full scope of consumer sentiment.

## **Theoretical Background**

As consumers become more tech-savvy and the pace of technological change accelerates, the role of innovation in marketing strategies has expanded significantly (Kumar et al., 2021). Companies that can effectively leverage cutting-edge technologies and data-driven insights to understand consumer behavior and market trends are better positioned to create value, foster customer engagement, and maintain a competitive edge (Dadwal., 2019). In this context, the integration of geospatial big data and AI represents a transformative approach to driving marketing innovation. The marketing landscape has undergone significant changes with the advent of big data and AI technologies. Traditional marketing strategies were often based on broad assumptions about consumer segments and relied heavily on historical data or broad demographic metrics (Smaldone et al., 2022). In contrast, innovation and technology marketing thrives on real-time, personalized, and location-based insights that enable marketers to target consumers more accurately (Khan et al., 2014). Geospatial big data, which provides detailed information about consumer activities and preferences at a specific location, combined with AI, enhances the ability of businesses to engage with customers in meaningful ways (Kong et al., 2020; Lee and Kang, 2015). At the core of innovation in technology marketing is the ability to harness vast and diverse datasets, such as consumer reviews, social media posts, images, and descriptions of products or services (Dwivedi et al., 2021). These data sources provide a wealth of information about how consumers perceive and interact with brands, products, or services. AI-powered sentiment analysis, a key tool in innovation marketing, enables businesses to extract insights from these datasets by evaluating the tone and emotions embedded in textual and visual content (George and Baskar, 2024). This allows marketers to understand not only what consumers are saying but also how they feel about their experiences with a brand or product, providing a deeper understanding of consumer behavior (Haleem et al., 2022).

## Methods

To address these challenges, this study proposes a novel approach that combines geospatial big data with advanced AI techniques to refine the identification of high-potential investment areas. The focus is on leveraging sentiment analysis to integrate and interpret data from a diverse set of sources, including consumer reviews, images, and descriptive content associated with various food and beverage establishments. By triangulating these data points, the study aims to provide a more accurate and comprehensive understanding of regional investment viability. The first component of this approach involves analyzing data from multiple categories within the food and beverage sector. This includes gathering and assessing information from restaurants, bars, diners, and lounge bars. Each category generates a set of data, from consumer feedback and ratings to visual content and descriptive texts (Aggarwal and Zhai, 2012). By aggregating and evaluating these diverse data sources, the study seeks to uncover patterns and trends and sentiment that might not be visible through traditional economic analyses (Munzert et al., 2014). This multidimensional approach allows for a deeper understanding of consumer sentiment, capturing not only explicit feedback but also underlying emotions and perceptions associated with these establishments (Smaldone et al., 2022). For instance, analyzing images and their captions can reveal consumer preferences related to ambiance, cuisine quality, and overall experience, while reviews provide direct insights into satisfaction levels and recurring themes. The study also incorporates sentiment analysis of consumer attitudes towards the broader geographic area of interest. Understanding how consumers perceive different regions can provide valuable context for evaluating investment potential. This aspect of the analysis helps to identify regions where positive sentiment and high engagement correlate with favorable investment conditions. To facilitate the practical application of these insights, the research proposes the development of a DSS named Pathfind3R. Pathfind3R is designed to integrate the various data sources and sentiment analyses into a cohesive platform that offers actionable recommendations for investors and marketers (Chopra et al., 2018). The system provides a comprehensive overview of potential investment areas, highlighting regions with strong consumer sentiment and high potential for growth. In summary, this study addresses the complexities of identifying optimal investment areas in international marketing by leveraging a sophisticated combination of geospatial big data and AI-driven sentiment analysis. By integrating and analyzing data from multiple sources within the food and beverage sector and understanding consumer sentiment towards different regions, the research aims to offer a more nuanced and accurate assessment of investment opportunities. The proposed DSS further enhances the utility of these insights, providing a valuable tool for strategic decision-making in the global marketplace.

## Results

The study analyzed a total of 2,592,891 data points, derived from 21,789 observations and 119 variables, all of which were sourced from the New York metropolitan area.

New York, as one of the largest and most diverse urban regions in the world, was selected for this study due to its rich and varied dataset within the food and beverage sector. The everyday user-generated content of international tourists and local residents, provides a wealth of user-generated content in English. The variety and volume of data from New York allow for more robust findings for a big data analysis, as the local data includes a wide range of broad spectrum of consumer feedback. So, settling New York as the study site ensures that the findings can be generalized to other major urban areas with similar characteristics. Data were collected in August 2024. The first phase of the study focused on analyzing the impact of consumer sentiment on the overall ratings. The multi-group analysis categorized the ratings into four groups: 1-2 stars, 2-3 stars, 3-4 stars, and 4-5 stars. Negative sentiment correlated with low scores ( $\rho = -0.42$ ) in the 1-2 stars' group, while positive sentiment had a strong correlation ( $\rho = 0.76$ ) with high scores in the 4-5 stars' group. The goodness-of-fit indices ranged from 0.85 to 0.93, confirming a solid model performance across all rating categories. In the second phase, the Pathfind3R was developed based on these data points and relationships. Pathfind3R integrates sentiment analysis and geospatial data, allowing users to visualize key features of the locations, including consumer sentiment, review trends, and geographic distribution. The system enables advanced visualizations like heat maps and boxplots, providing real-time insights for identifying optimal investment opportunities in the food and beverage industry. Pathfind3R supports investors by triangulating sentiment, reviews, and geographic data to pinpoint high-potential areas for direct investment, leveraging AI to deliver targeted, data-driven insights.

## **Discussion, Implications & Conclusion**

The findings of this study highlight the significant role of consumer sentiment in shaping the success of food and beverage establishments in a competitive market like New York. The strong correlations between sentiment and overall scores, particularly in the lowest and highest rating groups, underscore the importance of managing both customer experience and public perception. Establishments with lower scores suffered from overwhelmingly negative sentiment, while highly rated locations benefitted from positive reviews and visual sentiment, emphasizing the need for businesses to focus on quality and customer engagement to maintain or improve their standing. The DSS named Pathfind3R, developed in the second phase of this study, offers valuable implications for investors and business owners. By integrating sentiment analysis with geospatial and demographic data, Pathfind3R enables users to identify high-potential investment areas with greater precision. The system provides real-time visualizations that help detecting specific locations where consumer sentiment aligns with investment potential, minimizing risk and improving the efficiency of decision-making processes. This approach is particularly useful in industries like food and beverage, where customer satisfaction is highly variable and often influenced by subjective experiences. Pathfind3R's ability to capture and interpret this variability offers a strategic advantage in navigating complex urban markets like New York. In conclusion, the integration of AI-driven sentiment analysis and geospatial data within a DSS framework represents a

powerful tool for optimizing investment strategies. The insights gained from this study demonstrate the utility of such systems in identifying profitable opportunities and guiding data-driven decisions, offering a model that can be expanded and applied to other regions and industries in the future.

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