

An AI-driven Analytics and Communication Platform Empowering the Growth of the Homestay and Leisure Tourism Industry and Advancing Sustainable Rural Revitalization

-- Practice of Cultivating New Quality Productive Forces in Rural Areas of Huizhou, Anhui Province

Xiaoya Wang, Shichun Rui *

School of Management Science and Engineering, Anhui University of Finance and Economics, Anhui, China

*Corresponding Author: Shichun Rui

ABSTRACT

This paper develops an innovative analytics and communication platform based on AI technology, offering more personalized itinerary planning and experiences, and formulating more targeted marketing strategies for market expansion. Including an online natural language communication module, a machine-learning-based customer sentiment analysis and prediction module, as well as algorithms such as K-means and DBSCAN. Unlike traditional marketing approaches, the AI-driven analytics and communication platform processes large-scale data to identify the emotional attitudes and demand tendencies of potential customer groups. As a concrete form of new quality productive forces, it more effectively expands the growth potential of the leisure and homestay economy. As a development model for sustainable rural revitalization in the Huizhou region, it also provides valuable insights for government decision-making.

KEYWORDS

AI-driven communication platform; Sustainable development; Rural revitalization; K-means algorithm

1. INTRODUCTION

The Fourth Plenary Session of the 20th Central Committee of the Communist Party proposed to accelerate the modernization of agriculture and rural areas and to solidly advance the comprehensive revitalization of the countryside. In 2025, the No. 1 Central Document for the first time proposed the development of new-quality productive forces in agriculture and rural areas tailored to local conditions. This marks a new stage in China's agricultural and rural development, driven primarily by technological innovation. The new-quality productive forces in agriculture and rural areas is centered on technological, digital, networked, and intelligent development, introducing new technologies, new equipments, and new models to improve the overall factor productivity formed by optimizing the combination of knowledge, technology, management, data, and other elements. The introduction of this concept is not only a strategic choice to respond to the global technological competition in agriculture and rural areas, but also a key path way to promote urban-rural integration and the modernization of agriculture and rural areas. The new-quality productive forces redefine the way rural economies operate, through technological innovation, management improvement, and optimization of human capital, promoting the upgrading of rural industrial structures. This transformation towards a diversified economic development not only enhances economic benefits but

also preserves the ecological environment while inheriting and developing the unique local history and culture of rural areas.

In promoting the rural revitalization strategy, the homestay leisure tourism plays a crucial role in various counties and cities of Huizhou. By early 2024, the number of homestays has exceeded 950, with an overall annual visitor flow of about 2.1 million. Green mountains and clear water are as valuable as mountains of gold and silver. The leisure tourism and homestay industry relies on green mountains and clear water, along with cultural history, embodying the harmonious unity of economic development, environmental protection, and cultural heritage. In recent years, with market saturation and increasingly fierce homogeneous competition, how to promote the leisure tourism and homestay industry to break through its current development level, further expand market space, and enhance economic and social benefits holds significant practical importance for sustainable rural revitalization.

Since 2022, AI, marked by chatGPT, has made significant breakthroughs. It has been successfully applied in the fields of natural language understanding and generation, big data analysis and synthesis, and both local and global dynamic decision-making. Artificial Intelligence technology applied to the media communication industry, disrupting the original communication landscape.

Successful cases of applying artificial intelligence to the promotion and communication of tourism projects are continuously emerging both domestically and internationally. Italian researchers have developed "zIA," a chatbot powered by generative artificial intelligence that simulates the image of a knowledgeable local "aunt." It provides personalized recommendations, itinerary planning, and information inquiries through text and voice interaction. It demonstrates the potential of artificial intelligence in enhancing the visitor experience, capable of providing personalized services that resonate culturally. The Indians developed the "SMART" model, which includes emotion-driven personalized recommendations, machine learning-based predictive analytics, automated AI chatbots, real-time experience optimization, and targeted content personalization. By integrating these artificial intelligence components, Kerala has enhanced its tourism marketing strategy, thereby increasing visitor engagement and satisfaction. The domestic ice and snow tourism in Heilongjiang Province (IST) has analyzed online travel logs and reviews using artificial intelligence algorithms. Using Python for data scraping and sentiment analysis provides insights into visitors' perceptions and emotional attitudes, serving as a basis for formulating targeted marketing strategies, thus enhancing the attractiveness of the destination. Such examples are too numerous to list. It can be said that the characteristics of AI technology align well with the needs of the homestay and leisure tourism industry. Its online natural language communication ability, comprehensive data processing capacity, and insights into the emotional attitudes and demand tendencies of potential customer groups provide significant advantages for offering more personalized itinerary planning and experiences.

2. CURRENT SITUATION OF HUIZHOU HOMESTAY INDUSTRY

2.1. Features of Huizhou Homestays

The ancient architecture of Huizhou is its most iconic feature, with layouts primarily based on courtyards, featuring white walls, dark blue tiles, and staggered horse-head walls, along with exquisite stone carvings and wood carvings everywhere. Most of these buildings are renovated or transformed from ancestral halls or theaters from the Ming and Qing dynasties.

The ancient residents of Huizhou would particularly like to select sites that were "adjacent to mountains and by water," which is also one of the reasons why Huizhou homestays are so closely connected with nature. Due to the structural limitations of the ancient houses in Huizhou, there are relatively fewer guest rooms, which instead provides guests with a quiet space for rest and social interaction. The Huizhou homestays are far away from the hustle and bustle of modern life, with a slower pace of living, making them suitable for vacation travel and relaxation.

The Huizhou culture is also an indispensable feature of Huizhou homestays. Huizhou culture, as an important component of traditional Chinese culture, has profound cultural connotations. The merchants of Huizhou have always upheld the Confucian business philosophy of integrity as the foundation and righteousness as the basis of profit. Huimo-ink, She-inkstones, Huizhou brushes, and Chengxintang paper, known as the Four Treasures of Study from Huizhou, are a concentrated embodiment of the Huizhou artisan spirit. Among them, the intangible cultural heritage and folk customs of Huizhou include Huiju opera, Nuo dance, acrobatic performances and so on.

2.2. Development Trends of Huizhou Homestays

The customers of Huizhou homestays are mostly young people who seeks new experiences. In the future, Huizhou homestays will tend to be more clustered and intelligent. In the future, AI will be used around the clock and throughout the seasons to create more consumption scenarios, extend the consumption cycle, and meet the diversified accommodation needs of consumers. Currently, online AI platforms have become the main channel for booking homestays. The homestay economy is gradually becoming an economic pillar in the Huizhou region.

2.3. Challenges Facing Huizhou Homestays

The ancient architecture of Huizhou preserves much of Huizhou culture, but many deeper cultural connotations have yet to be explored. Meanwhile, the Huizhou homestays are generally located in ancient villages or old streets, and due to geographical constraints, the infrastructure in the area is not well developed. Most of the ancient buildings in Huizhou are relatively old and have certain safety hazards.

With the development of the homestay industry, the homogenized competition among Huizhou homestays is serious. Most young talents choose to go out and make a living, and there is a shortage of skilled personnel in Huizhou's rural areas. The cultural resources of Huizhou are abundant, but at this stage, the operators of homestays primarily rely on traditional methods like WeChat Moments and word-of-mouth for promotion and marketing, which are relatively simplistic. The promotional content mostly focuses on static cultural symbols such as ancient villages and Huizhou-style architecture, lacking in-depth exploration, making it difficult to fully engage tourists' interest.

3. ANALYTICS AND COMMUNICATION PLATFORM BUILT ON AI TECHNOLOGY

3.1. Concept of AI-powered Analytics and Communication Platform

An AI-powered analytics and communication platform is an integrated system using AI as its core engine, which collects, processes, and analyzes massive amounts of data, ultimately supporting the formulation of information dissemination strategies, content creation, channel distribution, and performance evaluation. Its core logic is to use data insights to guide communication decisions and to improve communication efficiency with intelligent tools.

3.2. Construction of AI-powered Analytics and Communication Platform

The analytics and communication platform leverages AI technology, deploying services and applications on the cloud, by integrating technologies such as natural language processing, machine learning, and etc. it can understand and process user queries, provide intelligent interactions and accurate responses, enhancing user experience and platform interactivity. Integrating Natural Language Processing (NLP) a branch of AI, enables computers to understand human language, helping AI to more accurately understand user intentions and respond accordingly. Machine learning,

on the other hand, optimizes task execution by learning from data, allowing the AI systems of the communication platform to continuously learn and adapt, providing more accurate and personalized services.

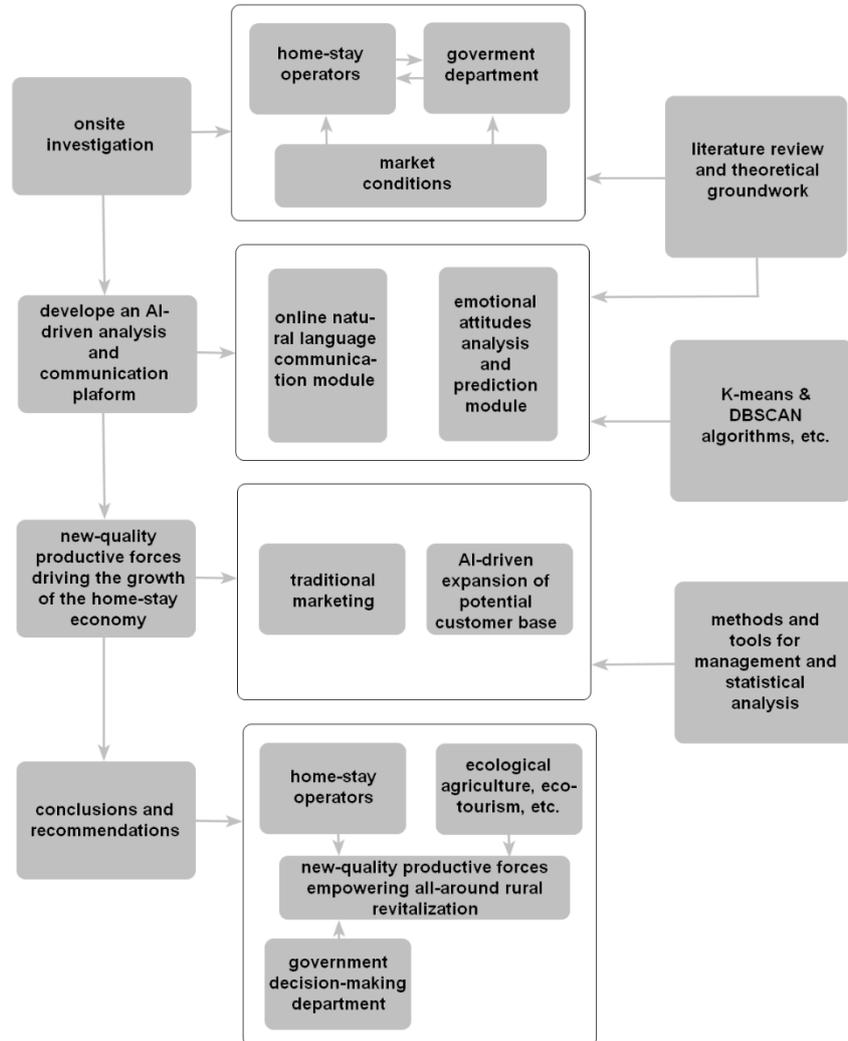


Figure 1. construction of AI-powered analytics and communication platform

The core advantages of the AI-powered analytics and communication platform are flexibility and scalability. Traditional IT architecture is often constrained by hardware resources and software licenses, making it difficult to respond quickly to business changes. Data is the core of AI technology, and AI communication platforms integrate data processing and analysis tools, covering cleaning, preprocessing, feature extraction, model training, and predictive analysis, efficiently handling massive amounts of data to provide a basis for decision-making. It is particularly important that the platform employs machine learning algorithms to automatically optimize data processing flows, improving efficiency and accuracy. The AI-powered analytics and communication platform can inject core competitive advantages into the development of Huizhou homestays and rural revitalization. It drives decision-making through data, providing precise insights into tourists' true preferences for architectural aesthetics, cultural experiences, and services, fundamentally transforming the traditional model that relies on experience. It achieves comprehensive intelligence from product optimization and precise marketing to public opinion management, not only efficiently enhancing the reputation of homestays and booking conversion rates but also promoting local culture, driving the branding and sustainable development of the entire rural industry.

Building an AI-powered analytics and communication platform as an entrepreneurial practice to introduce and implement new quality productive forces in rural areas, assisting in the sustainable rural

revitalization of the Huizhou region. To provide a broader perspective and more extensive industry insights for the government decision-making departments, and to develop new-quality productive forces in agriculture and rural areas according to local conditions, thereby meeting the national strategic needs for comprehensive rural revitalization.

4. MULTIDIMENSIONAL INDICATOR ANALYSIS OF CLUSTER ANALYSIS

4.1. Model Selection and Its Theoretical Explanation

K-means clustering:

K-means clustering is an unsupervised learning algorithm used to partition samples in a dataset into k non-overlapping clusters, with the principle of minimizing the variance within clusters and maximizing the variance between clusters. Let the sample set D be defined, and the K-means clustering algorithm aims to minimize the squared error for the obtained cluster partition C .

The specific steps of the K-means algorithm are as follows:

- (1) Randomly select k samples as the initial centroid vectors of the clusters;
- (2) Assign each sample data set to the nearest cluster.
- (3) Update the cluster centroid mean vector based on the cluster to which each sample belongs;
- (4) Repeat steps (2) and (3) until the set number of iterations is reached or the mean vectors of the clusters no longer change. The model is constructed, and the results of the clustering algorithm are output.

4.2. Analysis of k-means Based Clustering Metrics

By integrating online booking data, user review texts, and homestay attribute data, clustering analysis was conducted on 12 core variables, including price levels, geographic location, architectural aesthetics ratings, depth of cultural experience, service reputation, and facility completeness. The Huizhou homestays can be roughly categorized into four typical types, and based on their characteristics, differentiated and sustainable development paths can be planned to provide precise momentum for the overall brand enhancement of Huizhou homestays and rural revitalization.

Category One: High housing prices, high architectural aesthetic ratings, high cultural experience levels, exquisite service, and proximity to core scenic spots.

This type of homestay is not suitable for large-scale replication. Its core value lies in becoming a benchmark for Huizhou homestays, shaping a high-end reputation through exceptional experiences, attracting quality-seeking global tourists, thereby enhancing the overall tone and appeal of the "Huizhou homestay" brand, and becoming a showcase for Huizhou's intangible cultural heritage.

Category Two: Moderate housing prices, above-average natural or cultural landscape ratings, and moderate services and facilities. This type of homestay is the basic type in the Huizhou market and is suitable for attracting the general tourist audience through a "hot-selling explosive" strategy. The government or industry associations guide the standardization and upgrading of services and hygiene, enhancing overall reception quality while maintaining cost-effectiveness, forming the standards for guesthouses in the Huizhou region, and stabilizing economic development.

Category three: moderate housing prices, outstanding service ratings, unique characteristics, but relatively weak cultural and architectural aesthetic attributes.

This type of homestay should focus on specific customer groups and build core competitiveness through "special services." Bring more services and experiences to customers, such as organizing

parent-child farming, making Huizhou pastries, and nature education activities, extending consumption from accommodation to experience. Precision marketing adds a lively atmosphere to Huizhou homestays.

Category 4: Low housing prices, all ratings are at low levels

This type of homestay is a necessary category of Huizhou homestays. The key to its development lies in health security. Meet the most basic accommodation needs of tourists, such as limited budget, temporary rest, or as a transit point for travel routes. While providing basic accommodation services, it becomes a sales terminal for local agricultural specialty products, integrating into the rural industrial chain to gain additional income and better implement the rural revitalization strategy.

5. SUMMARY

In an era of rapid digital development, Huizhou homestays face a profound transformation from experience-based management to data-driven decision-making. According to the comprehensive assessment, AI-powered analytics and communication platforms hold significant value in empowering Huizhou homestays, promoting the local economy, and boost ingrural revitalization.

The traditional development model of Huizhou homestays heavily relies on the personal experience of the owners, making it difficult to grasp the ever-changing real needs of tourists, which restricts the scalability and branding development of rural industries. By integrating massive ammounts of data from online bookings, user reviews, and social media behavior, the platform can accurately identify the real preferences of tourists. It provides an objective and reliable basis for product optimization, service upgrades, and market positioning of homestays, laying a solid data foundation for the revitalization of rural tourism centered around homestays.

The K-means clustering algorithm integrated into the platform is the core tool for achieving refined operations. Its function lies in the ability to intelligently segment groups and achieve precise operations. This scientific classification allows operators to shift from traditional one-size-fits-all marketing to precise marketing and personalized service recommendations, improving the communication efficiency of Huizhou homestays, promoting the economic development of Huizhou, and supporting rural revitalization.

The AI-powered analytics and communication platform uses data to make targeted improvements to homestays and maintain brand reputation, maximizing the revenue of homestays. Not only promoting a specific homestay, it is clustering the whole homestayss in Huizhou area and driving the collective economic development in Huizhou. This marketing model greatly exceeds the economic benefits of a single homestay. It pays more attention to collective development, aligning with our country's rural revitalization strategy. Moreover, the platform is able to deeply explore and intelligently disseminate Huizhou culture, transforming cultural assets such as Huizhou-style architecture, intangible heritage crafts, and local specialities into powerful brand attraction.

Finally, the AI platform can drive the coordinated development of surrounding industries such as catering, agriculture, and handicrafts through data-driven approaches, leading comprehensive rural revitalization. By transforming data into insights and insights into actions, it not only effectively addresses the core challenges in the development of the homestay industry, but also acts as a "catalyst" for upgrading the rural industries. The AI-powered analytics and communication platform is an essential powerful engine for Huizhou to seize digital opportunities in the new era, achieving high-quality development of the homestay industry as well as the grand vision of rural revitalization.

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