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# Study on the City Image of Maoming Based on Drone Photography Data

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***Abstract*****—** *This study is based on drone photographs and related data of Maoming City obtained from the social platform "Sky City." Through methods such as computer vision image analysis, kernel density analysis (KDA), and standard deviational ellipse analysis, the research explores the spatiotemporal distribution characteristics of drone-captured imagery, the visual features of the city image, and the clustering of city image elements. By analyzing the city image of Maoming from a "God's-eye view," the study offers insights into the construction of Maoming's city image and drone management, providing recommendations for enhancing urban design and improving the quality of urban space.*

***Keywords*****— Drone, Visual image analysis, Kernel density analysis (KDA), Standard deviational ellipse analysis, City image**

## I. INTRODUCTION

In the 1960s, Kevin Lynch conducted studies on three representative American cities—Boston, Jersey City, and Los Angeles—and completed The Image of the City. He divided the spatial image of cities into five key elements: paths, edges, districts, nodes, and landmarks (Fang, 2001). These elements form the basic cognitive framework for understanding urban spaces (Chen, 2020). By exploring local characteristics and examining the unique images of different cities, Lynch's work emphasized the influence of historical, cultural, and geographical factors on city imagery (Gu and Song, 2001), while also assessing urban planning and design outcomes and providing suggestions for improvement. Research methods included field surveys, questionnaires, and data analysis, utilizing visualization software such as CiteSpace to create knowledge maps and analyze research hotspots and thematic developments (Xu, 2012). City image studies have significant application value in enhancing city recognizability, optimizing spatial structure, and promoting cultural heritage. As research methods have improved and their application deepened, city image studies have made substantial contributions to urban development, planning, and construction.

In China, researchers typically collect first-hand data through field surveys and resident questionnaires to analyze urban spatial cognition, combining this data with historical and cultural context to provide recommendations for urban planning optimization. For example, by analyzing the city image of Suzhou, researchers discovered the profound influence of the city's historical and cultural heritage on its image and proposed specific measures for preserving and passing down this legacy (Tian and Wang, 2014). Foreign scholars, on the other hand, have proposed various theoretical frameworks to explain the formation and development of city images, such as Smith's "From City to Civilization" theory, which explores the essence

and evolution of city imagery. Additionally, interdisciplinary studies abroad have investigated the relationship between city imagery and fields like urban development, tourism, and the cultural and creative industries, highlighting the close connection between city imagery and both economic prosperity and factors like social culture and urban management.

In the 1970s, Appleyard studied how the length of residence and levels of cultural education influenced city imagery (Appleyard, 1970). Francescato and Mebane explored the impact of different social classes on the city image of Rome (Francescato and Mebane, 1973). Moreover, international scholars have conducted case studies and comparative analyses on global cities, uncovering differences, similarities, and trends in city imagery. For instance, studies on international metropolises like London and New York, as well as popular tourist cities such as Sydney and Paris, have found that the formation of city imagery is closely tied to historical, cultural, and geographical factors, while also being influenced by political, economic, and media forces (Albers and James, 1973). Research on city images not only provides theoretical and practical guidance for urban planning and design but also plays a crucial role in enhancing city recognizability, optimizing spatial structure, and promoting cultural continuity. Overall, city image studies have provided essential theoretical support and practical guidance for urban planning and design. As research methods continue to evolve and applications deepen, city image studies will play an increasingly important role in the future, contributing more significantly to urban development.

Early studies on city imagery by urban planners primarily used photographs taken by tourists during their travels. Before the era of big data and the internet, the collection and research of photographic data were limited and lacked comprehensiveness. In the 1980s, some scholars analyzed photographs using postcards (Albers and James, 1988). Researchers have since used photos from tourist collections (Markwell, 1997), travel guides (Buzinde and Smith, 2006), and Visitor-Employed Photography (VEP) (Haywood, 1990) as research materials. With the rapid development of the internet, particularly in the Web 2.0 era, tourists sharing photos during their travels has become commonplace. Social platforms such as Flickr (Girardin et al.), Facebook (Nikjoo and Bakhshi, 2019), Pinterest (Song and Kim, 2016), and Chinese platforms like Weibo and WeChat Moments (Zhao et al., 2018) have become data sources for photo research. Image analysis methods include content analysis and semiotic analysis (Kim, 2015). Content analysis, a method based on attributes, is commonly used to analyze text but can also be applied to visual material. It focuses on the occurrence of certain themes and attributes within the target image, with the images manually classified according to specific rules (Garrod, 2009).

This study on the city image of Maoming is based on drone photography data and uses modern technological approaches to reveal the spatiotemporal distribution and visual characteristics of the city's image. It addresses the limitations of traditional city image research methods by employing advanced spatial analysis techniques such as computer vision image analysis, KDA, and standard deviational ellipse analysis, providing more comprehensive data on city imagery. Through systematic analysis of drone-captured imagery, the study uncovers the spatial distribution patterns and visual features of various image elements, while also offering suggestions for drone management in Maoming City to ensure the broader and more effective use of drone technology in urban research and development. Overall, this research not only promotes innovation and development in city image theory but also provides valuable reference and support for urban construction and planning, playing a significant role in enhancing spatial quality and shaping a positive city image.

## II. STUDY AREA AND METHODOLOGY

### 2.1 Study Area

Maoming City, also known as the "Southern Oil City," is located in the southwestern part of Guangdong Province, China, along the coast of the South China Sea. It is geographically positioned with higher elevations in the north, sloping downward toward the southwest. The total area of Maoming covers 11,427.63 square kilometers, and it administers two urban districts (Maonan District and Dianbai District) as well as three county-level cities (Gaozhou, Huazhou, and Xinyi). As of 2023, the

permanent population of Maoming stands at 6.2523 million (Figure 1).

Maoming boasts abundant natural and tourism resources, earning the title of one of China's outstanding tourist cities. Famous attractions include China's First Beach, Fangji Island, the Romantic Coast Resort, Maoming Open-pit Mine Ecological Park, Maoming Forest Park, Yushui Ancient Hot Springs, Douzhou Ancient City, and the Cultural Tourism Area of Madam Xian's Hometown, among others. The city's tourism industry has developed rapidly, attracting large numbers of domestic and international tourists. Maoming is not only an important city for economic development but also a city rich in cultural and tourism resources, making it a valuable subject for research.

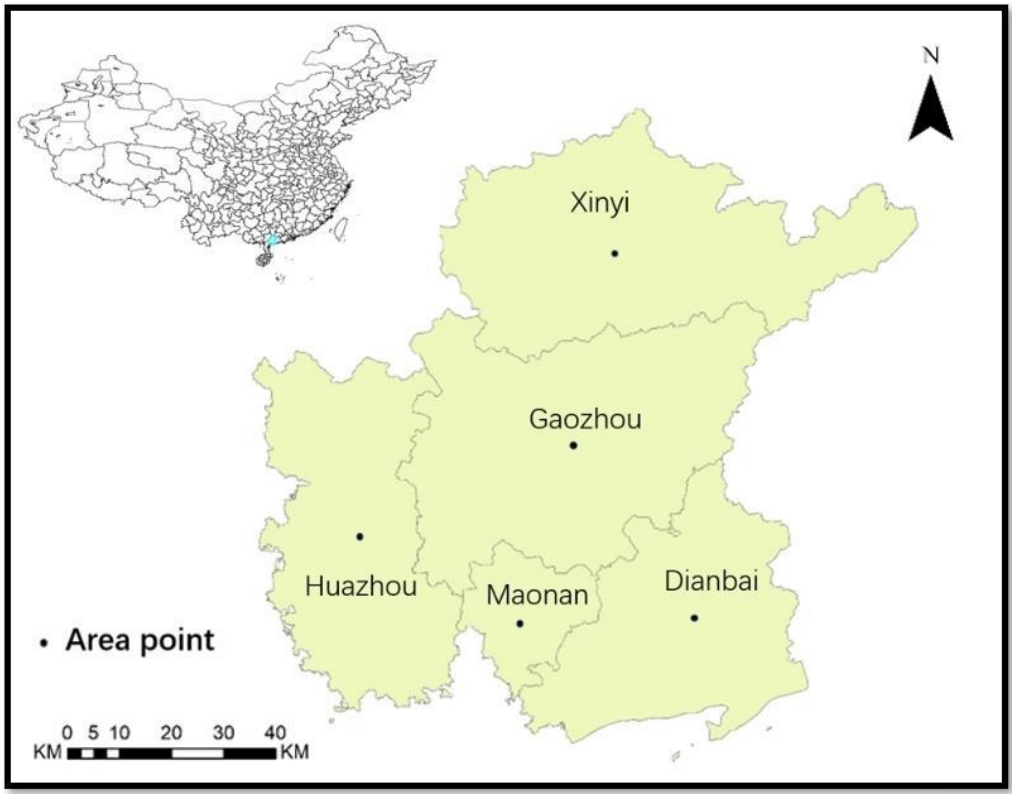


*Fig.1. Administrative Map of Maoming*

**2.2 Technical Approach**

This study is based on aerial images of Maoming City from the past decade, which were obtained using web scraping technology developed in the C language. After establishing a corresponding database, relevant theoretical foundations were selected. The research methods include literature analysis, computer vision analysis, and spatial feature analysis. Using the spatial analysis tools in ArcGIS, the study applies standard deviational ellipse and KDA to explore the spatiotemporal distribution characteristics of drone-captured images, the visual perception of Maoming's city image, and the classification of city image elements. Finally, recommendations for improving the construction of Maoming's city image are proposed (Figure 2).

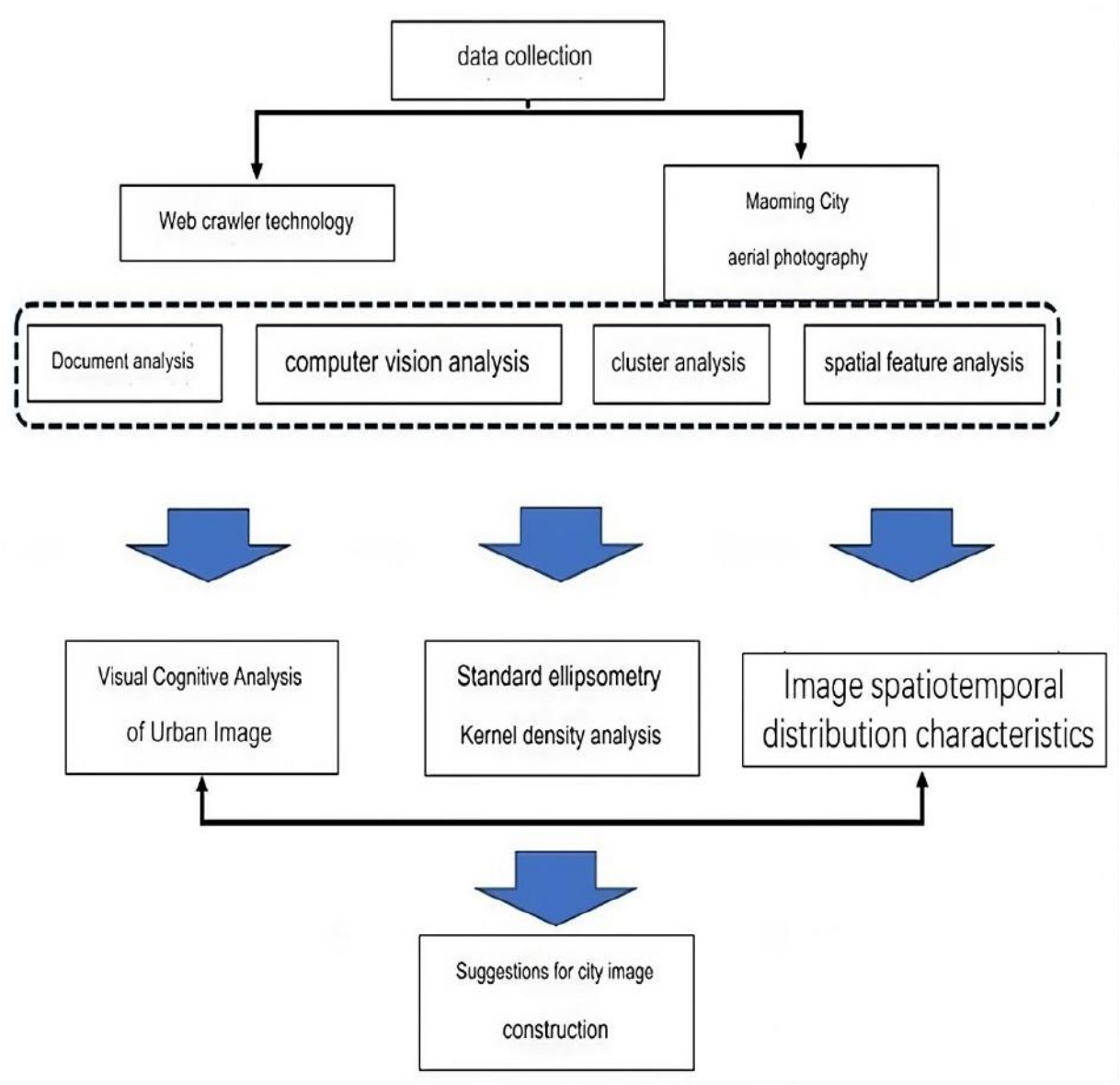


*Fig. 2. Technical Approach*

## III. METHOD

### 3.1Data Collection

The data for this study was sourced from DJI's social platform "SkyPixel" (https://www.skypixel.com/). DJI, based in Shenzhen, is a leading drone manufacturing company that holds approximately 70% of the global market share in the consumer drone sector (Wang et al., 2018). SkyPixel provides a platform for drone photography enthusiasts to upload and share their photos and videos. The photography works uploaded by users, along with descriptions and location information, constitute the primary data source for this research. Using web scraping technology, all drone aerial photos with the keyword "Maoming" were obtained from the SkyPixel website on July 10, 2024. A total of 965 images were collected, of which 845 contained latitude and longitude information, and 453 included textual descriptions. The retrieved data were then organized, and a simple database was established.

*Fig.3. Example of Maoming Drone Image Search on SkyPixel Website*

**3.2 Computer Vision Image Analysis**

Microsoft Azure Cognitive Services is a suite of services that includes APIs (Application Programming Interfaces) and SDKs (Software Development Kits) designed to assist developers in building intelligent applications without requiring direct AI or data science skills. This service utilizes algorithms to enable computers to understand and interpret human communication conducted through natural language. The API framework within Azure Cognitive Services aggregates various machine learning and AI algorithms, with this study primarily focusing on visual and language functionalities. The cloud-based Computer Vision API allows developers to use advanced algorithms to process images and extract information. By uploading images or providing image URLs, Microsoft's computer vision algorithms can analyze visual content and generate corresponding results based on user input and selections. After an image is uploaded, the algorithms identify objects, entities, and actions within the image, returning relevant tags. This research utilizes a program written in C# that invokes Microsoft Azure's Computer Vision API to batch upload drone photo data and employs AI to analyze the image content, returning keyword tags.

**3.3 Spatial Analysis**

(1) Kernel Density Analysis

Kernel Density Analysis (KDA) is a statistical method used for analyzing the geographic distribution of features. It effectively reflects the attenuation phenomenon of geographic occurrences in spatial distribution (Silverman, 2018). KDA is helpful in determining the relative spatial concentration of certain geographic events. This method is typically used to assess the degree of relative concentration of spatial distributions, allowing for a continuous representation of the density of research subjects. In this study, KDA is applied to explore the spatial distribution characteristics of the drone aerial data points. The specific calculation formula is as follows

$$f(x) = \frac{1}{nh_n}\sum_{i=1}^{n} k(\frac{x^2 - x_i}{h_n}) \quad (1)$$

（2）Standard Deviational Ellipse Analysis

The Standard Deviational Ellipse (SDE) is a quantitative method for calculating the spatial dispersion of a dataset, which can be used to determine the distribution direction and characteristics of the data (Lefever et al., 1971). In this study, the Standard Deviational Ellipse is employed to analyze the distribution direction and patterns of drone aerial data points. The direction of the long axis of the ellipse indicates the primary distribution direction of the data within the geographical space, while the area of the ellipse represents the degree of dispersion or clustering of the discrete points. The specific calculation formulas are as follows

$$\mathrm{SDE}_x = \sqrt{\frac{\sum_{i=1}^{n}\left(x_i - \bar{X}\right)^2}{n}} \quad (2)$$

$$\mathrm{SDE}_y = \sqrt{\frac{\sum_{i=1}^{n}\left(y_i - \bar{Y}\right)^2}{n}} \quad (3)$$

In the above formulas, $Xi$ and $Yi$ are the coordinates of feature $i$, $\bar{X}$ and $\bar{Y}$ represent the mean center of the features, and n is the total number of features.

## IV. ANALYSIS AND RESULTS

### 4.1 Temporal Distribution Characteristics of the Data

The trend of drone aerial data in Maoming City from 2014 to 2024 shows significant fluctuations (Figure 4). In 2018, there was a notable increase in the number of photos compared to 2017, marking a peak within the decade and clearly surpassing other years. Monthly statistical data indicates that the highest number of photos was recorded in April, May, and October of 2018, as well as in June 2022, with each of these months exceeding 40 photos.

In 2018, the monthly photo counts exhibited noticeable fluctuations, while the number of photos during 2014, 2015, and 2016 remained relatively low with slight variations. In 2020, with the widespread adoption of drone technology and an increase in photography enthusiasts, the number of photos in the first half of the year significantly exceeded that of the same period in 2019, indicating a sustained growth trend. In 2022, despite a decline in photo counts due to the impact of the pandemic, the overall trend remained positive.

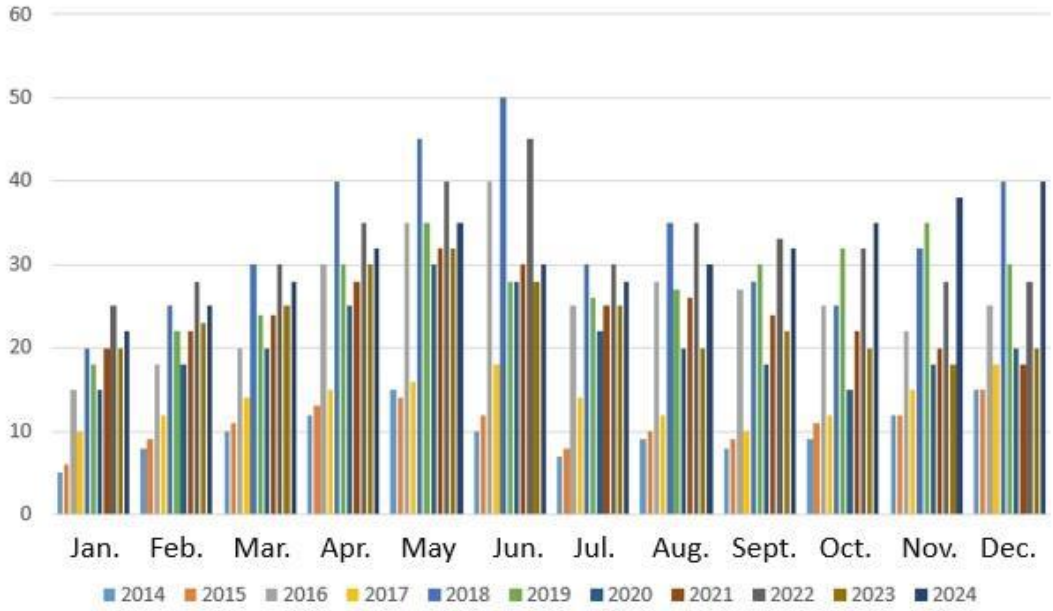


*Fig.4: Temporal Distribution of Photography Data*

The aerial photos exhibit a unimodal characteristic, with peaks in data occurring in April, May, and June, while other months show a gradually decreasing trend. Overall, the number of photos taken in spring is significantly higher than in summer and autumn. The months of July, August, and September, characterized by high temperatures, see the fewest aerial photos taken. In contrast, the three months of autumn display a gradual increase in the number of photos.

The lower summer data in Maoming City is primarily influenced by high temperatures, which reduce outdoor activities for residents. In spring, particularly in April and May, there is a notable increase in aerial photo counts, closely associated with various spring activities, festivals, and tourism promotion events. During this period, a series of cultural and tourism events, such as the "Maoming Spring Tourism Festival" and "Lychee Festival," are held, attracting visitors and boosting the number of aerial photos taken.

Additionally, the number of photos taken in winter is relatively low, significantly affected by weather conditions and outdoor activity levels. Overall, the variation in the number of drone aerial photos in Maoming City is closely related to seasonal changes, climatic conditions, and promotional activities by local governments, reflecting the

vibrancy of local tourism and cultural activities.

**4.2 Spatial Distribution Characteristics of the Data**

A total of 845 drone photos containing geographic coordinates were analyzed to understand the focal points and activity patterns of the photographers (Figure 5). The aerial photography was primarily concentrated in the central urban areas of Maoming, including Maonan District, Gaozhou City, and Dianbai District, as well as major coastal and cultural attractions nearby. Notable sites such as the Open-Pit Mining Museum, Shuidong Bay, Romantic Coast, Papua New Guinea Bay, and Maoming Beach attract many aerial photography enthusiasts. These locations not only boast excellent natural scenery and cultural history, but local governments also actively promote their visibility, contributing to the increase in aerial photography data. Additionally, Maoming's well-preserved ecological environment, such as the Wetland Park and riverside areas, has also generated a considerable number of aerial photos due to their picturesque landscapes.

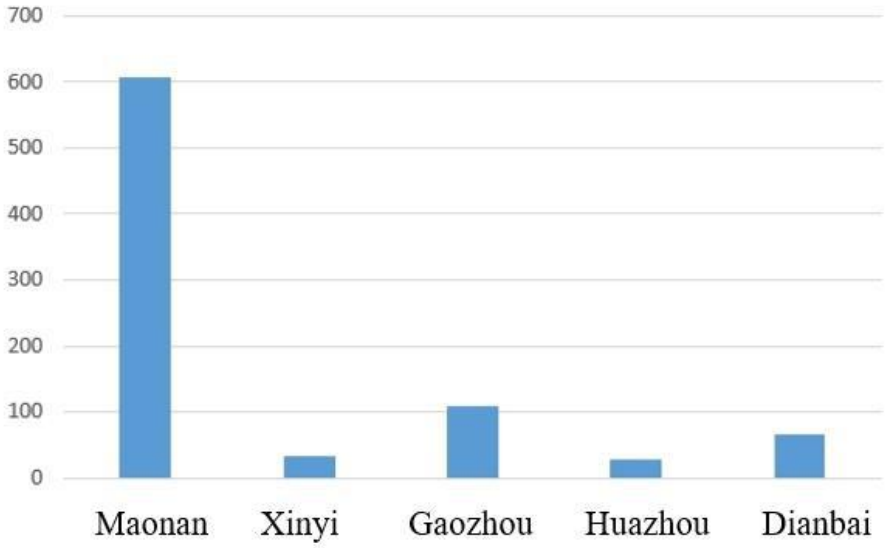


*Fig.5: Statistical Distribution of Drone Photos in Maoming City*

In contrast, the number of aerial photos from more distant county areas, such as Xinyi City and Huazhou City, is noticeably lower. These regions have relatively fewer well-known attractions and limited infrastructure, resulting in restricted aerial photography activities. Thus, the spatial distribution of aerial photos exhibits a pronounced centralization pattern, mainly focused in the city center and surrounding tourist hotspots, while the number of photos from remote areas remains relatively low (Figure 6).

To investigate the spatial distribution and geographical preferences, the drone aerial data points were imported into ArcGIS for visualization, resulting in a data point distribution map (Figure 7). The distribution of data points across various districts shows a concentrated pattern in the main urban area and near regional centers. Maonan District is notably concentrated in the central part of the region, Dianbai District is focused on the southwestern coastal area, and Xinyi is located in the northwestern area near the mountains, while Xinyi and Huazhou are close to the city center. The standard deviational ellipse analysis reveals a significant difference between the long and short axes of the data, indicating a pronounced directional spatial distribution, which aligns with a southwest-northeast orientation consistent with the urban form.

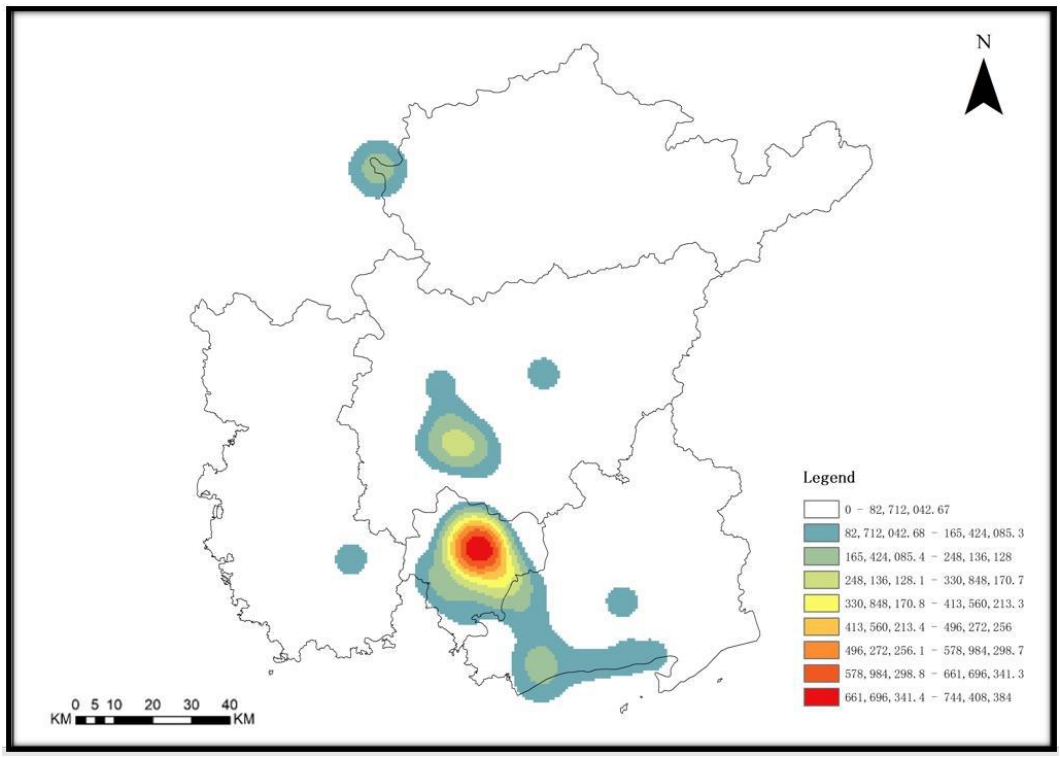


*Fig.6: Kernel Density Analysis of Drone Photography Locations*

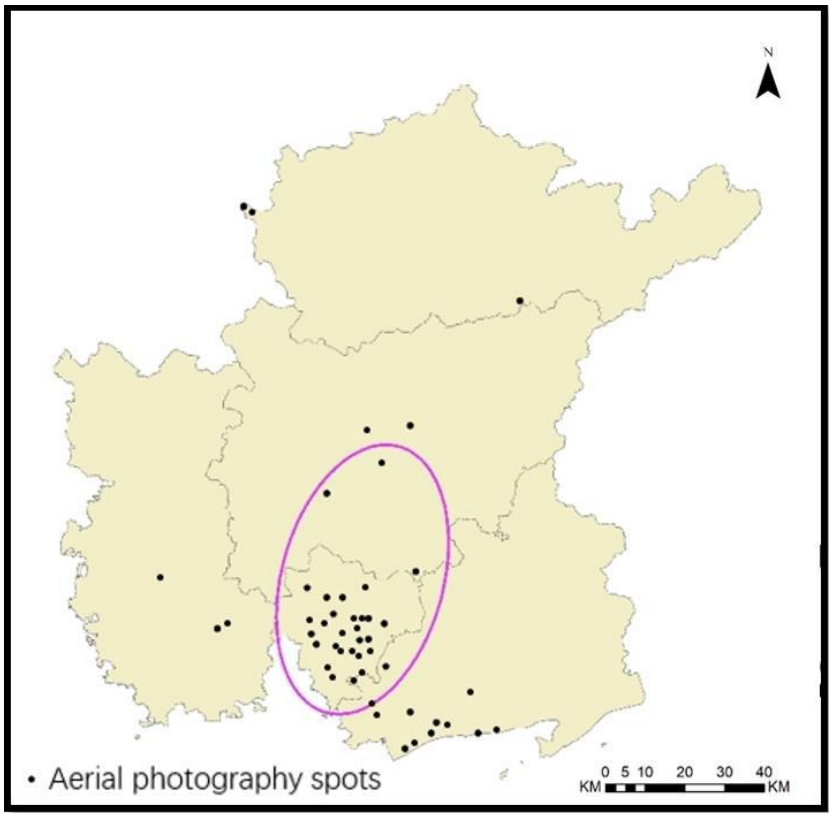


*Fig.7: Standard Deviational Ellipse Analysis*

### 4.3 Computer Vision Analysis

Computer vision technology was employed to extract keywords from the image content. To ensure the accuracy of the visual analysis, 300 aerial photos were selected, and NVivo 11 was used to conduct a frequency analysis of the keywords, resulting in 120 visual keywords with a total frequency of 3,600 occurrences. Among these, the top 30 visual keywords accounted for a total of 2,500 occurrences. The summarized results are presented in Table 1.

*Table 1: Statistical Analysis of Keywords from Drone Aerial Photos (Top 30)*

| Serial number | Keyword | Word frequency | Proportion | Serial number | Keyword | Word frequency | Proportion |
|---|---|---|---|---|---|---|---|
| 1 | Outdoor | 300 | 8.33 | 16 | Traffic | 50 | 1.39 |
| 2 | City | 280 | 7.78 | 17 | Colorful | 48 | 1.33 |
| 3 | Building | 250 | 6.94 | 18 | Nature | 46 | 1.28 |
| 4 | Water | 230 | 6.39 | 19 | Park | 44 | 1.22 |
| 5 | Green | 220 | 6.11 | 20 | Night | 42 | 1.17 |
| 6 | Light | 210 | 5.83 | 21 | Mountain | 40 | 1.11 |
| 7 | Sunset | 200 | 5.56 | 22 | River | 38 | 1.06 |
| 8 | Lake | 180 | 5.00 | 23 | People | 36 | 1.00 |
| 9 | Car | 160 | 4.44 | 24 | View | 34 | 0.94 |
| 10 | Field | 150 | 4.17 | 25 | Festival | 32 | 0.89 |
| 11 | Old | 140 | 3.89 | 26 | Sunny | 30 | 0.83 |
| 12 | Bridge | 130 | 3.61 | 27 | Construction | 28 | 0.78 |
| 13 | Street | 120 | 3.33 | 28 | Fishing | 26 | 0.72 |
| 14 | Home | 110 | 3.06 | 29 | Sports | 24 | 0.67 |
| 15 | Crowd | 100 | 2.78 | 30 | Market | 22 | 0.61 |

The summary of keywords reveals a rich array of terms that describe modern urban landscapes, such as "city," "building," and "traffic." This indicates a high level of focus on city imagery, particularly in the depiction of transportation and urban infrastructure. Additionally, many high-frequency words include adjectives like "outdoor," "green," and "peaceful," which are primarily used to describe the characteristics of the subjects being photographed, reflecting the visual focal points of the aerial images.

The analysis also highlights keywords that describe natural landscapes, such as "water," "lake," and "mountain," suggesting significant potential for showcasing natural beauty. In summary, the primary representation of city imagery captured by drone photography is the integration of vibrant urban landscapes with the surrounding natural environment. This novel perspective not only presents a comprehensive view of the city but also reinforces the harmonious relationship between urban and natural elements. The elevated viewpoint of drones allows for a clear depiction of urban layouts and landscape features, offering a unique visual experience compared to traditional photography.

When the prominent keywords identified through computer analysis were imported into ArcGIS, a spatial distribution map was generated (Figure 8) to explore the spatial characteristics of city imagery captured by drones in Maoming City. It is evident that photo data points of buildings and green plants are more concentrated, while those depicting water bodies, lakes, and similar features are relatively dispersed. A preliminary analysis suggests that this dispersion is influenced by the spatial separation

between the Maoming Open-Pit Mining Lake and other water bodies, such as the Jianjiang River. The primary concentration of buildings and lighting is found in areas such as the Maonan urban area, the Maoming Museum, the Cultural Memorial Hall, People's Park, and Cultural Park, indicating a presence of both cultural and natural landscapes. Lakes and similar features are mainly clustered in the Maoming Open-Pit Mining area, with some dispersion across public spaces like Xinh Lake Park and West Lake Park. Additionally, the overall distribution of green vegetation in Maoming City is evident along various transportation routes and public areas, while lighting data points are concentrated in locations like Xiaodongjiang, Shuidong Bay, and Romantic Coast.

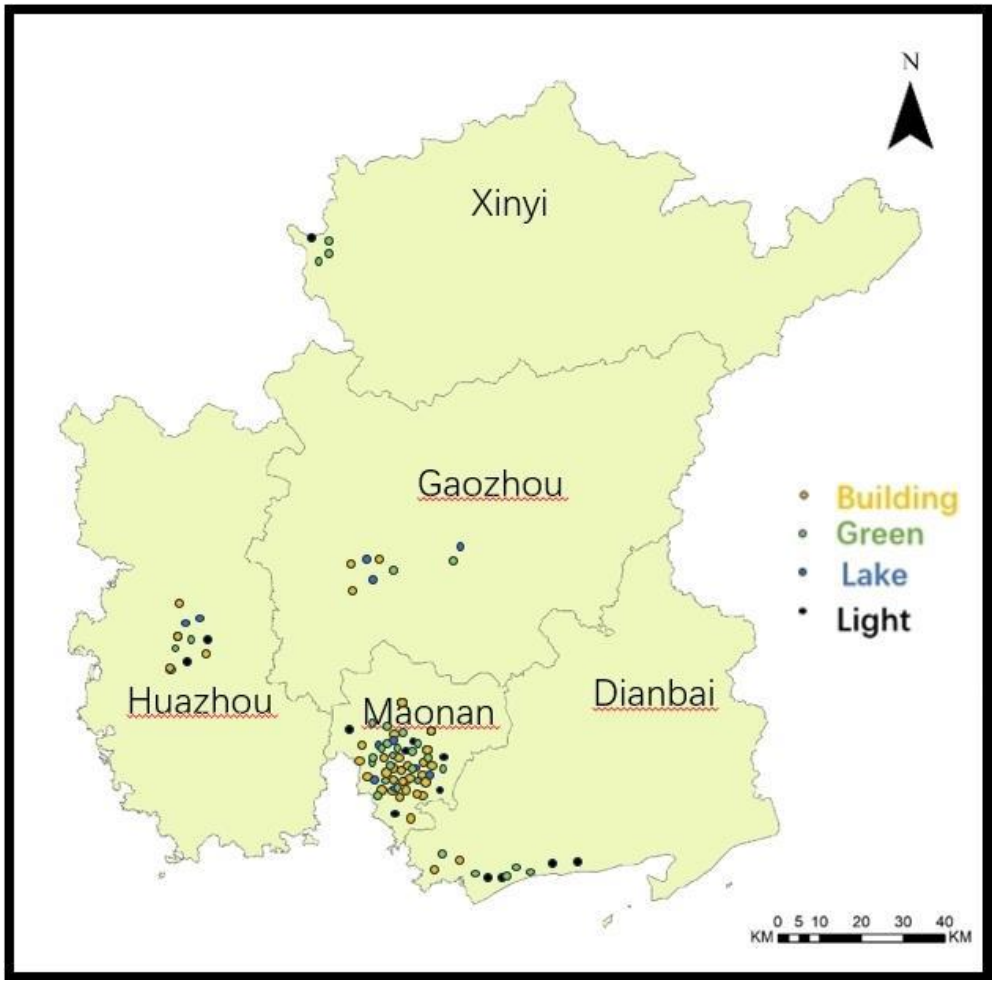


*Fig.8: Distribution Map of Selected Keywords*

## 5 Clustering City Imagery Elements Based on Aerial Images

City imagery is a crucial component of the overall image in the process of urban construction and development. By clustering different elements of city imagery and analyzing their spatial distribution patterns and content, recommendations can be made for distinctive urban development. This can assist planning departments in making more scientific decisions in urban design, ultimately enhancing urban spatial quality and shaping a positive urban image.

Kevin Lynch, through surveys of residents in Boston, Jersey City, and Los Angeles, categorized the components of urban imagery into five elements: paths, edges, nodes, districts, and landmarks. This study, in conjunction with Lynch's theory and relevant literature, positions the acquired aerial photos of Maoming City, which contain latitude and longitude data, as point elements within the urban space, thereby deducing multiple elements of urban imagery specific to Maoming City.

### 5.1 Roads

The road network in Maoming City plays an

important role in constructing city imagery. Dongfeng First Road and Renmin Avenue form the primary north-south axis of Maoming City, connecting multiple significant urban landmarks and cultural venues, such as the Maoming Cultural Center and the Maoming Museum. This road serves not only as a vital traffic route but also as an essential passageway for residents' daily lives. Additionally, the Ring Road encircles the main attractions of the city, with the furthest point from the city center being no more than 300 meters. As an important scenic beltway in Maoming City, the Ring Road links several imagery elements, including People's Park and Nanhai Cultural Square. Major thoroughfares such as Provincial Highway S280 and Provincial Highway S372 (Figure 9) serve as critical transportation hubs connecting various city regions, facilitating both intra-city traffic flow and travel needs to surrounding counties and cities.

The interplay of main streets and alleys forms a rich urban landscape, particularly along the streets of the old city, where many traditional buildings and cultural characteristics have been preserved. These roads are not only the lifeblood of the city but also essential spaces for the daily lives and cultural interactions of residents, reflecting the unique city imagery of Maoming.


*Fig.9: Schematic of Road Intentions*

Lynch's theory posits that roads serve as the primary channels through which observers navigate the city, with usage frequency varying based on familiarity with the urban environment. Unlike traditional studies of city imagery, the data in this research is derived from aerial photographs taken by operators using drones at a certain altitude (Figure 10). Nonetheless, for most photographers, roads remain a fundamental element of the city and a primary means through which city imagery is constructed. Additionally, roads are closely related to the other four elements of the city, effectively linking most imagery components together.

*Fig.10: Example of Roads*

**5.2 Boundaries**

As a coastal city, Maoming has relatively flat terrain in the southeast, with coastlines and rivers playing crucial roles in the urban layout. The main natural boundaries include the South China Sea to the south and the Jian River to the north, the latter creating a significant separation in the urban landscape. The Jian River divides the city's commercial areas from ecological protection zones, with the northern side predominantly showcasing cultural landscapes and urban development, while the southern side features rich natural scenery, creating a striking contrast (Figure 11).


*Fig.11: Schematic of Boundary Imagery*

Moreover, the city's major road networks, such as the Ring Road and the Guangzhu West Line Expressway, not only function as critical traffic routes but also spatially delineate urban functional areas. Urban planning departments have established clear regulations regarding building heights along the coastal and riverbanks, ensuring

the preservation of ecological spaces and the protection of natural landscapes during urban development. Maoming's Coastal Park and Wetland Park have become important recreational spaces for residents, creating positive interactions with the cultural landscapes of the urban core (Figure 12).

*Fig.12: Example of Boundaries*

**5.3 Nodes**

Nodes are strategically significant locations within the city, typically representing key areas that observers can access during their movements, leaving a lasting impression. These nodes may be locations where roads intersect or areas that showcase specific characteristics; they are not limited to small points and can include large squares or central urban areas. Nodes often become gathering points for community activities, symbolizing the core or identity of a region (Figure 13).

*Fig.13: Example of Nodes*

In Maoming City, key imagery nodes are concentrated in several strategic areas. For example, Maoming Donghui City, with its convenient transportation links, has become an important hub for city transit. City parks such as Xinh Lake Park, Chun Garden Park, and Cultural Park (Figure 14) not only provide recreational spaces for residents but also attract numerous tourists due to their beautiful environments and diverse activities, leaving a profound impact on visitors. Overall, the establishment of these imagery nodes enhances the connectivity of the city's transport network and public spaces, making the city image more pronounced.

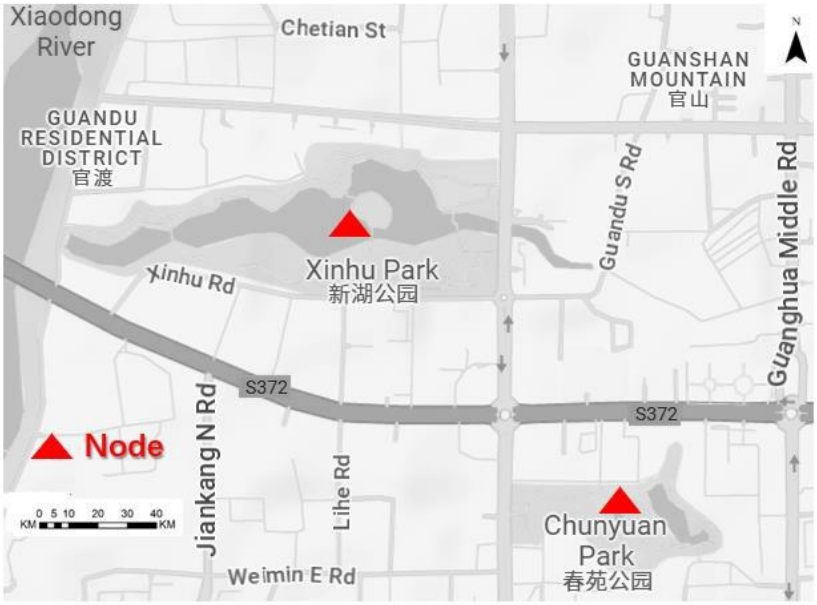


*Fig.14: Schematic of Node Imagery*

**5.4 Districts**

Imagery districts are larger spaces within the city where observers can identify specific regional characteristics. These districts are categorized based on the continuity of their themes and the similarity of their imagery elements, forming multiple uniquely charming imagery areas. The main imagery districts in Maoming City include Maonan, the old town of Gaozhou, the Cultural Park area in Maonan District, the Development Zone, and the Ocean Cultural area in Dianbai District (Figure 15).

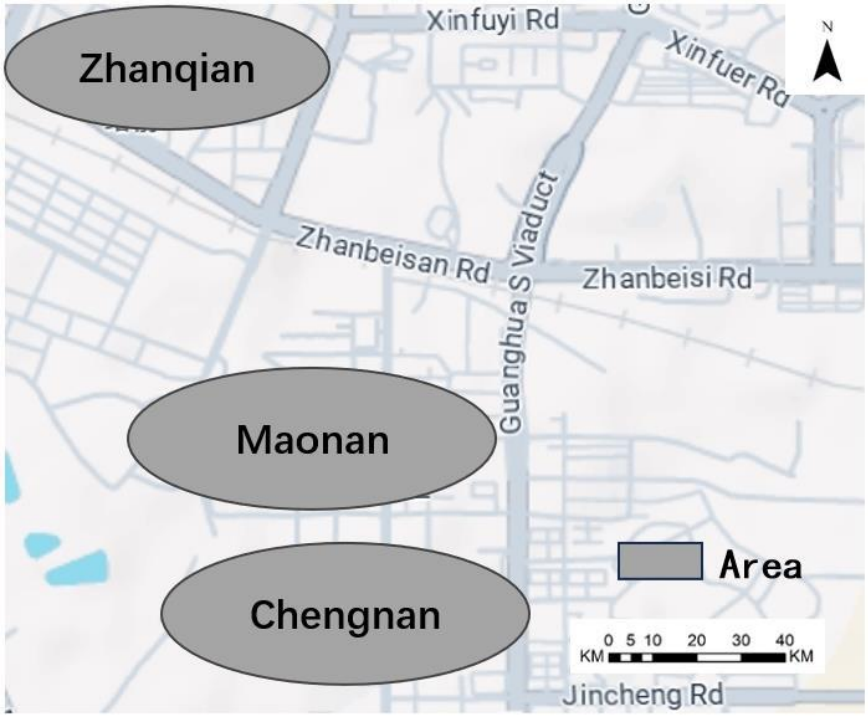


*Fig.15: Schematic of District Imagery*

In terms of spatial distribution, the old town is a concentration of Maoming's history and culture,

showcasing numerous traditional buildings and cultural landscapes. The Cultural Park area offers rich recreational spaces, attracting a large number of visitors and residents. The High-Tech Zone, an important area for economic development, features modern architecture and technology parks (Figure 16), showcasing the city's modernization. The Ocean Cultural area in Dianbai District is renowned for its unique marine scenery and rich water activities. These imagery districts contribute to Maoming City's distinctive urban character.

*Fig.16: Example of Districts*

**5.5 Landmarks**

Landmarks serve as point references that city residents rely on for understanding their urban environment, acting as positioning points for external observation (Figure 17). They can vary in size and complexity, often exhibiting unique or striking characteristics. Lynch noted that those familiar with a city typically rely on visible markers for navigation, often choosing buildings or structures with distinctive features as emblematic elements of the city.


*Fig.17: Schematic of Landmark Imagery*

In terms of imagery content, the landmarks in Maoming City are characterized by a rich blend of natural

scenery and modern architecture. Notable examples include Maoming's First Beach and Forest Park, such as Shuidong Bay and the northern peaks of Maoming, which serve as important symbols of the city, showcasing its natural allure. Additionally, modern structures like the Shuidong Bay Bridge, Maoming Sports Center, Xiaodong jiang Island, and the Open-Pit Mine Museum reflect the city's modernization, presenting Maoming as a point of economic growth (Figure 18). These landmarks not only carry the historical and cultural significance of Maoming but also highlight its potential for future development.

*Fig.18: Example of Landmarks (Image Source: Sky City)*

## V. CONCLUSION AND SUGGESTIONS

### 6.1 Conclusions

This research is based on aerial photographs and related data of Maoming City collected from the DJI work display platform "Sky City" from June 2014 to June 2024. Utilizing Lynch's theory of city imagery and integrating it with tourism destination theories, the study employs methods such as computer vision network image analysis and GIS spatial analysis to explore the temporal and spatial distribution characteristics of drone photography data in Maoming City. Through clustering analysis of city imagery elements and manual interpretation of the evaluation characteristics of Maoming's city imagery, the study analyzes city imagery construction from the "God's eye view" of drones and ultimately provides suggestions for the construction of city imagery and drone management in Maoming. The key conclusions of this study are as follows

（1）The spatiotemporal imagery of residents' activities is influenced by seasonal changes, showing a concentrated trend. The aerial photographs reveal a unimodal feature, with peak data observed in April, May, and June, while other months display a gradual decline. Monthly variations indicate that spring sees a significantly higher number of photographs compared to summer and autumn, with the least number of aerial photographs taken during the hot months of July, August, and September. The autumn months, however, show a gradual upward trend in the number of photographs. The low summer data is primarily attributed to high temperatures, which reduce outdoor activities. In contrast, the number of aerial photographs significantly increases in spring, especially in April and May. The drone photography data points are concentrated in the main urban area and near regional centers, with Maonan District concentrated in the central area, Dianbai District along the southwestern coast, and Xinyi in the northwest near the mountains, while Xinyi and Huazhou are closer to the city center. The analysis of standard deviation ellipses indicates a significant difference between the long and short axes of the data, suggesting a marked directional distribution of data points, predominantly in a southwest-northeast orientation.

（2）The keywords describing the content of the photographs predominantly reflect modern urban landscapes, such as city, building, street, traffic, and road. These terms reveal the characteristics of city imagery in Maoming.

（3）This study synthesizes key elements, including roads, boundaries, nodes, districts, and landmarks, to outline the spatial distribution of city imagery in Maoming City (Figure 19). Roads such as Provincial Highway S372 and the Ring Road (indicated by the red lines in Figure 21) connect major landmarks and cultural sites. Boundaries formed by coastlines, rivers, and major roads (represented by black boundary lines and blue water distribution lines in Figure 21) delineate urban functional areas (points B, D, G). Imagery nodes like Donghui City and Xinh Lake Park gather community activities (points A, C in the figure). Districts including Maonan, the old town of Gaozhou, and Dianbai District showcase the city's history and modernization. Landmarks such as the First Beach, Shuidong Bay Bridge, and Xiaodongjiang Island (points E, F, H in the figure) embody the organic integration of nature and modern urban planning.

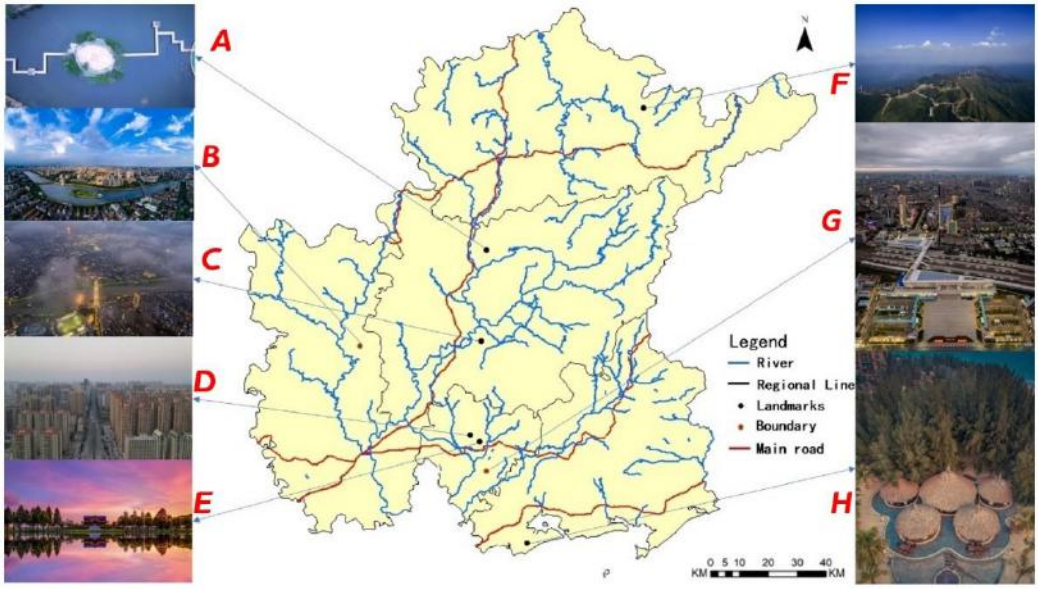


*Fig.19: Spatial Distribution of Key City Imagery in Maoming*

(A: Xihu Park Node B: Jian River Boundary C: Donghui City Node D: Maonan District E: Open-Pit Mine Museum F: Tianma Mountain in Xinyi G: Transportation Functional Area H: Romantic Coast Landmark)

**6.2 Suggestions**

With the rise in users of drone photography and the increasing sales of consumer-grade drones, traditional urban photography is being replaced by the "God's eye view" offered by drones. This study analyzes the city imagery of Maoming City using drone data, categorizing it into roads, boundaries, nodes, districts, and landmarks, and presents the following optimization recommendations.

（1）Strengthening City Imagery Around the "Oil City Landscape"

As the "Southern Oil City," Maoming should position this identity at the core of its city image construction, highlighting its role as a national petrochemical base. It is recommended to focus on the Open-Pit Mine Museum and the petrochemical industry chain, integrating pit restoration with industrial enhancement to create unique symbolic imagery.

（2）Shaping a Modern City Image

As an important node city in western Guangdong, Maoming should develop an city image promotion plan to advance city marketing, fostering the development of modern high-tech industries while shaping a modern city image rooted in traditional cultural heritage.

（3）Focusing on City Imagery in Outlying Areas

The research reveals that activities in Maoming City are primarily concentrated in Maonan District, with relatively few aerial photographs taken in peripheral areas such as Xinyi and Huazhou. These regions lack

well-known attractions, suggesting the need to enhance city imagery construction in outlying counties and explore local characteristics.

（4）Establishing Drone Usage Policies to Guide Flight

Visual analysis indicates that nighttime aerial photography is common; however, the complex night environment can affect operators' perception and obstacle avoidance systems. Management authorities should strengthen nighttime flight regulations to ensure safety while guiding citizens to use drones in appropriate areas. Additionally, photography contests can be organized to promote the city's image, along with the installation of signage to direct the best photography locations.

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