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Research Article

Evolution of Regional Economic Spatial Structure Based on IoT and GIS Service

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Unbalanced regional development is an inevitable trend in the development of all countries in the world. The rapid development of the Internet of Things (IoT) technology has created tools for the study of regional development issues. IoT has many advantages and thus owns a very wide range of applications. This paper makes use of geographic information system (GIS) technology, which can be viewed as one of the IoT sensing information. Changes in spatial regional economic differences and space and the evolution of the structure are particularly examined by processing spatial information such as maps, analyzing phenomena and events that exist on the earth, and exploiting Kriging and inverse distance weighting (IDW). The numerical results in this paper justify that the introduction of GIS technology to the study of economic diversity can upgrade regional economic research from a traditional qualitative and statistical level to a quantitative and spatial visualization level.

1. Introduction

1.1. Background and Significance. With the strong promotion of information technology, the Internet of Things (IoT) has gradually been applied in many aspects all over the world. The scale of the IoT industry has also continued to expand, becoming a new strategic industry. The IoT is not only a representative of a new generation of information technology but also an important development direction of a new generation of information technology. The IoT has many advantages, has a very strong permeability, and has a very wide range of applications. There is a close relationship between the IoT and the regional economy, which can promote the development of the regional economy, promote the transformation of the regional economy, and accelerate the growth rate of the regional economy. Therefore, research on regional economic differences based on the IoT is of great significance. Regional economic difference refers to the imbalance of the overall level of economic development between regions in a certain period of time [1]. Due to the imbalance of resources and development levels in each city (province, state), economic development cannot reach the same level in the same period, so there are regional economic differences [2]. Regional economic disputes are a global law in the process of regional development and a key issue in regional economic research. The study of regional economic spatial differences and their causes is helpful to understand the status quo of regional economic development, promote the economic development of underdeveloped areas, and consolidate the economic achievements of developed areas [3].

The intervention of Electronic System Design Automatic-Geographical Information System (ESDA-GIS) analysis method covers the shortcomings of traditional economic difference analysis, so it is possible to study the economic spatial relationship between regional units [4]. In addition, when selecting economic indicators for European Food Safety Authority analysis, this article did not use per capita GDP indicators, but selected 13 indicators representing different levels of economic disparity for the analysis of key factors, and narrowed the scope of the 13 economic disparity indicators. Through the weighted calculation obtained by processing, the final total evaluation value of the principal component analysis is used as the county-level unit economic evaluation score of the year, as a measure of ESDA-GIS analysis, and used to analyze the subsequent county-level economic spatial correlation [5, 6].

Due to the importance of national economic research, more and more research teams have devoted themselves to the research of the national economy and have achieved very good results. For example, Farah bakhsh conducted a detailed study on the evolution of the regional economic spatial structure through the GIS method and from this infers the future economic development trend, but because it did not integrate the global environment, the conclusion is inaccurate [7]; Chhetri economy can be used to analyze specific economic conditions, but it only represents the direction of big data, and it is still not applicable to some scenarios [8]. The accuracy of economic research is very difficult [9, 10].

In a bid to improve the accuracy of the regional economic spatial structure, this paper makes use of GIS-based IoT service to study the geographical environment of the region. In particular, we employ interpolation and local fitting approaches to ensure the accuracy of local economic data. As a result, a detailed division of the regional economic spatial structure was finally drawn out through controlled experiments.

The rest of the paper is organized as follows. Section 2 presents the data processing and analyzing approaches used in this paper, including interpolation-based overall/local fitting, correlation analysis, and spacial clustering. Section 3 demonstrates the general numerical results on the evolution of the regional economic spatial structure, whereas Section 4 focuses on those specifically related to the GIS service. Finally, Section 4 concludes the paper.

2. GIS-Based Regional Economic Spatial Structure

2.1. Interpolation Method Based on Overall Fitting Technology. The entire placement technique, the placement model, is determined by all the characteristic observations of all sampling points in the target area [11]. The characteristic of this interpolation technique is that it cannot provide the local characteristics of the interpolation area, so the model is mainly used for large-scale changes [12, 13]. What we usually call the surface stress analysis method is to approximate the general trend of the sampled data by selecting a binary function [14]. The general form of the binary function is

$$F(X, Y) = \sum_{R+s=0}^{R+s=P} B_{Rs} X^R Y^s. \quad (1)$$

$F(X, Y)$ is the actual observed data value, B_{Rs} is the fitted value of the trend surface, and P is the trend surface; when $p = 0$, it is the horizontal plane:

$$F(X, Y) = B_0. \quad (2)$$

When (X, Y) changes in space, when $p = 1$, it is an inclined plane, and $B_0, B_{1X}, \cdots, B_{XY}$ are the coefficients of the polynomial:

$$F(X, Y) = B_0 + B_{1X} + B_{2Y}. \quad (3)$$

When $p = 2$, it is a quadric surface:

$$F(X, Y) = B_0 + B_{1X} + B_{2Y} + B_{3X}{}^2 + B_{4XY} + B_5 Y^2. \quad (4)$$

Independent variable X, Y, dependent variable Z. The binary function must satisfy the least square sum of the difference between the observed value and the fitted value:

$$F(X, Y) = \arg \min \sum_{I=1}^{I=N} (Z(X_I - Y_I) - F(X_I - Y_I))^2. \quad (5)$$

Multiple regression techniques can be used to determine the aforementioned types of coefficients [15]. The use of a binary function to process surface interference voltage has the following characteristic: when $p > 3$, custom surfaces usually produce abnormally large or small values.

The placement residual is an independent error of the normal distribution and has a certain correlation. Before being used for local interpolation, the macro abnormal sampling value must be processed in advance. Total spatial interpolation was performed according to the empirical formula of one or more spatial parameters. This empirical equation is called the transformation function [16, 17], and it is also a common method of total interpolation technique. Since this article does not use placement technology, it will not be described in detail here.

2.2. Interpolation Method Based on Local Fitting Technology. The real surface of continuous space is difficult to express with mathematical polynomials. Therefore, the local placement technique is usually used to match the value interpolation through local sampling points [18]. The positioning method only uses neighboring values to estimate the value of unknown points. Generally, these are the following steps: (1) specify the adjacent search area or range, (2) search for points located in the adjacent area, (3) choose mathematical functions that express the spatial variation of these finite points, and (4) assign values to data points belonging to ordinary grid cells. Reset the operation of this step until all points on the grid are mapped [19].

Spline interpolation is a process of obtaining a set of curve functions by mathematically solving three bending moment equations through a series of smooth curves of shape values [20]. And, when all $p - 1$ degree derivatives and adjacent blocks at the limit of n degree polynomial are continuous, it is called a spline function [13]. The principle of the mobile placement method is to match the surrounding data points by defining appropriate local functions and solving the assembly function to find the interpolation of unspecified points. This method uses an unspecified point as the interference center [21]. The Kriging (lattice) interpolation method, cofounded by French geologist Georges Matheron and South African mining engineer DG Krige in 1997, is a geostatistical method and the best linear unbiased interpolation estimator (referred to as BLUE) [22, 23]. Kriging put it this way: Suppose that Z is a regionalized variable carried by a point and is 2nd order stationary (or intrinsic), $z(X_I)(I = 1, 2, \cdots, N)$, point bearer $X_I(I = 1, 2, \cdots, N)$. Now, we need to estimate the regionalization variables of the X_0 point bearing location, and the estimated amount used is

$$z'(X_I) = \sum_{I=1}^{N} \lambda_I z(X_I). \quad (6)$$

Choose λ_I to make the estimate of $z'(x)$ unbiased, and make the variance smaller than the variance of any linear combination of observations. That is, it satisfies the best: the deviation of the difference between the interpolation value and the true value is the smallest [24]; that is, the deviation of the difference between the interpolation value and the true value is the smallest, namely,

$$\mathrm{Var}\left[z'(X_0) - z(X_0)\right] = \min. \quad (7)$$

Linear. The interpolation value is a linear combination of observations, namely,

$$Z'(X_0) = \sum_{I=1}^{N} \lambda_I z(X_I). \quad (8)$$

Unbiased Estimation. The expected value of the difference between the interpolated value and the observed value is zero, namely,

$$e\left[z'(X_0) - z(X_0)\right] = 0. \quad (9)$$

In the MAPGIS software, we have provided us with three variable function models, namely, the power exponential model, the linear model, and the spherical (MATLON) model [25].

(1) Linear model:

$$\begin{cases} \gamma(h) = c_0 + c * \left(\dfrac{H}{A}\right), & 0 < H < A, \\ \gamma(H) = c_0 + c, & H > a \end{cases} \quad (10)$$

(2) c is the polynomial coefficient, power exponent model:

$$\gamma(H) = c_0 + c\left[1 - \exp\left(-\frac{H}{A}\right)\right], \quad H > 0 \quad (11)$$

(3) Spherical model:

$$\begin{cases} \gamma(H) = c_0 + c\left[1.5 * \left(\dfrac{H}{A}\right) - 0.5 * \left(\dfrac{H}{A}\right)^3\right] & 0 < H \le A, \\ \gamma(H) = c_0 + c, \quad H > A \end{cases} \quad (12)$$

The range of influence or fragmentation effect is represented by the variable a, and the critical change value is represented by the variable C. Meteorologists and geologists proposed the inverse distance weighting method, which was eventually called the Shepard method [26]. The concept is to place n points, the plane coordinate (X_j, Y_j) is the vertical height, $N = 1, 2, \cdots, I$, and the reciprocal distance weighted interpolation function is

$$F(X, Y) = \begin{cases} \dfrac{\sum_{J=1}^{N} \left(Z_J / D_J^P\right)}{\sum_{J=1}^{N} \left(1/D_J^P\right)} d = (X, Y) \neq (X_I, Y_I), I = 1, 2, \cdots, N, \\ Z_I(X, Y) = (X_I, Y_I), I = 1, 2, \cdots, N. \end{cases} \quad (13)$$

Among them, $D_J = \sqrt{(X - X_J)^2 + (Y - Y_J)^2}$ is the horizontal distance from point (X, Y) to point (X_j, Y_j), $J = 1, 2, \cdots, N$. P is a constant greater than 0, called the weighted power exponent.

The advantage of this method lies in the fact that the formula is relatively simple, especially suitable for scattered nodes, not a problem of grid points. Its disadvantage is that it can only get the maximum and minimum values of the function at the node, as interpolation takes the weighted average of the values at each node.

2.3. Correlation Analysis Method. There are some connections between many phenomena in nature. The relationship between the above two or more random variables is determined based on mathematical statistics and is called approximate relationship or correlation. The analysis and determination of this relationship are called correlation analysis [27].

The main task of correlation analysis is to study the closeness of the relationship between variables and to draw conclusions about whether the population is relevant based on the data sample. If we can get any information about another variable from a known variable, then these two related variables are called "independent variables." The correlation between two variables may be due to various complicated reasons, or one variable affects another variable, or there is an interaction between two variables, or there is no direct relationship between two variables; all variables are also affected by the third variable. In short, the relationship between the two involves certainty and random fluctuations. In the correlation model, both variables are random variables [28]. According to the closeness of the relationship between variables, correlation types can be divided into three types. That is, complete correlation, zero correlation, and statistical correlation.

A complete correlation (functional relationship) is between two variables x and y. If there is a correspondingly defined value y for any given value x, then the relationship between the two variables is complete correlation. Zero correlation (no relationship) is when there is no relationship between two variables or the change of one phenomenon (variable) does not affect the change of another phenomenon (variable). This relationship is called zero correlation or no relationship. If the relationship between two variables

Table 1: Descriptive results of spatial data.

Description item	Quantity	Very bad	Minimum	Max	Avg	Standard deviation	Variance
Longitude	181	9.845	98.098	107.943	103.962	1.926	3.709
Latitude	181	7.105	26.475	33.58	30.135	1.518	2.305
GDP per capita in 2015	181	6680.936	882.8	17563.736	3243.88	2551.923	512308.582
GDP per capita in 2016	181	2620.411	1543.539	24163.95	4986.854	4192.726	7578952.143
GDP per capita in 2018	181	3804	199	7003	10154.331	7160.394	1271243.012
GDP per capita in 2019	181	1738	617	5355	12376.232	8337.462	9513280.09

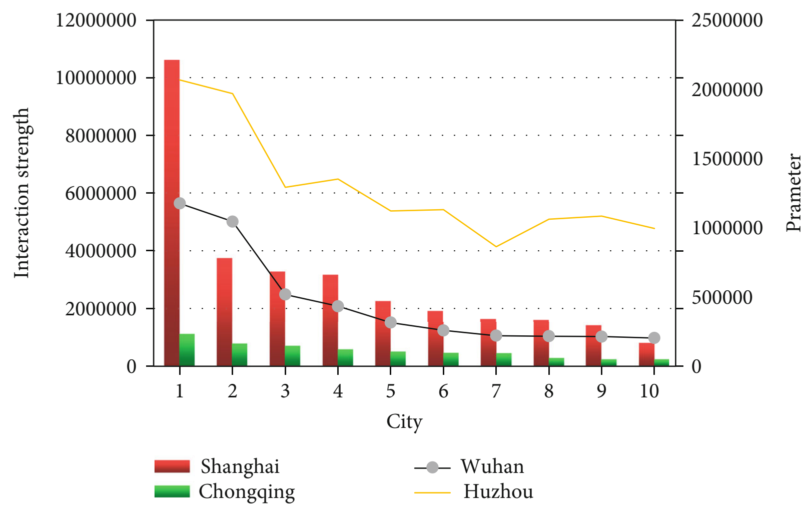

Figure 1: Interaction strength values of central cities in the three major regions.

is between complete correlation and zero correlation, it is called correlation or statistical correlation. When only studying the correlation between two variables, it is called simple correlation; when studying the correlation between three or more variables, it is called multiple correlation. In mathematical statistics, the parameters that determine the degree of a close correlation between variables mainly include covariance and correlation coefficient.

2.4. Spatial Clustering Method. In actual work, we often encounter the problem of sampling samples (or marking), and classification research is the basic method of scientific research. In statistics, cluster analysis is usually used to classify categories. The principle is to first treat a certain number of samples or indicators as one category and then divide the two categories by the highest affinity according to the degree of relevance of the sample (or indicator) and then consider the degree of the combined category and the other categories before the combination intimacy between. Repeat this process until all samples (or tags) are combined into one category. The spatial grouping method is different from the traditional statistical grouping analysis. First, spatial grouping is mainly based on the spatial location of geographic phenomena and reference-related feature information for grouping analysis; second, the purpose of spatial grouping is to analyze the spatial aggregation of spatial objects and their division into different subcomponents, groups (classes), and different subgroups (classes) occupying different spatial areas. The formation of subgroups is a product of the geographic environment. Based on this, certain geographic mechanisms can be revealed, and they can also be used as the basis for other analyses. Third, spatial cluster analysis is different from traditional cluster analysis. It is based on the spatial correlation of geographic variables, while spatial cluster analysis can be based on spatial autocorrelation [29].

The spatial grouping analysis method used in this document belongs to spatial statistics, and the starting point of spatial statistics is to consider that the specific geographic phenomenon or specific feature value in the peripheral unit is related to the same phenomenon or feature value in the area and adjacent area units. Spatial location produces two types of spatial effects: spatial dependence and spatial heterogeneity. The former is usually also called spatial autocorrelation or spatial correlation. Similar values in variables tend to appear in nearby locations, leading to spatial grouping. For example, some high crime areas in cities are usually surrounded by other high crime areas.

3. Numerical Results on the Evolution of Regional Economic Spatial Structure

3.1. Research Experiments on Spatial Data. In order to deepen the understanding of the internal relationship of

Table 2: Construction of economic difference evaluation index system.

	Selected indicator	Comment
1	Regional GDP	Sum of added value of all industries
2	GDP growth rate per capita	Important indicators of the national economy, reflecting the level of economic benefits
3	GDP growth rate	Reflect the level of economic growth
4	Industrial value added above designated size	Added value in the production process of large industrial enterprises
5	Industrial added value as a proportion of GDP	The importance of large industrial enterprises in the economy
6	The proportion of tertiary industry output value in GDP	Service-led economic transformation degree
7	The proportion of the added value of the primary industry in the area of commonly used cultivated land	Industrial productivity in the primary industry
8	Total retail sales of consumer goods per capita	Realization of the purchasing power of social goods
9	General budget revenue of local finance	Reflect the level of economic scale
10	Per capita net income of rural residents	Income of rural residents
11	Per capita net income growth rate	Income of urban residents

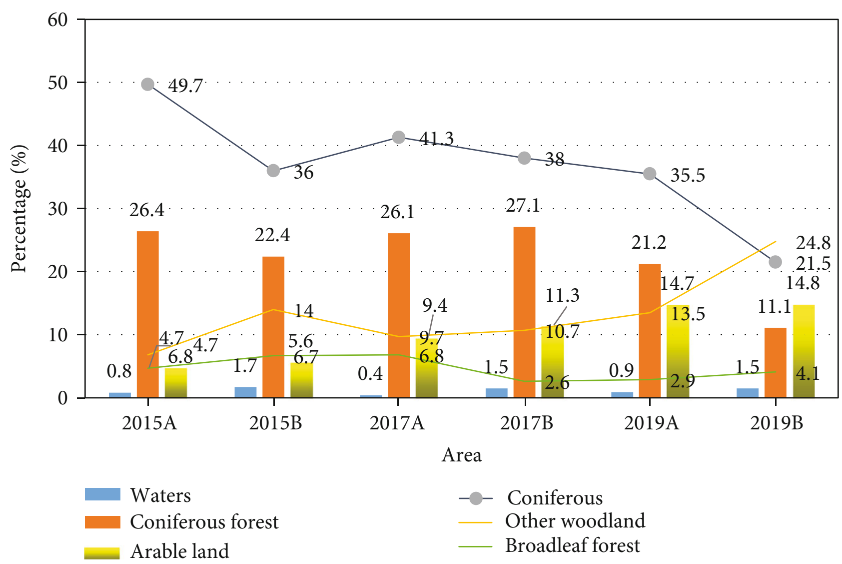

Figure 2: Percentage of (A, B) land use landscape type.

the data, for better and in-depth analysis of the data, recent research and analysis of spatial data are often conducted to obtain the value of spatial attributes and the spatial distribution of data. For data association, it is very useful to understand the particularity of the data, which lays the foundation for the final GIS spatial analysis research. Here, I use the corresponding SPSS statistical tools to explore and analyze the data. SPSS is the English abbreviation for Statistics Product and Service Solutions, which is a statistical software package for social sciences. It is one of the most famous statistical analysis software in the world. First, we investigate and analyze the distribution and eigenvalues of spatial data. Here, we use the analysis and description function in SPSS software. The description of the data is shown in Table 1 and Figure 1.

In addition to the variance and standard deviation in the table, other indicators are relatively easy to understand. Among them, variance and standard deviation are descriptions of deviation trends. Deviation trend refers to the characteristics of the data set, which deviates from the central value of the distribution, reflecting the degree to which the value of each variable deviates from its central value. Through the comparative analysis of variance and standard deviation, if the variance and standard deviation of a given data set are the smallest, it means that the difference of the data set is the smallest, so the data set is more representative than some study prospects.

3.2. Experiments on the Spatial Structure and Characteristics of the Urban System. The urban system refers to a group of interconnected and evenly spaced towns in a relatively integrated region or country. Its characteristics are different types and clear division of labor. Due to regional differences and different natural environments, each city

Table 3: List of interaction strength values of three major regional central cities.

Serial number	Shanghai		Chongqing		Wuhan	
1	Suzhou	10609688.7	Chengdu	1101360	Ezhou	1175061.88
2	Wuxi	3749384.92	Luzhou	770543.54	Xiaogan	1044256.58
3	Hangzhou	3290657.92	Guangan	695230.8	Huanggang	517237.24
4	Nantong	3174218.88	Nanchong	565544.55	Huangshi	432841.85
5	Ningbo	2265610.52	Neijiang	487017.88	Xianning	315264.27
6	Changzhou	1919727.61	Zigong	446243.63	Changsha	258717.88
7	Nanjing	1649481.85	Suining	431156.91	Nanchang	220375.88
8	Jiaxing	1611413.01	Yibing	268598.96	Shanghai	217113.32
9	Shaoxing	1395929.23	Guiyang	228169.92	Nanjing	213876.45
10	Huzhou	785746.26	Ziyang	222364.65	Yueyang	203564.99

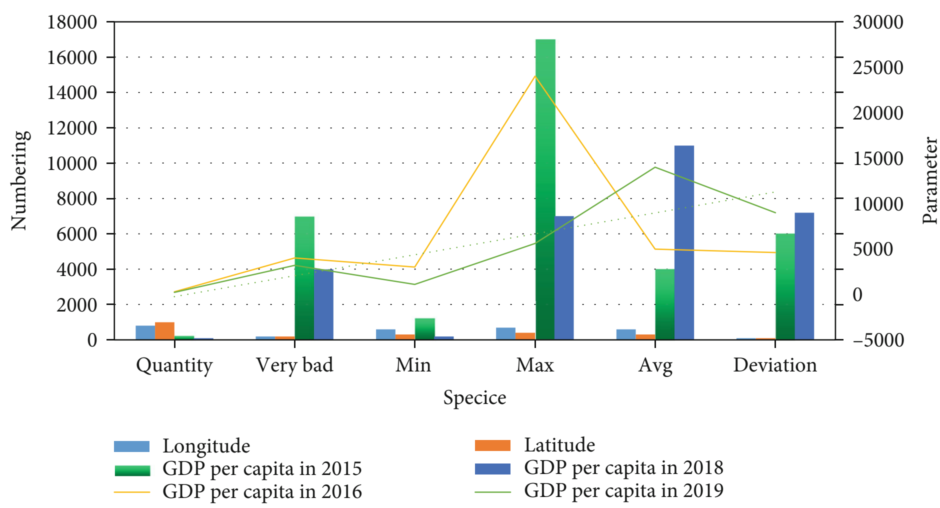

Figure 3: Descriptive results of spatial data.

will develop in a direction conducive to its development. As time goes by, urban agglomerations will form a clear division of labor and interconnections, for example, traffic cities, tourist cities, historical and cultural cities, coal cities, and complete cities. It is variable. The urban system is not static after its formation. The scale, structure, and form of the urban system will change over time and change in government planning. You must have integrity. The bourgeois system is not a closed social and economic system. It refers to a unified whole composed of a series of cities of different scales, different functions, and interconnected cities, with the designated central city as the core of the defined area. The cycle and exchange of energy, matter, and information continue with each other. The bourgeoisie and the outside world continue to exchange and cooperate in the fields of politics, economy, culture, science and technology, trade, etc., in order to strengthen the external relations of the bourgeois system and its own rapid and healthy growth.

The spatial structure of the urban system refers to the spatial interaction of towns in a region, which merges the spatially separated towns into an organic whole with a specific structure and function. Studies have shown that the spatial distribution of urban systems has obvious scale-free characteristics and has a random fractal structure within a certain range. There are three basic fractal dimensions to describe the spatial structure characteristics of the peripheral urban system: one is the fractal set dimension, which starts from the point density and describes the same characteristics of the urban peripheral spatial distribution; the other is the dimension fractal correlation from multiple starting with point density; it describes the relative distribution of system components; the third is the fractal network dimension, which starts directly from the data distribution and describes the spatial structure of the system.

With the rise of transportation and information technology, the spatial structure of today's global system is based on the connections of channels, nodes, levels, flow, terrain, and networks. Nodes and channels are the material basis of the space structure. Domain and network are the functional elements that form the spatial characteristics. It can be considered that the spatial structure of the urban system is composed of different levels of cities, spatial flows, passages, regions, and networks.

Table 4: Percentage of (A, B) land use landscape type.

Land landscape Type	2015 A	2015 B	2017 A	2017 B	2019 A	2019 B
Waters	0.8	1.7	0.4	1.5	0.9	1.5
Coniferous forest	26.4	22.4	26.1	27.1	21.2	11.1
Coniferous and broad-leaved mixed forest	49.7	36	41.3	38	35.5	21.5
Other woodland	6.8	14	9.7	10.7	13.5	24.8
Arable land	4.7	5.6	9.4	11.3	14.7	14.8
Broadleaf forest	4.7	6.7	6.8	2.6	2.9	4.1

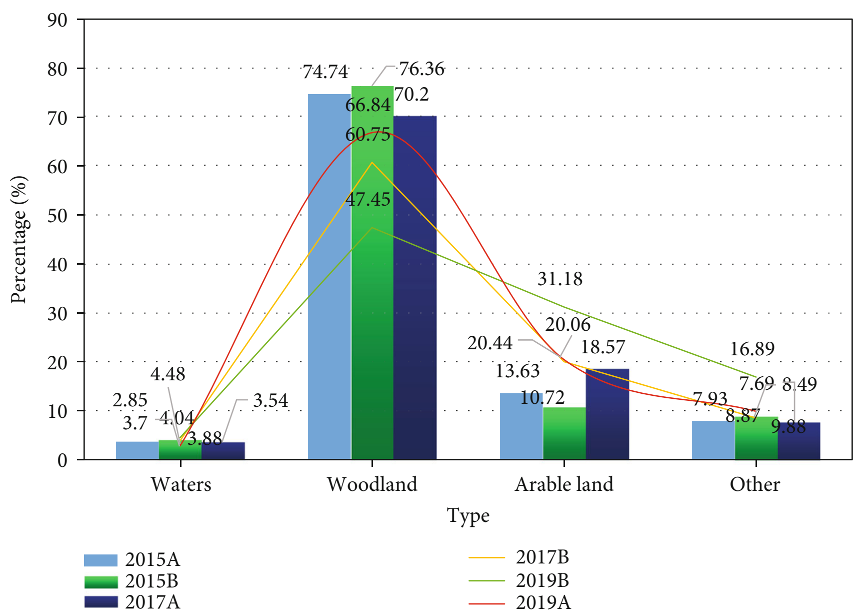

Figure 4: Percentage of land use landscape types in A and B.

Table 5: Percentage of land use landscape types in A and B.

Land landscape type	2015 A	2015 B	2017 A	2017 B	2019 A	2019 B
(1) Waters	3.7	4.04	3.54	3.88	2.85	4.48
(2) Woodland	74.74	76.36	70.2	60.75	66.84	47.45
(3) Arable land	13.63	10.72	18.57	20.06	20.44	31.18
(4) Other	7.93	8.87	7.69	8.49	9.88	16.89

4. Evolution of Regional Economic Spatial Structure Based on GIS Location Services

4.1. Interaction Between Cities in the Study Area. The law of universal gravitation is the law of gravitation that explains the interaction between objects. It is the law of mutual attraction between objects due to their mass. Since the urban system is located in a relatively integrated region or country with the central city as the core, it is composed of a series of cities with different scales, different functions, and close connections. At the same time, the urban system is complete, hierarchical, and dynamic. The internal relationship of the urban system is like every planet has satellite orbits, and central cities also have satellite cities, county seats, and other systems, forming a complete urban system. And there is a relationship between attraction and repulsion according to the universal law of gravitation. When a city is far away from the central city, the attractiveness and aversion of the central city are relatively weak, and the space for independent development is larger, even affected by the surrounding cities; it is also close to another system and attracted by culture and its policy. When the distance is relatively close, the impact will be greater and the resources will be relatively greater, so it will be developed and promoted in collaboration with other parts of its own system.

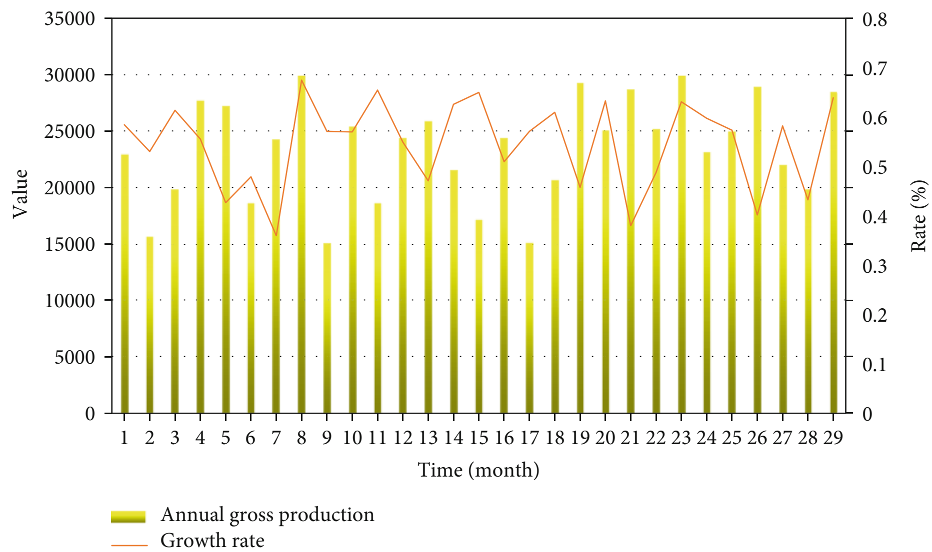

Figure 5: Annual production table of A.

There is a relationship between gravity and repulsion between towns. Under the influence of distance, economy, and culture, when the gravitational and repulsive forces between the two cities are balanced, the cities will develop together; otherwise, they will restrict and hinder each other and affect the city. The development of the city will lead to the unity or diversification of the city. In the urban system, due to distance, cities outside the system may be greatly affected by other systems, and the development of cities will also tend to other systems. This article introduces the types of gravity in physics to analyze the strength of the interaction between cities. Take the straight-line distance between cities as the radius, and calculate the attractiveness between the two as a feature to characterize the intensity of interaction between cities. The spatial interaction force M is used to measure the strength of the interaction between cities, the city's population size, economic development level, and other related indicators which are used as characteristic values to measure the quality of the city, and the interaction between cities is studied and calculated.

Taking into account the availability of data, the population data of 110 cities in the Yangtze River Economic Zone in 2014 and the GDP of the same year were selected, and the direct distance data between cities was used for calculation. According to the method of calculating the urban interaction force, the value of the interaction force among 110 cities in the Yangtze River Economic Zone was calculated. The results show that in the city system of the Yangtze River Economic Belt, Shanghai has the strongest interaction with other cities, the closest connection, and the highest sum of interaction possibilities, which is 36967794, which is significantly higher than other cities. He established Shanghai in the urban residential area of the Yangtze River Economic Zone. For functional and organizational key positions, except for Shanghai, the top 15 cities in terms of the intensity of interaction with other cities are Suzhou (31531495), Wuxi (25667714), Nanjing (22230653), Hangzhou (18759240), Changzhou (16964566), Yangzhou (14270), Shaoxing (10821511), Zhenjiang (10567366), Nantong (8900823), Chongqing (8233501), Wuhan (7601085), Ningbo (6845078), Changsha (6574185), and Taizhou (6308996). Among the 15 cities, 12 cities belong to the Yangtze River City Group, 2 cities belong to the Middle Yangtze River City Group, and 1 city belongs to the upper Yangtze River City Group. In order to facilitate the study of the overall urban spatial interaction of the Yangtze River Economic Belt, Chongqing in the upper reaches of the Yangtze River, Wuhan in the middle reaches of the Yangtze River, and Shanghai in the lower reaches of the Yangtze River were selected and their power to interact with cities in each region. Table 2 and Figure 2 show the top ten cities ranked from high to low in terms of interaction intensity with the three outer cities.

Table 6: Annual production table of A.

Area A	2015	2016	2017	2018	2019
Annual gross product	22990	27722	34606	37757	40154
Growth rate	8.9	11.9	8	8.2	7.6

4.2. Land Use Changes on Both Sides of the Region. Based on the interpretation results of land use in different periods of the above two typical plots, the interpretation results are then counted to obtain the percentages of different land use landscape types in the two study plots.

It can be seen from Table 3 and Figure 3 that the percentage of land use types in different periods is different. Generally, coniferous forests and deciduous forests account for a larger percentage, while other types of land use account for a relatively small percentage. At the same time, the

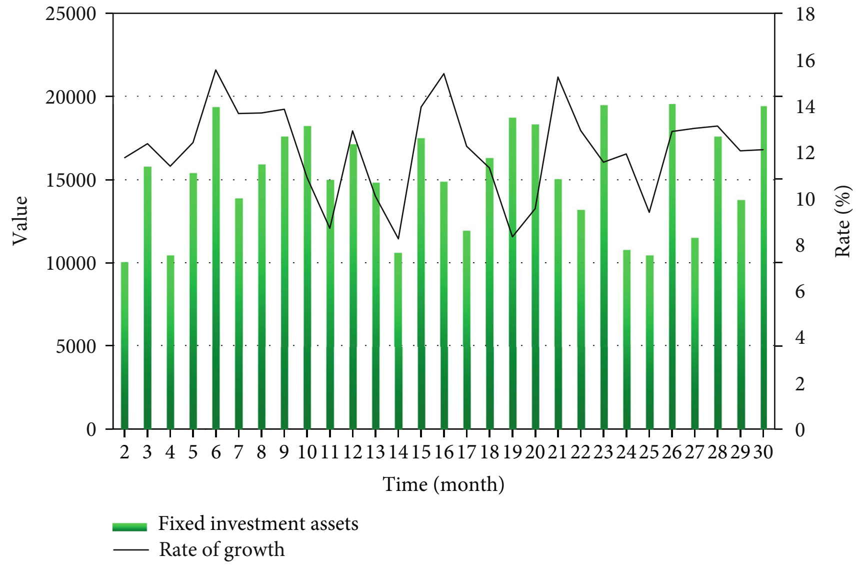

Figure 6: Fixed assets of the whole society in A.

analysis of the main land use landscape types on both sides of the A and B boundary shows that in all three periods, the percentage of coniferous forest on the A side is higher than that on the B side. A means decreases every year. The B end accounted for a sizable percentage, and both sides were on the rise year after year. On side B, the fraction of cultivated land is comparatively high, and both sides are rising year by year; on side A, the proportion of mixed coniferous forest is relatively high, and both sides are decreasing year by year.

Through the analysis of Table 4 and Figure 4, it can be seen that forest land is the main land use landscape type on both sides of the boundary between A and B, and forest land accounts for the largest proportion, followed by cultivated land. This is mainly due to the rehabilitation of human beings, which makes the cultivated area continue to increase. The analysis of the land use landscape types on both sides of the border between A and B in different periods shows that in all four periods, except for side B, the largest percentage of woodland in 1976, both sides accounted for a larger proportion. Both A and B sides showed a downward trend year by year; except for the larger proportion of B side in 1976, the proportion of cultivated land in other periods was higher than that of A side. The results show that the artificial arable land of side A has been restored to a large extent, and the two sides of the boundary have been increasing year by year, and the proportion of other lands on side B is relatively high, and the two sides of the boundary have a trend of increasing year by year.

4.3. Current Economic Situation of A. Table 5 and Figure 5 show the annual GDP of Province A from 2015 to 2019. The graph shows that the GDP of Province A has increased year by year, from 2,299 billion in 2015 to 40,154 billion yuan in 2019. In terms of the growth rate, the average annual growth rate of GDP has decreased since 2010, indicating an overall negative trend. The GDP growth rate is increasing from a quantitative standpoint. In 2010, the economic growth rate was the fastest, reaching 11.9%, followed by the annual GDP growth rate of A. Prices rise slowly. It can be seen that in the process of rapid economic growth, Area A has encountered some bottlenecks. These bottlenecks hinder the rapid growth and slow down A region's economy. Combined with the actual situation of A, part of the reason may be due to the environmental problems of the earth. Obstacles to economic growth, especially the land problem of A, make sustainable economic growth possible. Therefore, in the process of economic development, it is necessary to combine the actual environment of A to coordinate growth.

Table 7: Fixed assets and their growth rates in the whole society of A.

Area A	2015	2016	2017	2018	2019
Fixed investment assets	9906	11452	17096	20194	23555
Rate of growth	15.9	15.6	21.4	18.1	16.6

Table 6 and Figure 6 show the total investment in fixed assets of society A from 2015 to 2019. The picture shows that the fixed asset investment of society A has increased from 990.6 billion yuan in 2015 to 2,355.5 billion yuan in 2015 and 2019, and the investment amount has almost doubled. Such a huge change is also an important reason for A's economic growth. Although the number of fixed assets has accumulated in a large amount, it is not difficult to see from the quantity that the annual growth rate of fixed asset investment has been declining very slowly since 2017, and the downward trend is very obvious. The growth rate has begun to decline from 22.9% per year. A's investment share will fall into a "recession" every year, as shown in Table 7 and Figure 7.

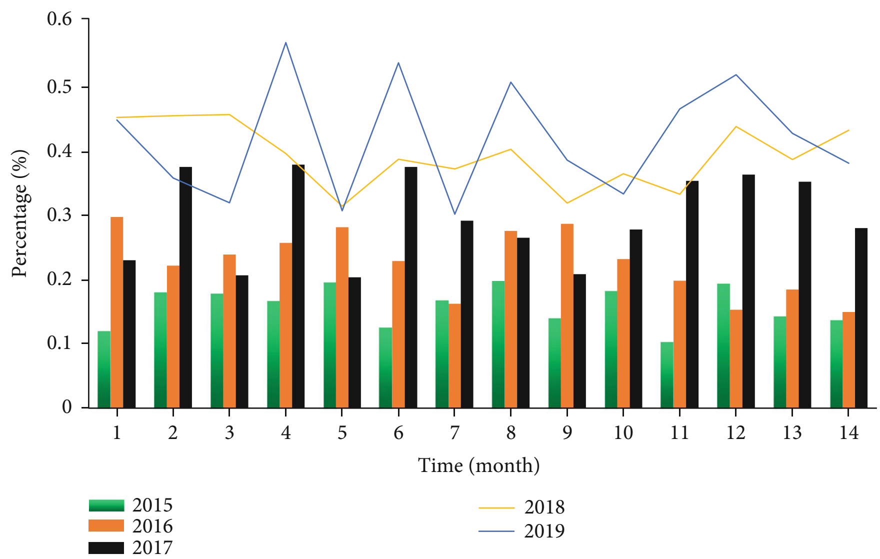

Figure 7: Growth rate of fixed assets and annual production growth rate in A.

5. Conclusions

This paper mainly studies the evolution of regional economic spatial structure based on GIS positioning-related IoT services. In particular, we analyze the economic growth and investigate the evolution process of the regional economic space structure. The data set used in this study is largely derived from a brief period of time on the Chinese market. Additionally, we will collect additional data over a longer period of time around the world in order to build a more universal theoretical framework in the near future.

Data Availability

All data used are given in the paper.

Conflicts of Interest

The author declares that they have no conflicts of interest.

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