Criteria for judging Sustainable Cities

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Abstract

Intelligent growth is a theory of urban planning that originated in the 90s of last century. Its goal is to curb the continuous spread of the city and the loss and reduction of the city - centered surrounding farmland.the population of each city, growth needs, geographical conditions, determine the direction of the city's intelligence. (Weights) of ten measures and three basic conditions are established, the best measures are obtained, the best measures are compared with the current measures, the degree of dispersion (non-success rate) of each measure is calculated, the geometric mean is calculated, Genetic algorithm optimization, calculate the success rate. Evaluation: success rate> 0.6 for success, success rate> 0.9 for the very successful. Then select the city Yangling, Sao Paulo [the United States]through the literature to obtain population, growth demand, the basic conditions of the basic data, the basic condition matrix. The success rate of the actual measures to assess he local government policies to collect the actual measure of the matrix to calculate the success rate of 0.8094, 0.7967, the two cities are successful.

Keywords

Analytic Hierarchy Process; Optimization Model; Smoke to digital; Feedback to adjust; MATLAB.

1. Background

In recent years, the world's urbanization has accelerated, particularly in developing countries, where the United Nations population issue has suggested that 66 % of the world's population is expected to be urban dwellers by 2050, which will bring 2.5 billion people into the urban population[1]. Because cities are the main consumers of natural resources, they are the main producers of pollution and waste[2], and urbanization will lead to a sharp reduce in land resources, especially the farmland around urban areas.

2. Assumptions

In order to make our research proceed smoothly, we make some assumptions as follows:

Assuming that the population policy of the city which we study does not change, and the floating population doesn't occupy a large proportion of the total population;

Assuming that there is no war, terrorist attack, and large-scale infectious disease in the city;

Assuming that the crime rate of the city under study remains unchanged;

Assuming that the city adhere smart growth initiatives, and its economic development strategy, the direction of development will not change;

Assuming that there won't be a large-scale natural disasters that can change the city' terrain.

3. Notations

Table 1: Notations

Symbols	Definition
A	Population matrix
B	Growth Demand Matrix
C	Geographical Condition Matrix
T	Basic condition weight total matrix
M	Best Practices Matrix
m	Practical measures matrix
X	Basic Condition Matrix
a	Error factor

3.1 Yangling

According to the appropriate ratio, we list the proportion of the local policy input matrix **m** and the appropriate basic condition matrix **X**, making the abstract problems specific and reflecting the digital characteristics to simplify the problem analysis. From this we get:

m = [1+1+0:1 :2+0:1 0:2+0:1+1 0:2+0:1 0:2+1+1+0:11+1+0:5+1+0:1 1+0:10.2+0.14.1 1.5] (1)

$$\mathbf{X} = [\, x_1 \;\; x_2 \;\; x_3 \,] \quad (2)$$

We get Yangling's 2015-2016 eight quarters of economic growth rate[3] as shown in Table 3:

Table 4: Yangling's 2015-2016 eight quarters of economic growth rate(Unit:%)

2015.1stquarter	2015.2ndquarte	2015.3rdquarte	2015.4thquarter
1	2	3	4
13	12.6	12.7	12.5
2016.1stquarter	2016.2ndquarter	2016.3rdquarter	2016.athquarter
5	6	7	8
12.3	10.8	11.5	12.2

The growth curve shown as follows:

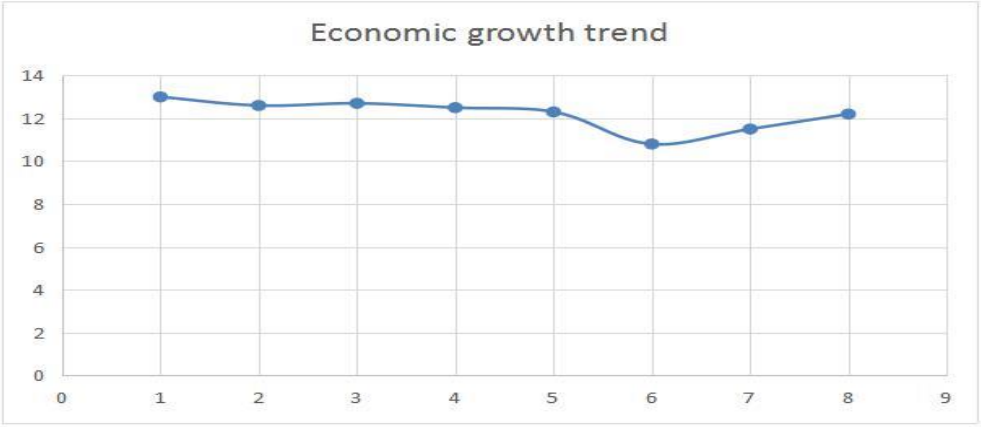

Figure 1: Economic growth trend

According to the available data, we estimated the economic growth rate of four quarters in 2017 by neural BP algorithm[4], it shows as follows:

Table 5: Yangling's 2017 four quarters of economic growth rate(Unit:%)

2017.1stquarter	2017.2ndquarte	2017.3rdquarte	2017.4thquarter
9	10	11	12
12.1728	12.1636	12.1518	12.1394

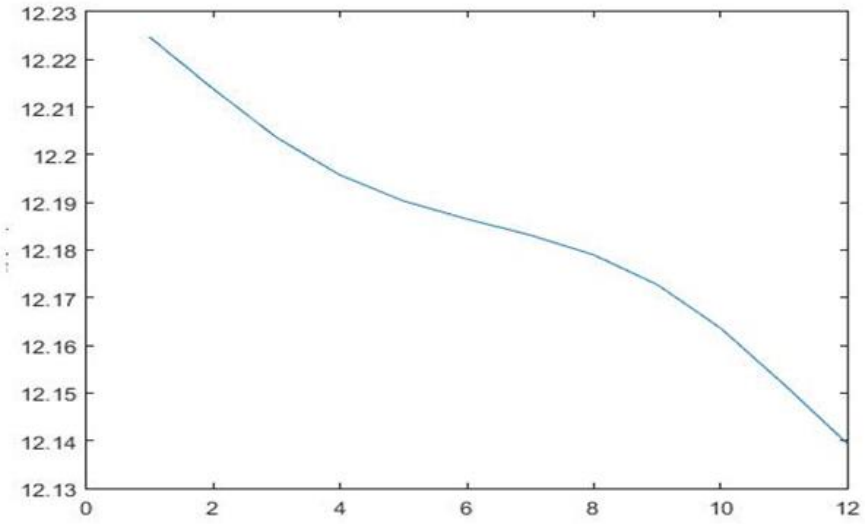

Figure 2: Economic growth trend(2017)

we take the average growth rate of 12.1569, according to the Yangling Demonstration Zone ecological environment status and evaluation[5], the environmental factor was 0.37*(28 + 12.1569), so:

$$\mathbf{X} = [\ 28 \quad 12.15 \quad 0.37 \quad (28 + 12.1569)\ ] \tag{3}$$

Putting it into the first question in the index, using MATLAB to get results:

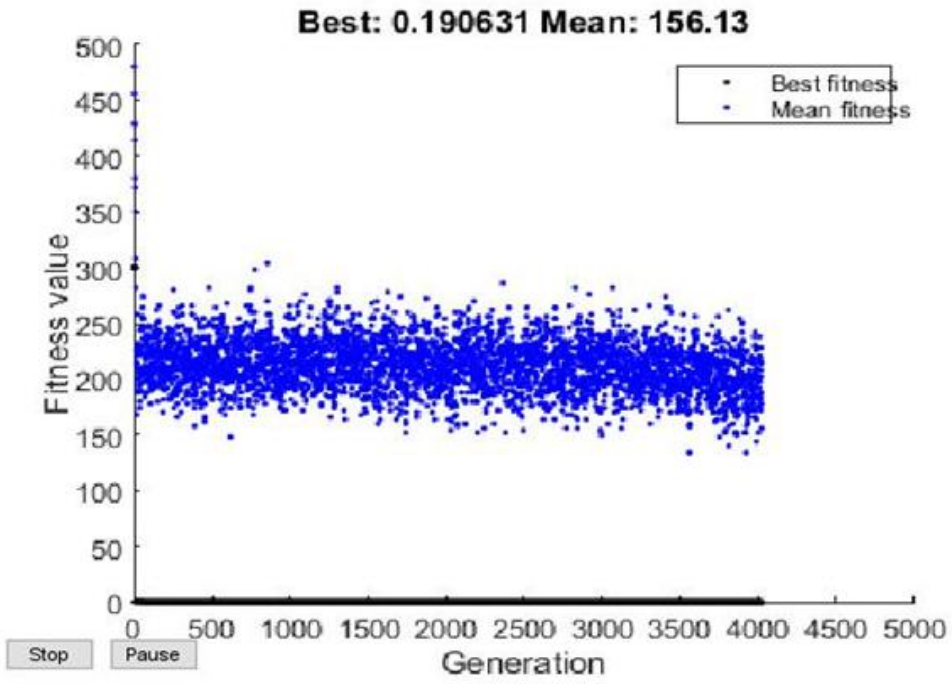

Figure 3: Result

Therefore, the success rate of Yangling's smart growth plan is: 1-0.190631 =0.8094.

3.2 St. Paul

The same as the above analysis, we get:

$$m=[1.1 \quad 1/10 \quad 1/3+1/10+1 \quad 1/10+1 \quad 1/10+1 \quad 1/3+0.1 \quad 1/2+1/3+0.1 \quad 2+1/10 \quad 2.1 \quad 0.6] \quad (4)$$

$$X=[x1 \quad x2 \quad x3\ ] \quad (5)$$

We get St.Paul's GDP growth curve over the past decade, as shown in Figure.4:

Figure 4: St. Paul's GDP growth curve(2001-2015)

According to the available data, we estimated the GDP of four quarters in 2017 by Gray prediction[6], it shows as follows:

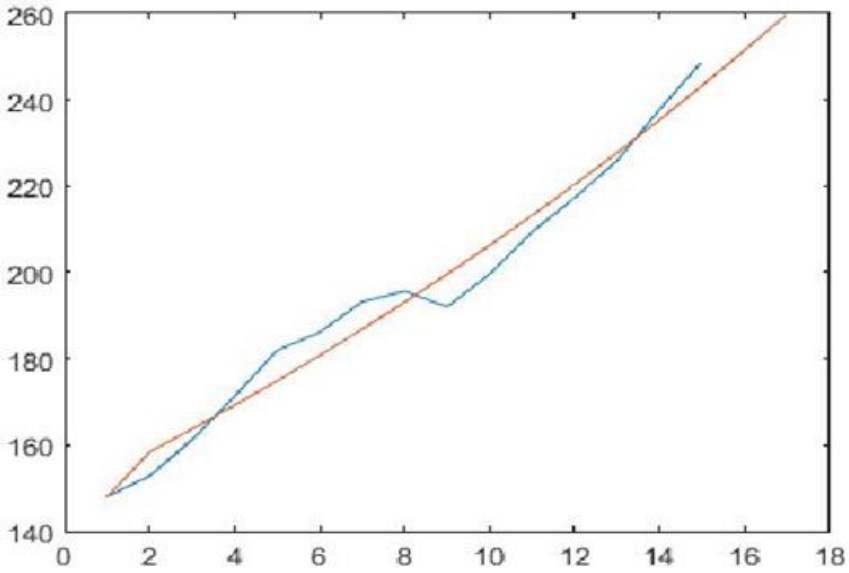

Figure 5: St.Paul's GDP of four quarters(2017)

It can be seen that the predicted result (red) is not much different from the actual situation (cyan), the 2016's is 251.3188 billion and the 2017's is 259.7272 billion. The growth rate is 3.35%. After investigating the eco-environment of St. Paul, we can know:

$$X = [\ 30 \quad 3.35 \quad 0.37 \quad 10.5/24 \quad (30 + 3.35)\ ] \tag{6}$$

According to the first question's index, using MATLAB to get results:

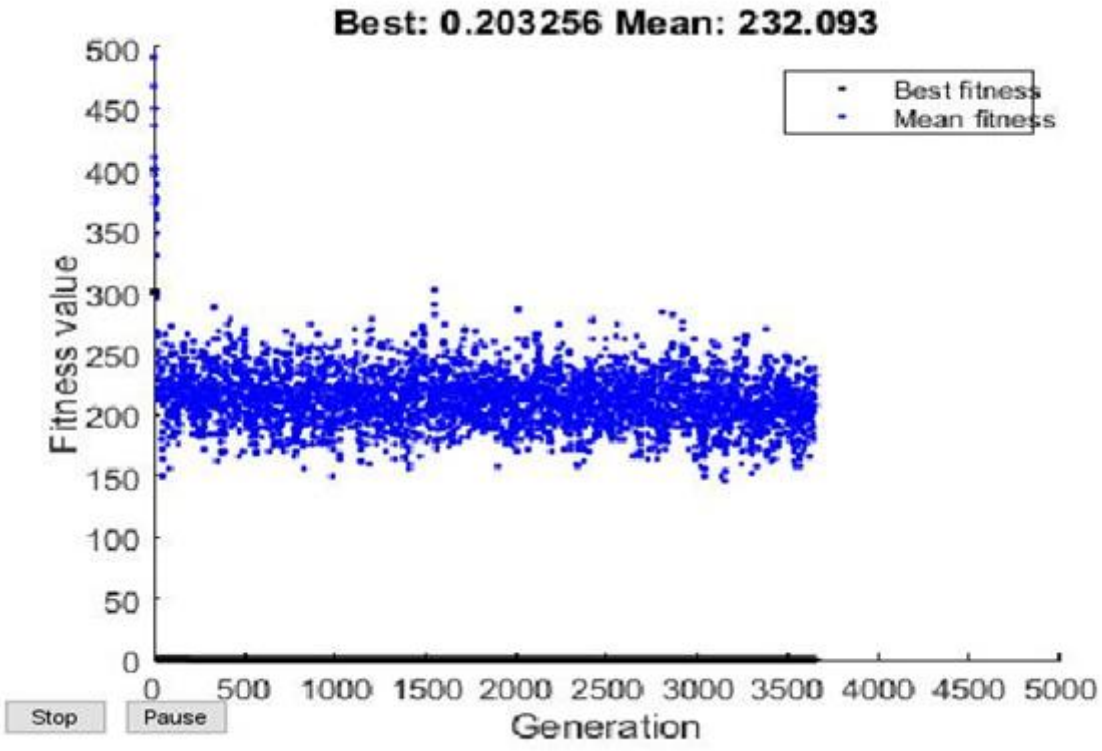

Figure 6: Result

Therefore, the success rate of St.Paul's smart growth plan is: 1-0.203256 = 0.7967

We can draw the conclusion through the analysis and evaluation:the smart growth plan of two cities are both successful.

4. Model Advantages

We use an abstract data-word approach to quantify the fuzzy, intelligent urban development assessment into an analysis of mathematical problems with exact variables.

In the quantification of the actual policy of fuzzy, the score method is used to score the comparison matrix. Model shortcomings

In the process of quantification, inevitably due to incomplete data collection have unavoidable errors, and is likely to have a huge error, can not control.

References

[1]World Urbanization Prospects. United Nations. 2014. https://esa.un.org/unpd/ wup/ Publications/ Files/WUP2014-Highlights.pdf

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[5]yu-xia Xu, zhi-kuan Jia, qing-fang Han, liu Yh, qing-fei Zeng. Yangling demon-stration zone and the present situation of the ecological environment evaluation[J]. Journal of northwest agriculture and forestry university of science and technology (social science edition), 2005, (4) : 99-104.

[6]http://baike.so.com/doc/110467-116546.html