How to Choose Company Location in Multilingual Environment

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ABSTRACT. With the rapid development of the world economy and science and technology, the proportion of the international market has been constantly increasing and increasing companies have formulated their own internationalization strategies. Taking into account the geographical differences, many international companies tend to open offices in different business districts. This places a high demand on office staff, especially in terms of language, because of the need to deal with a diverse client base around the world. To choose office place, we make a prediction on the trend of global language by Growth curve prediction method. Taking the strategy for modulating the weight of each criterion, we construct future world with model to simulate suitable office site. Finally, these statistics could help us simulate the future trend.In order word, our models have high stability,high error-tolerant rate and extensive applicability.

KEYWORDS: Language Distribution, Global economic, Language migration Introduction

1. Background

A language is the long-term, unique creation that uses this linguistic group, which is used to describe one's own history, describe one's own life, sing one's own poems, and record all of one's own experiences. There are currently approximately 7000 languages spoken and not all continents are equally diverse in the number of spoken languages. Whereas Asia leads the statistics with 2,301 languages, Africa follows closely with 2138. There are about 1,300 languages in the Pacific, and 1,064 in South and North America. Europe, despite its many nation-states, is at the bottom of the pack with just 286.Almost half of the world's population claim one of only ten languages as their mother tongue. Of the 7.2billion people on Earth, nearly two-thirds speak one of these 12 languages as their native language. The numbers are fascinating because they reflect the fact that two-thirds of the world's population share only 12 native languages. Moreover, our world is globalized and interconnected, many factors as well, languages may increase or decrease over time.

In order to confront the difficult situation in which the languages change and prior information is scarce, we set out to create mathematical models and do predictions. Our model accounts for next 50 years and impact with immigration and emigration with countries that speak other languages. In our globalized, interconnected world, additional factors taken into consideration, including social, legal, economic, cultural and science and technology aspects, cost and benefit is prioritized. We propose an effective strategy to choose office location for a large multinational service company.

2. Languages distribution forecast

This model is designed to simulate the distribution of various languages speakers over time.

The Growth Curve model simulates the population next 50 years.

y is the number of languages speakers, L is the limit value of y , r is the block rate constant , $r > 0$

$$\frac{dy}{dt} = ry(1 - \frac{y}{L})$$

To test whether the use of Logistic curve method, is to see if the ratio of the amount of incremental growth of the given data reciprocal is connected near some constant b,

$$\frac{1/y_{t+1} - 1/y_t}{1/y_t - 1/y_{t-1}} \approx b$$

The estimation method is explained as follows:

Let's suppose,

$$y'_t = \frac{1}{y_t}$$

Then

$$y'_t = K + ab^t$$

By taking these equations as an estimation parameter

$$S_1 = \sum_{t=1}^{m} y'_t \, , S_2 = \sum_{t=m+1}^{2m} y'_t \, , S_3 = \sum_{t=2m+1}^{3m} y'_t$$

The final results we can get

$$\begin{cases} b = \left(\frac{s_3-s_2}{s_2-s_1}\right)^{\frac{1}{m}} \\ a = (s_2 - s_1)\frac{b-1}{b(b^m-1)^2} \\ K = \frac{1}{m}\left[s_1 - \frac{ab(b^m-1)}{b-1}\right] \end{cases}$$

We used population data from 1960 to 2016 to predict the next 50 years of that. As is shown in Figure 1, about 1.4 billion Chinese speakers in 2016, there will be approximately 1.5 billion Chinese speakers in the world after 50 years. The curve tends to be saturated since 2060.The correlation coefficient of the fitting is 0.99, which confirms our thoughts. This allowed us to design our program to generate probabilistic number and distribution of the languages.
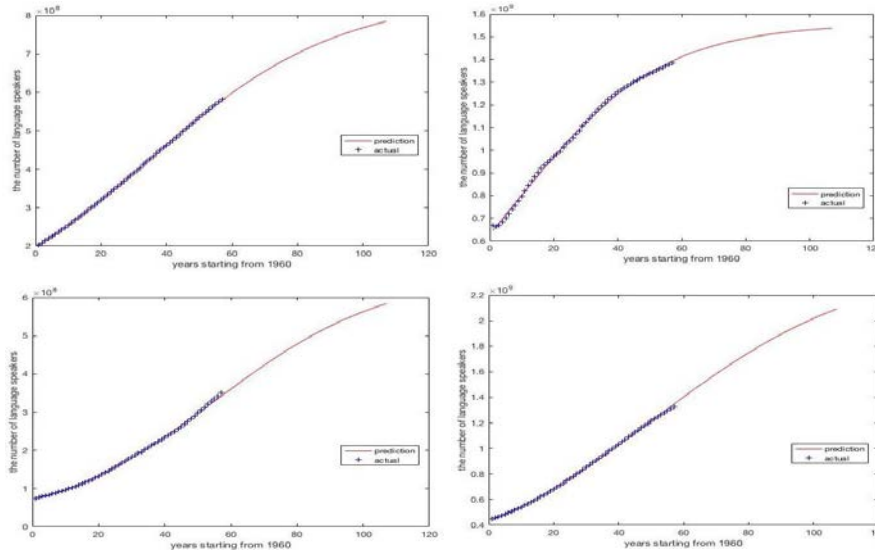

Figure. 1 Prediction of the Number of People who speak Spanish, Chinese, Arabic, Hindi

3. Number of speakers

3.1 Terminology

We use RBF artificial neural network to predicts the relationship between factors and the number of language speakers, like a hidden layer and an output layer. The hidden layer basis function of RBF neural network has many forms, the commonly used function is Gaussian function, input factor is $X = [x_1, x_2, \cdots x_n]$, output is $Y=[y_1, y_2, \cdots y_n]$. The input layer implements a nonlinear mapping from X to $R_i(X)$,

the output layer implements a non-linear mapping from $R_i(X)$ to X.n represents the number of impact factor, w_{ik} is the weight of two related neurons,

$$\hat{y}_k = \sum_{i=1}^{m} w_{ik}\, R_i(X), k = 1, \cdots, p,$$

As the models above, based on the previous number of languages native speakers. We conduct neural network training using matlab tools. Through fitting prediction model, we get the values of four factors next 50 years. Then we put those into trained neural network to get the number of language speakers next 50 years.

3.2 Back Propagation and RBF model (BP&RBF)

This model studies the number of native speakers and total language speakers in the next 50 years.

Neural network structure diagram is shown ab ove, through the trained neural network, we predict the total number of Japanese speakers from 2017 to 2066.
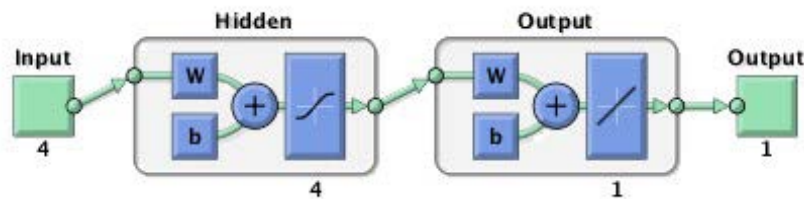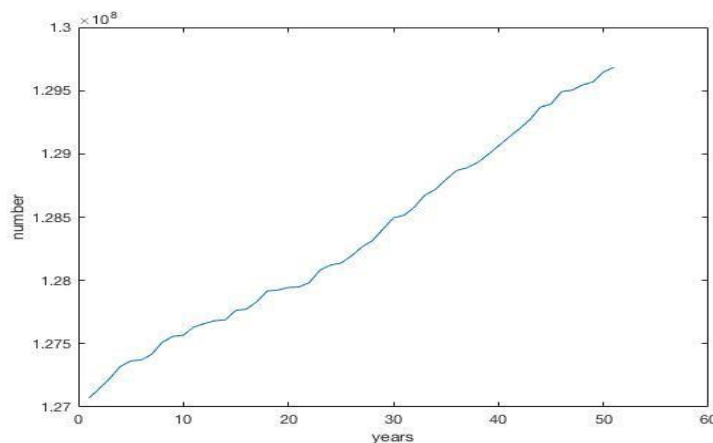

Figure. 2 How the Neural network work

Figure. 3 Prediction about Japanese Speakers

4. How to choose office location and language

4.1 Introduction

There three layers in AHO model. The highest one is our objectives, that is we are to find the optimal location that the COO may consider to set a new office. [5] The middle one are restrictions, as we proposed here, legal government policy, composite environment, language, cost and talent supply. The lowest one is outcome. As is shown in Figure 3, we select 6 cities to be prioritized.

4.2 Analytic Hierarchy Process model (AHP)

According to our combined prediction model, we can choose the suitable location to set a new office under the current and our plan. In this model, we are going to analyze how to choose the best location to set a new office.

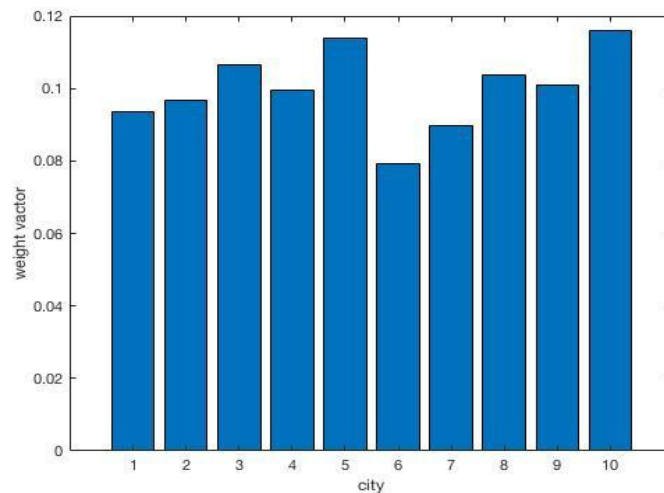We have done lots of research and practice, finally we are to make choice between 10 cities.

Figure. 4 How we choose the office location

From the figure above, we can see that the city 10,5,3,8,9,4 are the top 6, which means they are the best choice, that is London ,Cairo, Stockholm, Moscow, Buenos Aires and Los Angeles respectively.

Figure. 5 Analytic Hierarchy Process

4.3 Affect the language of choice

Economic effect

Language skills are an important part of the workforce. Besides, economic activity needs to be organized by language directly. There is a close interaction between economy and language. As we all known, economic activity is an important part of human social life [6]. And economic activities need to be organized through language. Because of this, many economists and linguists pay more attention to the norm of economic terms and attach importance to the rhetoric of economic texts.

From an economic point of view, common language can save costs, especially trading costs.

Policy effect

Language policy is a series of measures or guidelines for governments, academic institutions, or other groups to solve the linguistic reality of a community or a certain community. Strengthening domestic mother tongue education and actively promoting its strong mother tongue are common features of language policies in many countries.

Learning foreign languages is not only necessary for international information exchanges, but more importantly, it will bring economic benefits to language users, increase the soft power of their countries and enhance their international competitiveness. Many governments attach great importance to their own foreign language education and have included foreign language education in their own strategic development plans.

Social environment and political system affect people's language awareness and language attitude, and thus affect people's linguistic view. The view of language further influences the formulation, implementation, evaluation and research of language policy and language education policy. In international communication, language is the basis of communication. In recent years, the academic community

has basically reached a consensus that language itself is an important component of a country's soft power, and language-mediated discourse has a constructive function that directly affects international politics.

In 1995 ninety percent of the students tend to learn English, German (40%), French (40%) and Spanish (10%), after the EU proposed that "students must study two European languages." Foreign language teaching should not be simple

It is limited to teaching students one, two, and even three languages, but focusing on students' comprehensive language and cultural communication skills. In the United States, a follow-up study of 18 years shows that the bilingual teaching model provided by schools can not only improve students' second language performance but also improve their overall academic performance. [9] □ Culture effect

Learning a foreign language means learning cross-cultural communication and using another way of thinking. Culture, including literature, art, philosophy, history, geography, etc., also cover people's customs and habits, lifestyles, codes of conduct, religious beliefs and community organizations, all of which have a direct impact on language learning. In this way, we should do our best to avoid too much emphasis only on languages.

Technology effect

The development of science and technology has greatly enriched the way of language communication. Advanced technology enables the widespread dissemination of languages that are limited by geography, distance and other factors. Taking an e-book for example, in the information age, language can be transmitted faster and further. Therefore, in an extend, the development between science and technology and languages is mutually reinforcing. [10]

5. Evaluation of the Model

5.1 Strengths

● **Our model is flexible and readily adaptable**

It can be well applied in other places and we just need to change specific conditions. We can also change settings to investigate effects of each parameter.

● **Our data comes from the official website**

Such as the United Nation, the world health organization, which is believable. With these real-world data and other reliable sources, our model can be more effectively represents changes.

● **We take into account a number of main factors**

There are many factors that may affect future of language, such as economic, regional culture, country policy.

5.2 Weaknesses

● **We didn't consider the impact from different qualities of languages**

We set all languages in the same statistical standards. Some real language conditions with little impact are omitted. However, the real condition is much more complex. Though we have added power supply to our model, it still lacks benefits of languages forecasting. [11]

● **The data we obtained is limited**

Though the data we have is credible enough, it still in a small sample size. Considering the limited time, we are unable to search for more comprehensive data. Therefore, our research is restricted in relatively smaller range.

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