

Food prices Analysis Model in the Cloud Environment

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Abstract — Lowering the price of food is beneficial to people's livelihood. To carry out effective control of food prices is an important part of the national macro-control policies. To predict the price of grain is to realize control of basic food prices, directly related to the effectiveness of the control policies, measures and reliability. In view of this situation, we attempt in this paper to combined current advances in cloud computing technology to propose a technique based on forecast methods to effectively improve the accuracy and reliability of grain price analysis and forecast.

Keywords - cloud computing; grain price forecasting; grain price analysis; Hadoop

I. INTRODUCTION

As a large agricultural country, grain price relates not only the income and consumption level of farmers, but the long and healthy development of our agriculture. The effective control to grain price is the basis of country stability, social development, and one of an important part of our national macro-control [1].

Currently, most of the grain price forecasting is still traditionally from experts' experience and sample mathematical models, such as Linear extrapolation model, exponential smooth model and so on[2]. In most cases, these analysis only emphasizes the influence of history grain price changes to the future grain price. However, historical price is not the only reason for the changing for actual price, and the relation is uncertain and nonlinear. So it is not workable to get the answers through these traditional methods, which is also the important bottleneck limiting grain price. Therefore, to know more impact factors influencing grain price, and to build grain price forecasting model on the foundation of these factors are very important to increase the accuracy and reliability of grain price forecasting and analyzing. Cloud computing built on the basis of cloud service is a new computer technology recently. Its developed design idea and compute service model can integrate lots of computer network resources and make full use of them, which increase computing service capability and lower large computing costs[3]. Using cloud computing to process the large data of grain price influence factors together with data mining algorithm to know the relationship of grain price and influence factors, to achieve the grain price forecasting and analysis is more efficient and more accurate.

This article presents a model on basis of cloud computing grain price forecasting and analyzing. In the circumstance of cloud computing, this model uses a prior algorithm to analyze the relationship between grain price and

its influence factors and achieves grain price forecasting and analyzing by the relationship.

II. CLOUD COMPUTING TECHNOLOGY AND HADOOP FRAME

A Cloud Computing Technology

Cloud computing is one kind of distributed computation. The basic theory is to divide the complicated compute into many small computing processes (subprogram) and complete it by many cloud servers through network, then returns the result to users. The whole process involves network searching, computing analysis, program dividing and gathering and so on.

With cloud computing technology, by large cloud network service, cloud computing service supplier can gather all computing device resources of cloud network, process thousands of data and information, reaches the same computing capability and results with big super computers^[4]. At present, the frequent cloud computing includes material resources, resource pool layer, the middle layer management and SOA construction layer. Physics layer are mainly hard resources, like server, memory, and some network devices; resource pool layer is resource pools made of large resources in the same type, includes computing resource pool and data resource pool.^[5] The construction of Resource Pool is mostly from the design and management to Physics Layer, such as to research a cloud service system with 2000 cloud servers, in order to solve questions like the energy consumption and heat radiation, people need to manage the physics layer construction design resources and related application services, in order to use resources effectively to supply device resource support for cloud service. SOA Construction Layer is to encapsulate cloud service 's web service, by encapsulating cloud system

computing service in the way of web service, manage and use it as the same time[6].

With this point, in grain price forecasting and analysis, we can make the best of cloud computing technology to process grain price influence factors, find the changes and rules in the huge factors, then analyze and forecast the price.

B Hadoop Cloud Computing Frame

Hadoop is a very famous cloud computing distributed foundation frame developed by well-known Apache Open Source Foundation. Cloud computing and service built on this frame can greatly reduce design workload and improve the reliability and stability of cloud computing system. When we design cloud computing system on Hadoop, computing processing rate can be greatly increased based on its powerful parallel computing control mechanism. The advantages are as following [7]:

- 1) As a processing frame, Hadoop is very scalable and customizable. Developer can implant his own computing and processing task in Hadoop frame to process in parallel.
- 2) With powerful data processing capacity, Hadoop can process data in PB class.
- 3) Hadoop frame supplies reliable memory safety protecting system, can restore and process the data of failure nodes by maintaining more working data copies.
- 4) It is very cheap to construct cloud computing system by Hadoop, convenient to maintain, and upgraded by powerful Open Source Hadoop community for free.

Meanwhile, Hadoop has frames wrote by Java language, so it is quite ideal to operate on Linux platform [4]. Application program in Hadoop can also be edited by other languages, such as C++. With specialty of grain price forecasting and analysis system, this article use Hadoop cloud computing service frame to build grain price forecasting and analysis system.

III. BUILD GRAIN PRICE ANALYSIS AND FORECASTING MODEL ON BASE OF APRIOR ALGORITHM

A Aprior Algorithm

Aprior algorithm is a classical data mining algorithm, which can find relationship of impact factors and grain price easily. In the designing process of grain price analysis and forecasting, a prior algorithm can explore the relevancy of current grain price、 history price and all impact factors. As a classic and frequently-used data mining algorithm, a priori algorithm is used in large-scale data analysis system at present. The whole a priori algorithm can be divided to two steps: linking and pruning.[8]

1) linking

Linking is a very important step in algorithm, which is mainly aimed to find L-K. In carrying out algorithm, candidate item-set K (tag set is C_K) is produced by L_(k-1)linked with itself.

2)Pruning

C_k is L_k's superset. Superset mainly refers all members in the set can be frequent and less frequent, and must meet one condition - all frequent item sets must be included in C_k. By scanning database in carrying out algorithm, first, all candidate related amount is confirmed first, then L_k.

In the process of grain price analysis and forecasting with aprior algorithm, this article is to find the confidence between grain price and all related impact factors. By this confidence, we can construct grain price analysis model, calculate and forecast grain price.

B Constructing Grain Price Forecasting Model

The grain price forecasting model designed in this article based on a prior algorithm is as Figure 1. All the grain prices are built on data of the grain retail price index, grain production price index, worldwide grain price index, rural and urban residents grain consumption and supplication rate and consumer price index and so on from year 2005 to year 2015[9].

By putting this 10 years grain index parameters to database of our country's Agriculture Ministry and World Agriculture Ministry as a foundation(We need to put data about rural residents and urban residents from our Agriculture Ministry to analyze and compare for our rural and urban residents grain consumption and supplication rate, so individual programming analysis model are needed in analysis procedure),we can construct data mining model database, and use a prior algorithm to process data mining and analyzing, reach the confidence between all factors and grain price, then calculate grain price by computing model to obtain the nowadays grain price.

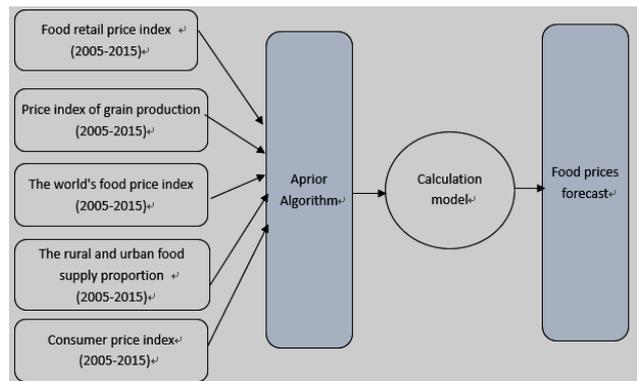


Figure 1. Grain price forecasting model on aprior algorithm.

IV. GRAIN PRICE ANALYSIS AND FORECASTING ON HADOOP CLOUD COMPUTING FRAME

A Hadoop Data Preprocessing

As above, grain price forecasting model are based on aprior algorithm. The huge data is from our country’s Agriculture Ministry and world agriculture organizations, stored in the database on a prior forecasting model. Because these data includes latest 10 years’ history data, with low processing rate of a prior algorithm itself, forecasting rate will be very low if process it at the meantime. So this text brings cloud computing method to achieve a prior algorithm through Hadoop cloud computing frame. In Hadoop computing, firstly, the 10 years data should be stored as html format into Hadoop frame, then extract grain price impact factor data by Hadoop Mapreduce [7].

After extracting grain price impact factors, the data received can be dealt with directly, then associate grain price forecasting model on a prior algorithm with Hadoop cloud computing frame, and write the got data to HDFS database prepared for Hadoop algorithm processing immediately[10].

B Grain Price Analysis and Forecasting Based on Hadoop Cloud Computing Frame

On the basics of Hadoop data pre-processing as above, combined with Hadoop cloud computing frame, this article has designed Hadoop cloud computing processing based grain price analysis and forecasting model as Figure 2. Hadoop cloud computing frame is set on Linux virtual machine, constructs the whole cloud computing frame through Hadoop cloud service parts, then design Hadoop in parallel with a prior to deal with tasks, executed and scheduled by Hadoop parallel scheduling controller, divide a prior algorithm to multiple parallel tasks to different virtual computing nodes to process. Meanwhile, by Hadoop data pre-process model, in grain price forecasting database system, use algorithm to import grain retail price history data, grain production price history data, world grain price history data, rural and urban history data and residents consumption price index history data in Hadoop’s HDFS file system to support Hadoop in processing of prior algorithm. This method greatly improves the execution efficiency of a prior algorithm. After the execution of a prior algorithm, confidence of all impact factors with grain price is concluded, sent to grain price computing model to get the forecasting grain price.

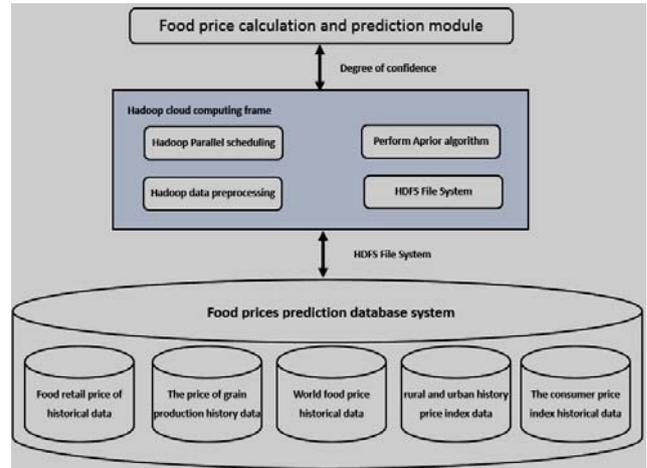


Figure 2. Grain price forecasting model on aprior algorithm.

v EXPERIMENTAL ANALYSIS

This article constructs grain price analysis and forecasting system on basics of grain price analysis and forecasting model with Hadoop cloud computing frame foundation.

This system forecasts and analyzes the history grain prices for January, June, December of 2014 to verify its accuracy and reliability, forecast the grain price of June,2015 in the same time^[3]. The forecasting and analysis results showed in Table 1. From the contrastive analysis between predicting prices and actual prices, we can see this grain price analysis and forecasting model based on Hadoop is highly reliable and accurate. The error is less than 0.1RMB per 500g, which conforms to the Financial statistics and analysis requests.

TABLE I EXPERIMENT FORECASTING RESULTS

Date	Forecasting price(500g/RMB)	Actual price(500g/RMB)
Jan.2014	2.30	2.41
Jun.2014	2.51	2.59
Dec.2014	2.45	2.47
Jan.2015	2.44	2.41
Jun.2015	2.55	--

VI. CONCLUSION

By effectively forecasting and analyzing grain price, it will be more accurate to control grain price and more effective to take methods for the counties, very meaningful to maintain and promote agriculture production and development as well as social stability. This article shows a grain price forecasting and analysis model based on cloud computing, which is carried out by a prior algorithm under cloud computing circumstance, mines the relationship between all impact factors and grain price to receive the

relevance and confidence reaching the forecasting and analysis for grain price. Experiments tell that the grain price forecasting and analysis model constructed on Hadoop cloud computing frame and a prior algorithm can forecast grain price accurately and reliably, and very meaningful to promote the development for our country's agriculture.

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