Use AI Technology to Analyse Corporate Goods Price Index

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Abstract—In this work we took advantage of AI technique (data mining) to analyze the dataset of Corporate Goods Price Index (simple for CGPI). The public-use dataset from Chinese Bank is used in this research. We carry out a thorough research, and compare twenty-four kinds of different models and present the optimal results.

Index Terms—Corporate Goods Price Index, AI, Data Mining, Weka

I. INTRODUCTION

Corporate Goods Price Index (CGPI) is a investigation and statistics system in China, which is approved by Chinese statistical bureau, and implemented by Chinese Bank. The reprheensive products in CGPI includes 791 kinds of products, which stand for overall material products which cover agricultural products, minerals, oil and coal products, and processing products. It also contains primary product, intermediate product, and final products, even consumer goods and investment goods.

Data mining is commonly considered as the process of extracting the useful knowledge and rules from large collections of data [1]. Data mining techniques have been proven to be successful application in many areas, including Marketing, Economy, Medicine, Science and so on [2]. In this work we took advantage of AI technique (data mining) to analyze the dataset of CGPI.

II. RELATED WORK

After the literature survey, we found that there have been only a few studies on the CGPI analysis using statistical approaches [3]. Chen used multivariant statistical approaches to do the linear regression analysis to CGPI. The study of Chen [3] shows that multivariant statistical approaches is an possible method to study the relationship among the statistical parameters of CGPI, and estimate the current price to monitor the macrography economics. However, unfortunately Chen only investigated one approach, and this research should be still preceded deeply. More data mining algorithm could be investigated and be compared in this research.

III. DATASET AND METHOD

In this study, we adopted the dataset of CGPI from 2000 to 2009 in P.R. China. The data source is from the website of Chinese Bank, which includes 5 attributes and 117 records. The summary of the dataset is shown as Appendix A.

We have used Weka to experiment with these algorithms. Weka is a open source data mining software, which contains the tools for data pre-processing, classification, regression, clustering, association rules, and visualization [4].

Five performance measurements are used in this research: correlation coefficient, mean absolute error, root mean squared error, relative absolute error, root relative squared error.

IV. EXPERIMENT RESULTS

The overall results are shown in Appendix B, and we picked up the optimal results shown in Appendix C. After comparing, we could find that M5Rules algorithm has the best performance.

A. The data model of function

Functions.LeastMedSq

\[
\text{OverallInd} = 0.2226 \times \text{Ari} + 0.017 \times \text{Min} + 0.078 \times \text{Oil} \times \text{Pr} + 0.6882 \times \text{Oce} \times \text{Pr} + (-0.5797) 
\]

B. The data model of function

Functions.LinearRegression

\[
\text{OverallInd} = 0.226 \times \text{Ari} + 0.017 \times \text{Min} \times \text{Pr} + 0.0782 \times \text{Oil} \times \text{Pr} + 0.6816 \times \text{Oce} \times \text{Pr} + (-0.3746) 
\]

C. The data model of function

Functions.PaceRegression

\[
\text{OverallInd} = (-0.3746) + 0.226 \times \text{Aro} \times \text{Pr} + 0.0179 \times \text{Min} \times \text{Pr} + 0.0782 \times \text{Oil} \times \text{Pr} + 0.6816 \times \text{Oce} \times \text{Pr}
\]

Functions.SMOreg
\[ \text{OverallInd} = \text{ex} = \]
\[ + 0.3173 \times \text{(normalized Ari Pr o } + \]
\[ 0.0394 \times \text{(normalized Mine Pr o } + \]
\[ 0.1823 \times \text{(normalized Oil Pr o } + \]
\[ 0.6061 \times \text{(normalized Pr oce Pr o } - \]
\[ 0.0476 \]
\[ (4) \]

B. The data model of rules

Rules.M5Rules

Rule: 1

\[ \text{If} \]
\[ \Pr ocePr o > 101.285 \]
\[ \text{Then} \]
\[ \text{OverallIndex} = 0.225 \times \text{Ari Pr o } + \]
\[ 0.0168 \times \text{Mine Pr o } + 0.0789 \times \text{Oil Pr o } + \]
\[ 0.6861 \times \text{ProcePr o } - 0.7029[47 / 0.703\%] \]
\[ \text{Rule: 2} \]
\[ \text{If} \]
\[ \Pr ocePr o > 98.175 \]
\[ \text{Then} \]
\[ \text{OverallIndex} = 0.235 \times \text{Ari Pr o } + \]
\[ 0.0178 \times \text{Mine Pr o } + 0.0757 \times \text{Oil Pr o } + \]
\[ 0.6805 \times \text{ProcePr o } - 0.8761[43 / 0.87\%] \]
\[ \text{Rule: 3} \]
\[ \text{OverallIndex} = 0.2218 \times \text{Ari Pr o } + \]
\[ 0.0205 \times \text{Mine Pr o } + 0.0809 \times \text{Oil Pr o } + \]
\[ 0.6764 \times \text{ProcePr o } + 0.0201[27 / 1.234\%] \]
\[ (5) \]
\[ (6) \]
\[ (7) \]

C. The data model of trees

Trees.MSP

\[ \Pr ocePr o <= 101.285 : \]
\[ \mid \text{ProcePro } <= 98.175: \text{LM1(27/0.591\%)} \]
\[ \mid \text{ProcePro } > 98.175: \text{LM2(43/0.519\%)} \]
\[ \text{LMPro } > 101.285: \text{LM3(47/0.703\%)} \]
\[ \text{LM num: 1} \]
\[ \text{OverallIndex} = 0.2252 \times \text{AriPro } + \]
\[ 0.0198 \times \text{MinePro } + 0.079 \times \text{OilPro } + \]
\[ 0.68 \times \text{ProcePro } - 0.4102 \]
\[ \text{LM num: 2} \]
\[ \text{OverallIndex} = 0.2334 \times \text{AriPro } + \]
\[ 0.0178 \times \text{MinePro } + 0.0761 \times \text{OilPro } + \]
\[ 0.6807 \times \text{ProcePro } - 0.7876 \]
\[ \text{LM num: 3} \]
\[ \text{OverallIndex} = 0.225 \times \text{AriPro } + \]
\[ 0.0168 \times \text{MinePro } + 0.0789 \times \text{OilPro } + \]
\[ 0.6861 \times \text{ProcePro } - 0.7029 \]
\[ \text{Number of Rules: 3} \]
\[ (8) \]

Define abbreviations and acronyms the first time they are used in the text, even after they have been defined in the abstract. Do not use abbreviations in the title unless they are unavoidable.

D. ANALYSIS

We use M5Rules model to analyze the parameters of CGPI.

\[ \text{OverallIndex} = 0.225 \times \text{Ari Pr o } + \]
\[ 0.0168 \times \text{Mine Pr o } + 0.0789 \times \text{Oil Pr o } + \]
\[ 0.6861 \times \text{ProcePr o } - 0.7029 \]
\[ (9) \]

It is clearly shown that the parameter of processing product have most influence on overall index and play determinative role. The parameter of processing product increases one point, then overall index will increase 0.6861 point. Secondly, the parameter of agricultural product play certain influence. The parameter of agricultural product increases one point, then overall index will increase 0.225 point. However, the parameters of oil product and mine product have little influence on overall index, and could be ignored in some certain situation.

V. CONCLUSION

This study clearly shows that AI technique (data mining) is a good method to study parameters relation of CGPI. We could take good advantage of data mining algorithm result to track CGPI and monitor macroeconomy. In future, we could also investigate time series algorithm to predict CGPI.

ACKNOWLEDGMENT

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REFERENCES

### Appendix A Summary Of Dataset

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Type</th>
<th>Minimal</th>
<th>Maximal</th>
<th>Average</th>
<th>Standard deviation</th>
<th>Skewness</th>
<th>Valid records</th>
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<td>OverallIndex</td>
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<td>110.300</td>
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<td>AriPro</td>
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<td>6.885</td>
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<td>106.312</td>
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<tr>
<td>OilPro</td>
<td>Continuous</td>
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<td>126.800</td>
<td>107.598</td>
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<tr>
<td>ProcePro</td>
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### Appendix B All Experient Results

<table>
<thead>
<tr>
<th>functions</th>
<th>Correlation coefficient</th>
<th>Mean absolute error</th>
<th>Root mean squared error</th>
<th>Relative absolute error</th>
<th>Root relative squared error</th>
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<td>0.9890%</td>
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<td>MultilayerPerceptron</td>
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<td>21.5087%</td>
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### Appendix C Optimal Experiment Results

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<th>functions</th>
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