Technical University of Košice

Faculty of Mining, Ecology, Process Control and Geotechnologies

Advanced prediction models for sales forecasting

Master thesis

2023 **Bc. Aleš Jandera**

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Study Programme:	Process control of raw materials and material extraction and processing
Field of Study:	Cybernetics
Department:	Faculty of Mining, Ecology, Process Control and Geotechnologies (FBERG)
Supervisor:	doc. Ing. Tomáš Škovránek, PhD.

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Abstract in English

Sales forecasting can be divided into two main categories: short-term and long-term forecasting. Short-term forecasting is generally done on a weekly or monthly basis. Long-term forecasting is done on a quarterly or annual basis. There are many different methods that can be used for sales forecasting. The most common method is trend analysis. Trend analysis looks at past sales data to identify patterns and trends that can be used to predict future sales. Other methods include regression analysis and time series analysis. Advance prediction modeling is a type of long-term forecasting. It uses historical data and statistical techniques to predict future sales. Advance prediction modeling is often used by companies to make strategic decisions about inventory, pricing, and marketing.

Keywords in English

Mathematic modeling, forecasting, linear prediction

Abstract in Slovak

Prognózy predaja možno rozdeliť do dvoch hlavných kategórií: krátkodobá a dlhodobá prognóza. Krátkodobé prognózy sa vo všeobecnosti vykonávajú týždenne alebo mesačne. Dlhodobé prognózy sa robia štvrťročne alebo ročne. Existuje mnoho rôznych metód, ktoré možno použiť na predpovedanie predaja. Najbežnejšou metódou je analýza trendov. Analýza trendov sa zameriava na údaje o minulých predajoch, aby identifikovala vzory a trendy, ktoré možno použiť na predpovedanie budúceho predaja. Ďalšie metódy zahŕňajú regresnú analýzu a analýzu časových radov. Predbežné predikčné modelovanie je typ dlhodobého predpovedania. Na predpovedanie budúceho predaja využíva historické údaje a štatistické techniky. Pokročilé predikčné modelovanie často používajú spoločnosti na strategické rozhodnutia o zásobách, cenách a marketingu.

Keywords in Slovak

Matematicke modelovanie, predpoved, linearna predikcia

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Ústav riadenia a informatizácie výrobných procesov

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Advanced prediction models for sales forecasting

Študent: **Bc. Aleš Jandera**

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Declaration

I hereby declare that this thesis is my own work and effort. Where other sources of information have been used, they have been acknowledged.

Košice, 30.4.2023 . . . . . .

Signature

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Introduction

Linear prediction is a method used in signal processing to predict future values of a time series based on past observations. The technique is based on the assumption that the signal can be modeled as a linear combination of past values and a noise term. Long-term linear prediction refers to the application of this method to predict values over a longer period of time, such as months or years. It requires a greater amount of data and is more complex than short-term prediction, but can be useful in areas such as stock market forecasting and weather prediction. The goal of this master thesis is to developing new algorithms and mathematical models to improve the accuracy of long-term predictions in sales forecasting. Matlab [1] livescript [1] will be used as development enviroment.

Task formulation

Proposed a mathematical model and alghoritms for sales forcasting based on long-term prediction with improved Levinson - Durbin scheme which should have better performance and acuraccy than known linear prediction mechanism.

[1] MATLAB is a fourth-generation programminglanguage and numerical analysis environment. Uses for MATLAB include matrix calculations, developing and running algorithms, creating user interfaces (UI) and data visualization.

1 Analytical part

1.1 Introduction

1.2 Levinson-Durbin sheme

1.3 Linear prediction

1.3.1 Short-term linear prediction

1.3.2 Long-term linear prediction

2 Syntactic part

Based on the Analytical part 1 let us create new mathematical models and approaches to made a fast and accuracy sales forcasting consist of long-therm linear prediction with individual weights calculated for each period all based on Levinson-Durbin scheme caled Extended linear prediction (ELP) We expect to get better results than by using prediction based on short-term or long-term standard linear prediction (see section 1.3). Finally, our approach will return future values for sales companies based on previous data with better aberration than linear prediction has.

3 Evaluation

3.1 Experiment

4 Summary

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Appendix A Flowcharts

Appendix B Modeling different situations

A Flowcharts

A.1 Short-term linear prediction

A.2 Long-term linear prediction

A.3 Extended long-term linear prediction

B Modeling different situations