

MAKERERE UNIVERSITY

DESIGN OF A MACHINE LEARNING BASED SYSTEM FOR PHARMACEUTICAL PURCHASES

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> > April 27, 2020

A Report submitted in partial fulfillment of the requirements for the **Degree of Bachelor of Science in Telecommunications Engineering** at Makerere University.

Declaration

Add your declaration here.

Dedication

I dedicate this to my parents who have been there for me in this entire study period both emotionally and financially .

Acknowledgments

Add acknowledgments.

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Abstract

Data traffic demand has been increasing exponentially and this trend will continue over the foreseeable future. This has forced operators to upgrade and densify their mobile networks to enhance their capacity. Future networks will be characterized by a dense deployment of different kinds of base stations (BSs) in a hierarchical cellular structure. However network densification requires extensive capital and operational investment which limits operator revenues and raises ecological concerns over greenhouse gas emissions. Although networks are planned to support peak traffic, traffic demand is actually highly variable in both space and time which makes it necessary to adapt network energy consumption to inevitable variations in traffic demand.

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List of Abbreviations

3G	Third Generation mobile network
4G	Fourth Generation mobile network
5G	Fifth Generation mobile network
AC	Alternating Current
ACI	Adjacent Channel Interference
AP	Access Point
etc.	

Symbols and Notations

If you have any, add them here. Otherwise, leave this section out.

α	Pathloss exponent
β	Bias value with ABRP connectivity
\mathcal{B}	System Bandwidth
$\mathcal{L}(\cdot)$	Laplace transform
$\mathbb{E}[\cdot]$	Expectation operator
$\mathbb{P}[\cdot]$	Probability operator
σ^2	Additive noise power
etc	

This is how we reference. For example, Cisco [1] and Numerical Analysis [2].

Introduction

1.1 Background

People act on the basis of forecasting models whether they are on paper or in their heads. You are better off quantifying these estimations so you can discuss them rationally as opposed to making them based on intuition. For pharmaceutical distribution companies, it is essential to get good estimates of drugs, due to the short shelf life of many medicines and the need to control stock levels, to avoid excessive inventory costs while guaranteeing customer demand satisfaction, and thus decreasing the possibility of loss of customers due to stock outages.

Before digital technology dominated the world, the forecasting process was done manually by experienced individuals in the domain. This intuition required a lot of experience and was prone to error. Due to this multifaceted problem, they started realizing the need for automating the pharmacy sales forecasting process. Thus, research and experiments were carried out with statistical, machine learning, deep learning and ensemble techniques to achieve more accurate sales forecasts. [1]

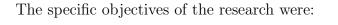
Effectiveness of two forecasting methods, namely ARIMA and Long-Short Term Memory (LSTM) neural networks is investigated.

Daily sales data for a period of two years is analyzed. First, we arranged our data in a proper format to easily perform predictions with the same data file using Microsoft excel. The data file was imported into the google colab jupyter notebook by first cloning it from GitHub, then using pandas passed into a variable for further processing.

Using box-plots, we were able to see that Cotrimoxazole has more outliers than the rest of the drugs which makes it much harder to predict the future sales value.

1.2 Aims and Objectives

The main aim of the research project was to



- To
- To
- To

1.3 List of Publications

The following papers have already been published or submitted.

- P.1 Publication 1
- P.2 Publication 2

1.4 Contributions of the Project

The following major contributions have been accomplished during the course of this research:

- 1. Developed ...
- 2. Performed
- 3. Proposed a

1.5 Organization of the Report

This report has ***** chapters.

Heading of Chapter 2

2.1 Introduction

2.2

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2.3 Summary

Add another Chapter

3.1 Introduction

3.2 Mathematical Preliminaries

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Numerical Results

Table 4.1: Simulation Parameters

Parameters	Values
Network size	$A = 5\mathrm{km} \times 5\mathrm{km}$
Total BS bandwidth	$\mathcal{B} = 20 \mathrm{MHz}$
BS and user densities	$\lambda_b = 1.6 \times 10^{-5} \text{ m}^2, \lambda_u = 2\lambda_b$
Transmit power	$P_t = 21 \mathrm{dBm}$
Pathloss parameters	$L = -33 \mathrm{dB}, \alpha = 4$
Power parameters	$\mathcal{N}_b = 2, P_0 = 6.8 \mathrm{W}, \Delta = 4, P_{sl} = 4.3$
Additive noise parameters	$F = 10, T_a = 300 \mathrm{K}$

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Conclusions and Future Works

5.1 Conclusions

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5.2 Ideas for Future Work

References

- [1] Cisco, "Cisco Visual Networking Index: Forecast and Trends, 2017–2022 White Paper Cisco Systems.Inc, Document ID:1551296909190103, Updated February 27, 2019.
- [2] R. L. Burden and J. D. Faires, Numerical Analysis: Bisection Method, 9th Ed., Brooks/Cole, Cengage Learning, 20 Channel Center Street, Boston, MA 02210, USA, 2011.

Appendix A

Appendix

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