ELECTRICITY DEMAND PREDICTION OF LARGE COMMERCIAL BUILDINGS USING SUPPORT VECTOR MACHINE

Indika Sujeewa Samarawickrama

(108863K)

Degree of Master of Science

Department of Electrical Engineering

University of Moratuwa

Sri Lanka

July 2014

ELECTRICITY DEMAND PREDICTION OF LARGE COMMERCIAL BUILDINGS USING SUPPORT VECTOR MACHINE

N.G. Indika Sujeewa Samarawickrama

(108863K)

Thesis/Dissertation submitted in partial fulfillment of the requirements for the degree
Master of Science

Department of Electrical Engineering

University of Moratuwa
Sri Lanka

July 2014

DECLARATION

I declare that this is my own work and this thesis does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

Also, I hereby grant to University of Moratuwa the non-exclusive right to reproduce and distribute my thesis/dissertation, in whole or in part in print, electronic or other medium. I retain the right to use this content in whole or part in future works (such as articles or books).

Signature: Date:

The above candidate has carried out research for the Masters thesis under my supervision.

Signature of the supervisors:

Dr. K.T.M. Udayanga Hemapala Date:

Dr. Buddhika Jayasekara Date:

ACKNOWLDEGEMENTS

First of all, I would like to express my deepest sense of gratitude to my supervisors, Dr. K.T.M.U. Hemapala and Dr. B. Jayasekara, for their support, guidance and valuable advice throughout these academic years. I would like to thank University of Moratuwa for giving me the opportunity to study in the institute. My appreciation and thanks to the following people who have been very helpful and for their great contribution in the accomplishment of the study:

- All the building owners and managers for their help in the data collection.
- The members of Metrological Department, for sharing their knowledge and experiences and providing all weather data to the research.

Finally, thanks to all lecturer & my friends whom I have been working with throughout the period of study in University of Moratuwa.

ABSTRACT

In an ideal competitive commercial world, having accurate energy forecasting tool becomes a Key Performance Indicator (KPI) for the building owners. Energy forecasting plays a crucial role for any building when it undergoes the retrofitting works in order to maximize the benefits and utilities. This thesis elaborates accurate energy forecasting tools based on Support Vector Machine Regression (SVMR). SVM is one of the most important methods which is widely applied in different literatures, in forecasting and regression of random data sets. It estimates the regression using kernel function, which is composed of a set of linear functions that is defined in a high-dimensional feature space while, inputs having nonlinear performance.

In the case study, four commercial buildings in Colombo, Sri Lanka, are randomly selected and the models were developed and tested using monthly landlord utility bills. Careful analysis of data identified three important parameters, (Dry-bulb temperature (T), Solar Radiation (SR) and Relative humidity (RH)), which have significant contribution to the model, which is under consideration. Stepwise searching method is used to investigate the performance of SVM with respect to the three tunable parameters, C, γ and ε; and thereby to develop the radial-basis function (RBF) kernel.

The results showed that the structure of the training set has significant effect to the accuracy of the prediction. The analysis of the experimental results reveal that all the forecasting models give an acceptable result for all four commercials buildings with low coefficient of variance & a low percentage error (% error).

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES