**电 子 科 技 大 学**

UNIVERSITY OF ELECTRONIC SCIENCE AND TECHNOLOGY OF CHINA

**学士学位论文**

**BACHELOR THESIS**



Title Gaussian Process Prediction of

Stock Price Trends

Major

Student ID

Name

Supervisor

**ABSTRACT**

**Keywords:** Gaussian process, Gaussian process regression, Model fitting, Stock price prediction

**CONTENTS**

Chapter 1 Background 1

1.1. Gaussian Process 1

1.2. Gaussian Process Regression 1

1.3. Project Aims and Contributions 1

1.4. Thesis Outline 1

Chapter 2 Gaussian Process Regression Model 2

2.1. Gaussian process regression model 2

2.2. The GP prior 2

2.3. The marginal likelihood 2

2.4. Hyperparameters learning 3

2.5. Make predictions 3

Chapter 3 System Analysis and Design 4

3.1. Project decomposition 4

3.2. Algorithm design 4

3.3. Experiments/Software design 5

Chapter 4 Implementation 6

IF ONLY EXPERIMENTS: 6

4.1. Dataset preprocess 6

4.2. Training (Model fitting) 6

4.3. Testing (Make predictions) 6

IF THERE IS AN INDEPENT SOFTWARE: 6

4.1. Software implementation 6

4.1.1. Software framework 6

4.1.2. Software module 1 7

4.1.3. Software module 2 7

4.1.4. Software module 3 7

4.2. Model implementation 7

4.2.1. Dataset preprocess 7

4.2.2. Training 7

4.2.3. Testing 7

Chapter 5 Evaluation and Software Test 8

5.1. Evaluation metrics 8

5.2. Test cases 8

5.2.1. 8

5.2.2. 8

5.2.3. 9

Chapter 6 Conclusions 10

Material Translations 11

References 13

Acknowledgement 14

# Chapter 1 Background

## 1.1. Gaussian Process

Introduction of GPs. Provide a mathematically elegant framework for Bayesian inference in machine learning community, can offer principled uncertainty estimates for a wide range of ML problems.

A Gaussian process defines a prior over functions. Given some observed function values, we are able to derive the posterior over functions.

## 1.2. Gaussian Process Regression

Inference of continuous function values in this context is known as GP regression.

## 1.3. Project Aims and Contributions

This thesis aims to …

## 1.4. Thesis Outline

The structure of the thesis …

# Chapter 2 Gaussian Process Regression Model

## 2.1. Gaussian process regression model

Suppose *n* training data , *n*\* testing data , …(Generally, we assume any input is multi-dimensional while the output is just one dimension).

Standard GP regression model assumes , where *f* is a non-linear unknown function parameterizing the probabilistic mapping between inputs and outputs which is corrupted by Gaussian observation noise . Typically, *f* is specified by the elegant GP prior with explicit parameters, , here without loss of generality a zero-mean function is assumed and the covariance function depends on the hyperparameters ***θ***.

…

## 2.2. The GP prior

Joint prior of , the latent function values at training inputs/locations **X**, and , the predicted values at testing locations **X**\*, with covariance matrix with ,

## 2.3. The marginal likelihood

## 2.4. Hyperparameters learning

Using (stochastic) gradient descent method to minimise the Negative Log-Marginal Likelihood (NLML)

Choose .

is also 𝒪(*N*3) in time and 𝒪(*N*2) in space.

## 2.5. Make predictions

The posterior predictive distribution,

Consider the noise ,

# Chapter 3 System Analysis and Design

## 3.1. Project decomposition

According to the project requirements, decompose the task and narrate the technical solution using diagrams, flowcharts etc.

## 3.2. Algorithm design

Description and flowchart of the GPR algorithm.

## 3.3. Experiments/Software design

Your design of the experiments or software. OS, framework, Libs, datasets etc. …

# Chapter 4 Implementation

## IF ONLY EXPERIMENTS:

## 4.1. Dataset preprocess

Dataset, stock price, introduction

Sometimes, the dataset preprocess such as clean, normalize etc.

Dataset separation, training data, test data, or may be even validation data.

## 4.2. Training (Model fitting)

Fitting the model based on the training data.

After training, the model (hyperparamters) are learnt. Graphically show the hyperparamters.

Diagrams, source code should be displayed here.

## 4.3. Testing (Make predictions)

Use the model trained, make predictions for the test data.

Diagrams, source code should be displayed here.

## IF THERE IS AN INDEPENT SOFTWARE:

## 4.1. Software implementation

### 4.1.1. Software framework

Describe the framework, GUI designed and show the related source code.

### 4.1.2. Software module 1

Describe the software model 1, show the printed screens and the related source code etc.

### 4.1.3. Software module 2

…

### 4.1.4. Software module 3

## 4.2. Model implementation

### 4.2.1. Dataset preprocess

### 4.2.2. Training

### 4.2.3. Testing

# Chapter 5 Evaluation and Software Test

## 5.1. Evaluation metrics

Show the evaluation metrics used in the thesis, such as RMSE (Root Mean Square Error).

## 5.2. Test cases

Configurations of the test cases, results, figures, charts …

### 5.2.1.

### 5.2.2.

### 5.2.3.

# Chapter 6 Conclusions

Conclude your project.

# Material Translations

Translate an English paper (with minimum words satisfied) into Chinese. (**I DO NOT KNOW WHETHER IT IS MANDATORY!**).

# References

1. C. E. Rasmussen and C. K. I. Williams. Gaussian Processes for Machine Learning. MIT Press, 2006.
2. C. M. Bishop. Pattern Recognition and Machine Learning. Springer, 2006.

# Acknowledgement

Acknowledgement