2102531 System Identification

Term Project
Semester 1/2016

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Abstract

This project aims to apply an identification technique to real-world problems. There are 2 topics selected from various applications, namely, (i) solar irradiance forecasting using time-series models and (ii) estimation of autoregressive with exogeneous inputs model for fMRI data. Students spend six weeks on this project where each week a progress report must be submitted.

Instruction to students

Each week students are supposed to submit the weekly progress report to CourseVille in Assessment section, where *everyone* must submit the group report in typesetting and .pdf format. Any proposed ideas, comments, or practical considerations should be stated in the report to keep track of your concerns or problem found as the work progresses. The use of LaTeXto type the document is highly encouraged. The progress reports should be named as `solar_week1.pdf` `brain_week1.pdf` where the week number refers to the week of submitting the report. We have created a shared folder `ee531_project_2016` and all the established necessary files must be kept here except your codes in progress. Put the progress reports in the folder `report` each week as well.

Student lists

1. Nattaporn Plub-in (Master)
2. Patavee Prakrankamanant (Undergrad)
3. Supachai Suksamosorn (Master)
4. Vichaya Layanun (Undergrad)
5. Nop Polboon (Undergrad)
6. Maxime Facquet (Undergrad)
7. Ranyaphat Hongpipatsak (Master)
8. Veenakorn Suphatsatienkul (Master)
9. Morokot Cheat (Master)

Final report format

All groups should use the following formats:

- All vector graphics (such as MATLAB figures) must be in .eps or .pdf format.
- All MATLAB codes must be in the appendix with proper comments explaining the codes. You can use `listings` package for source code listing in LaTeX. Mark the language (MATLAB) to highlight the codes. Each MATLAB file should be referred to the section where it is used, or you can explain which function is used to generate each figure.
- Use BibTeX to create reference lists.

1 Solar Irradiance Forecasting using Time-series Models

Student list:

1. Supachai Suksamosorn
2. Vichaya Layanun
3. Maxime Facquet
4. Veenakorn Suphatsatienkul

1.1 Progress deadlines

Wed Oct 12

- Typesetting report of brief literature of solar irradiance forecasting.
- Review of time-series models; ARMAX and ARIMA models.

Wed Oct 19

- Before revising the report, keep `solar_week1.pdf` in the folder.
- Revise the LaTeX codes on typesetting.
- Insert examples of solar irradiance plots. Provide various examples from different seasons.
- Make a clearer understanding about estimating ARMAX and ARIMA models and on existing techniques such as ML.
- More details about how to choose d (the order of differencing). Read more about correlation functions.

Wed Oct 26

- Write the project title on the cover page.
- Do some experiments on testing differencing to estimate ARIMA model. Replace all the figures from other sources, by your own figures from the experiments.
- Study about seasonal effects and how to remove them. Test it with real data sets.
- Revise the report according to my comments.

Wed Nov 2

- Study and make a very clear understanding of the properties of correlation functions. Why does a fast decaying property represent the stationarity?
- Study the method of fitting ARIMA model. Once the period is fixed, how can one fit the seasonal term? Certainly, the method is implemnted in R code but we must learn the principle and method underlying such command.
- Use a more proper method to solve the problem of data missing.
- Design an experiment on fitting ARIMA and ARIMAX models. Compare the models by using the evaluation performance index.
- Revise the report according to the comments.
- Stop reading random things on the Internet and use them as main references. Once you know the keywords from the Internet, just read from textbooks, research papers, or more reliable sources.

Wed Nov 9

- Move the derivation of autocorrelations to the appendices. Make sure you understand the derivation.
- Finish the experiments of removing seasonal effects.
- Revise the report according to my comments.
- Comparisons between models.

Wed Nov 16

- XXX

Mon Nov 21

- Presentation of the term project.

2 Estimation of ARX models for fMRI data

Student list:

1. Nattaporn Plub-in (Master)
2. Patavee Prakrankamanant (Undergrad)
3. Morokot Cheat
4. Ranyaphat Hongpipatsak
5. Nop Polboon

2.1 Progress deadlines

Wed Oct 12

- Typesetting report of brief literature of fMRI studies.
- Review of ARX model.

Wed Oct 19

- Before revising the report, keep `brain_week1.pdf` in the folder.
- More details about fMRI literature. Add some example of BOLD signals.
- Explain how to get BOLD signals as time series from fMRI 3D images.
- Detailed review of ARX model and least-squares solution. Give an unconstrained LS estimate.
- Consider a problem of estimating ARX model with zero constraints. Give a closed-form solution.

Wed Oct 26

- Write the project title on the cover page.
- Do some experiments on estimating ARX model with no constraints.
- Write MATLAB codes on estimating ARX models with zero constraints.
- Put descriptions of fMRI data (neuroimage2013). Explain the experiments.
- Revise the structure of the report according to my comments.

Wed Nov 2

- Explain a clearer concept of Granger causality using a more rigorous explanation. This leads to explaining why the zero constraints in A matrices of ARX model is important. Look for references in the report of Pawarisson (my previous student on the web, under the menu "Group").
- Design experiments to verify the LS estimation of ARX model (both with and without the zero constraints.)
- Arrange the MATLAB codes in a more organized way.
- Put descriptions of fMRI data (neuroimage2013). Explain the experiments and explain why ARX models are needed in order to fitting fMRI time series collected in such experiments.
- Finish the experiment on finding cardiac and respiratory signals from this fMRI data sets.
- Revise the report according to my comments.
- Stop reading random things on the Internet and use them as main references. Once you know the keywords from the Internet, just read from textbooks, research papers, or more reliable sources.

Wed Nov 9

- Provide the work contribution of team member in each week.
- Correct the MATLAB files. The derivation of vectorizing matrices is not correct.
- Explain more about the input descript and how to model it.
- Organize all the codes. Give the outline of the description of each function.
- Revise the report according to my comments.

Wed Nov 16

- XXX

Mon Nov 21

- Presentation of the term project.