**DS809: Final Project**

This class is focused on the fundamentals of time series analysis: exploration and modelling using ARIMA and state-space techniques. These methods form the basis for countless more complicated and/ or specialized methods.

In practice, the methods you use will depend on your data and your research question. Your task for the final project is to research a method for time series data that is not explicitly covered in this class (but that builds on methods that are covered). The following are your options for techniques to focus on:

* X11 decomposition
* Analyzing seasonality using Fourier transforms
* Changepoint analysis (using CUSUM and/ or Bayesian methods)
* ARCH/ GARCH models for modelling the variance of a time series.
* Stochastic volatility models (using the state-space framework)
* Other (if you choose this option, you must have a proposed topic **and** dataset by 1/29/24.

The primary deliverable consists of a paper (with supporting code) and a presentation (20 minutes). Your paper must include the following sections, at a minimum:

1. **Introduction:** Brief description of the method, the data, and why this method is appropriate for your dataset
2. **Method**: Describe the method in detail, with appropriate citations. Include a toy example that displays the use of the method on a very simple (probably simulated) dataset.
3. **Application**:Use the method on the dataset of your choice. Provide detail on your dataset using exploratory techniques (plots, tables). Describe the results in detail, using plots where appropriate.
4. **Conclusion**:What were the strengths and weaknesses of the method for your dataset. What insights about your data were gleaned from this analysis.

**Due Date:** You must submit a proposed topic/ dataset by 2/5/24 (unless you are doing a custom topic, in which case your proposal is due 1/29/24, as mentioned above). The paper will be submitted, and the presentation will be delivered on the last day of class, **March 12**.

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| Criteria | Exceptional (5) | Proficient (4) | Competent (3) | Developing (2) | Needs Work (1) |
| Introduction | Clearly articulates the problem, significance, and objectives. | Provides a comprehensive overview with clear objectives. | Introduces the topic, but objectives may lack precision. | Introduction lacks clarity or fails to highlight objectives. | Absent or very unclear introduction. |
| Method Description | Rigorous explanation of the methodology. | Provides a clear and well-reasoned methodology overview. | Presents an acceptable methodology overview but with some gaps. | Methodology overview lacks clarity or is not well-reasoned. | Absent or very unclear methodology overview. |
| Application | Rigorous development of application for the method. | Appropriate statistical methods applied with clear interpretation. | Adequate application of statistical methods and interpretation. | Limited application of statistical methods with weak interpretation. | Inadequate or no application of statistical methods. |
| Results and conclusion | Insightful discussion of results, implications, and limitations. | Reasonable conclusion with clear implications. | Conclusion is present but may lack depth and detailed implications. | Limited conclusion with vague implications. | Absent or very superficial conclusion. |
| Quality of writing and presentation | Exceptional writing quality, well-organized, clear presentation | Proficient writing, organized, and mostly free of errors, competent presentation | Adequate writing with occasional organizational or language issues. | Writing lacks clarity, organization, or contains frequent errors. | Incoherent writing, disorganized, and numerous language errors. |
| References | Comprehensive, accurate, and properly formatted references. | Accurate references, mostly comprehensive, and properly formatted. | Adequate references with occasional inaccuracies or formatting issues. | Limited references with frequent inaccuracies or formatting issues. | Incomplete or incorrect references. |