

Lecture 0

Course Information

MATH 8090 Time Series Analysis

[About the Instructor](#)

[Class Policies](#)

Whitney Huang
Clemson University

[About the Instructor](#)

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About the Instructor

- **Current Role:** Associate Professor of Statistics. Primarily teach in the Data Science and Analytics program, plus a Time Series course
- **Background:** Born in Laramie, Wyoming, and raised in Taiwan



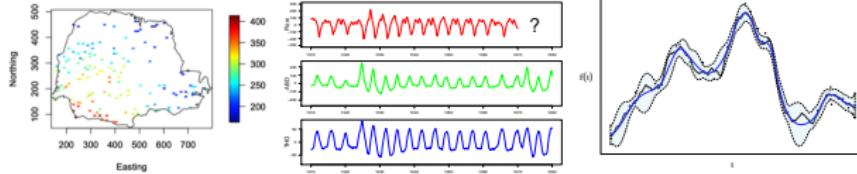
- **Academic Path:** Started with a B.S. in Mechanical Engineering and transitioned to Statistics for graduate studies

- **Doctorate:** Ph.D. in Statistics, 2017, from  PURDUE UNIVERSITY.

Completed a   postdoc before joining 

Overview of My Research

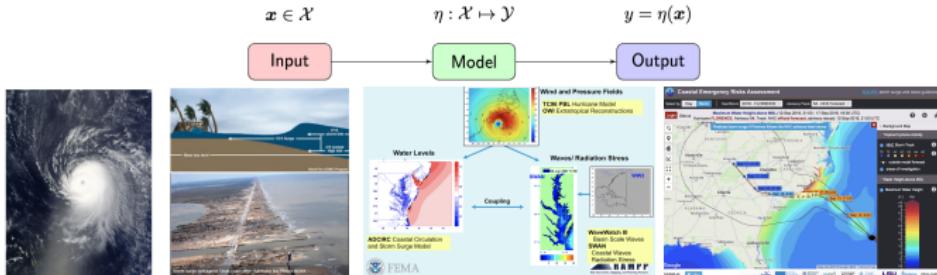
• Spatio-Temporal Statistics



• Extreme Value Analysis



• Surrogate Modeling of Computer Experiments



How to Reach Me?

- **Email:** wkhuang@clemson.edu

Please include [MATH 8090] in your email subject line

- **Office:** O-221 Martin Hall

- **Office Hours:** [Monday 9:00 AM-10:15 AM](#), [Tuesday 9:00 AM-10:15 AM](#), and [Thursday 1:50 PM-2:30 PM](#), and by appointment

About the Instructor

Class Policies

Class Policies

- There will be some homework assignments:
 - To be uploaded to Canvas by 11:59 PM ET on the due dates
 - You are responsible for scribing two lecture notes using the provided L^AT_EX template
 - The lowest homework grade will be dropped
- There will be **two 60-minute exams**. The (tentative) dates are: **Thursday, Sep. 25, and Thursday, Oct. 30.**
- There will be a **final project**. It could be a **data analysis**, a **simulation study**, **methodological or theoretical research**, or a **report on a research article** of interest to you. Topics for the project must be approved by me no later than **Nov. 13 (Thursday)**.

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Evaluation

Grades will be weighted as follows:

Homework	20%
Exam I	25%
Exam II	25%
Final Project	30%

Final course grades will be assigned using the following grading scheme:

>= 90.00	A
88.00 ~ 89.99	A-
85.00 ~ 87.99	B+
80.00 ~ 84.99	B
78.00 ~ 79.99	B-
75.00 ~ 77.99	C+
70.00 ~ 74.99	C
68.00 ~ 69.99	C-
<= 67.99	F

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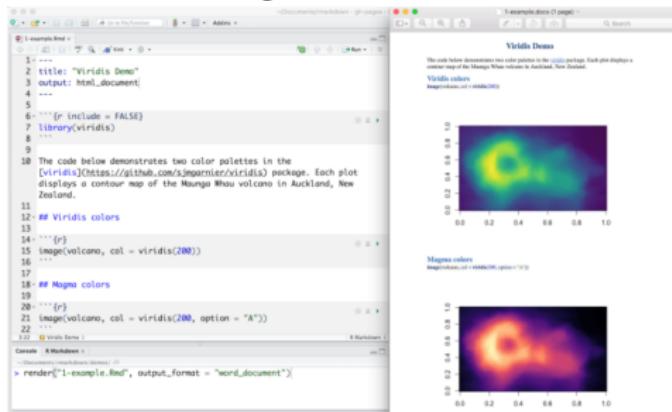
Computing

We will use software to perform statistical analyses.

Specifically, we will be using R/Rstudio



- a **free/open-source** programming language for statistical analysis
- available at <https://www.r-project.org/> ([R](#));
<https://rstudio.com/> ([Rstudio](#))
- I strongly encourage you to use **R Markdown** for homework assignments



The screenshot shows the RStudio interface with two panes. The left pane displays an R script named "1-example.Rnw". The right pane shows two plots: "Viridis Demo" and "Magma colors".

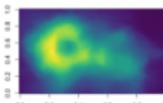
```
1: <!-->
2: title: "Viridis Demo"
3: output: html_document
4: ---
5:
6: <!--{r include = FALSE}
7: library(viridis)
8: -->
9:
10: The code below demonstrates two color palettes in the
11: [viridis](https://github.com/rbgreen/viridis) package. Each plot displays a
12: contour map of the Maunga Whau volcano in Auckland, New Zealand.
13: ## Viridis colors
14: <!--{r}
15: image(volcano, col = viridis(200))
16: -->
17:
18: ## Magma colors
19:
20: <!--{r}
21: image(volcano, col = viridis(200, option = "A"))
22: -->
```

Viridis Demo

The code above demonstrates two color palettes in the [viridis](#) package. Each plot displays a contour map of the Maunga Whau volcano in Auckland, New Zealand.

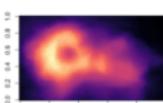
Viridis colors

image(volcano, col = viridis(200))



Magma colors

image(volcano, col = viridis(200, option = "A"))



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- Course syllabus / Announcements
- Lecture slides/notes/videos
- R Codes
- Data Sets

Course Website

About the Instructor

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Link: <https://whitneyhuang83.github.io/MATH8090/Schedule.html>

MATH 8090 Time Series Analysis, Forecasting and Control

Contact Information

Instructor: Whitney Huang

Email: whitney.huang@clemson.edu

Office Hours: Monday 9:00 AM-10:15 AM, Tuesday 9:00 AM-10:15 AM, and Thursday 1:50 PM-2:30 PM, and by appointment

Syllabus:[Link](#)

Announcements

- Welcome to MATH 8090!

Schedule

Week	Date	Topic	Slides	Notes with R Code	Homework Assignments/Labs	Exam/Project
1	Aug. 21	Course Overview and Review of Statistical Concepts	Course information; Slides 1	R Session 1		
2	Aug. 26 and Aug. 28	Modeling Trend and Seasonality with Regression Techniques	Slides 2	R Session 2	HW 1 Due: Aug. 31	
3	Sep. 2 and Sep. 4	Stationary Processes: Properties, Mean, and Covariance Functions	Slides 3	R Session 3		
4	Sep. 9 and Sep. 11	Estimating Mean and Covariance of Stationary Processes	Slides 4	R Session 4	HW 2 Due: Sep. 14	
5	Sep. 16 and Sep. 18	ARMA Models: Properties, Model Selection, and Diagnostics	Slides 5	R Session 5	HW 3 Due: Sep. 21	
6	Sep. 23 and Sep. 25	ARMA Models: Prediction, Estimation, and Inference	Slides 6	R Session 6	HW 4 Due: Sep. 28	Exam I: Sep. 25
7	Sep. 30 and Oct. 2	ARIMA Case Study and ARIMA Models	Slides 7	R Session 7		
8	Oct. 7 and Oct. 9	Seasonal Models: SARIMA	Slides 8	R Session 8		
9	Oct. 16	Regression with Time Series Errors and Related Topics	Slides 9	R Session 9	HW 5 Due: Oct. 19	
10	Oct. 21 and Oct. 23	GARCH Models and Their Applications in Financial Time Series	Slides 10	R Session 10		
11	Oct. 28 and Oct. 30	Frequency-Domain Analysis of Time Series	Slides 11	R Session 11		Exam II: Oct. 30
12	Nov. 4 and Nov. 6	Estimation in the Frequency Domain	Slides 12	R Session 12	HW 6 Due: Nov. 9	
13	Nov. 11 and Nov. 13	Introduction to State-Space Models	Slides 13	R Session 13		Final Project Proposal Due: Nov. 13
14	Nov. 18 and Nov. 20	State-Space Models and Multivariate Time Series Models	Slides 14	R Session 14	HW 7 Due: Nov. 21	
15	Nov. 25	Multivariate Time Series Models and Spatial-Temporal Models	Slides 15	R Session 15		
16	Dec. 2 and Dec. 4	Review and Further topics	Slides 16			Final Project Presentation Dec. 5 5:30pm - 7:30pm
17	Dec. 8-12	Final Project				Final Project Due

- *Introduction to Time Series and Forecasting*, 3_{rd} Edition, **Peter Brockwell and Richard Davis, 2016** [[Link](#)]
- *Time Series Analysis and Its Applications With R Examples*, 4_{th} Edition, **Robert Shumway and David Stoffer, 2017** [[Link](#)]
- *Time Series Analysis with Applications in R*, 2_{nd} Edition, **Jonathan Cryer and Kung-Sik Chan, 2008** [[Link](#)]
- *Time Series Analysis: Forecasting and Control*, 5_{th} Edition, **George Box, Gwilym Jenkins, Gregory Reinsel, Greta Ljung, 2015** [[Link](#)]
- *Analysis of Financial Time Series*, 3_{rd} Edition, **Ruey Tsay, 2010** [[Link](#)]

Tentative Schedule

Dates	Topic
8/21	Course Overview and Review of Statistical Concepts
8/26 & 8/28	Modeling Trend and Seasonality with Regression Techniques
9/2 & 9/4	Stationary Processes: Properties, Mean, and Covariance Functions
9/11 & 9/11	Estimating Mean and Covariance of Stationary Processes
9/16 & 9/18	ARMA Models: Properties, Model Selection, and Diagnostics
9/23 & 9/25	ARMA Models: Prediction, Estimation, and Inference
9/30 & 10/2	ARMA Case Study and ARIMA Models
10/7 & 10/9	Seasonal Models: SARIMA
10/16	Regression with Time Series Errors and Related Topics
10/21 & 10/23	GARCH Models and Their Applications in Financial Time Series
10/28 & 10/30	Frequency-Domain Analysis of Time Series
11/4 & 11/6	Estimation in the Frequency Domain
11/11 & 11/13	Introduction to State-Space Models
11/18 & 11/20	State-Space Models and Multivariate Time Series Models
11/25	Multivariate Time Series Models and Spatial-Temporal Models
12/2 & 12/4	Review and Further topics