STA 829. Topics in Applied Statistics I
Functional Data Analysis

Syllabus

Jun Song

Department of Statistics
Korea University

Course Information

Instructor

Name	Jun Song
Email	junsong@korea.ac.kr
Office	330 Political Science & Economics Bldg. (정경관)
Office Hours	Mon. 3:30 – 4:30 pm or by appointment

Course Information

Meeting	MW 10:30 - 11:45 am, 301 SK Future Hall
Textbook (optional)	- *Introduction to Functional Data Analysis*, by Reimherr and Kokoszka - *Functional Data Analysis with R and Matlab*, by Ramsay, Hooker, and Graves

Course Objectives

You will be able to

- Understand the fundamentals of functional data analysis
- Understand statistical objects in an infinite-dimensional space
- Utilize the functional data with R.
- Topics: mean functions and covariance operators, Hilbert space objects, functional regression models, sparse functional data, spatial data analysis using functional data framework, functional dimension reduction, etc.
- The topics we deal with are the basics of functional data analysis, but the core of it. After you take this course, you will have a much easier access and understanding of recent research papers using functional data.

Prerequisites

- R: This class does not teach programming.
- Undergraduate-level regression analysis courses
- STAT 513 Inferential Statistics
- **All of the above are required to take this course.**

Evaluation

Evaluation

Item	Percentage
Attendance & Participation	10
Homework	10
Exams	60
Project	20

- If you **miss one of midterm/final exam/project**, you will receive **F** irrelevantly to your total score.
- Details will be explained in the next section.

Required Work

Attendance

- Students are expected to be present on time for all class sessions. Students are responsible for all announcements and supplements provided in class.
- Attendance will be checked randomly in class.
- You are allowed three unexcused absences. Each additional absence will lower your overall score by 5%.
- Distraction of class is not allowed. In this case, you will be asked to leave immediately, which will count as an unexcused absence.

Participation

- Points start from 10%.
- **Quizzes**
  - Sometimes quizzes will be given occasionally in class **without announcement** beforehand.
  - No pressure: open-book. Basic question or survey question. No grading (just on/off).
  - If you do not submit it on time, it will be counted as an **absence**, and participation points will be deducted.
- In-class questions are welcome and highly encouraged.

Homework

- There will be 3-4 homework assignments during the semester. You will have a notice at least a weak before the due date.
- Homework will be submitted online, and check the due date & **time** carefully for each assignment. Usually, the submission deadline is right before the class starts on the due date.
- Email deliveries are NOT acceptable unless you are told to do.
- **Late Penalty**
  - less than one hour: 10%
  - more than one hour & less than 24 hours: 20%
  - more than 24 hours: 100%
- No credit will be given for a correct answer without work to support it.
- For each assignment, **a few questions** will be randomly selected and graded.

Exams

- Standard **in-class exams**.
- closed-book tests.
- You are allowed to bring your own **handwritten** formula sheet (one sheet of A4 size, one-sided).
- **Midterm: 10:30 - 11:45 am, Monday, October 23, Location: TBA**
- **Final: 10:30 - 11:45 am, Monday, December 18, Location: TBA**
- On the exam date, students should expect to arrive 5 to 10 minutes earlier than the scheduled meeting time to start the exam on time.

Project (Individual Project)

- The project aims to provide a comprehensive understanding of FDA through practical application to real data.
- You are free to choose any topic related to the course. This could involve data analysis (application), studying a new method not covered in class, or developing a new research project.
- You are required to select a real dataset for which you believe there are interesting questions to be answered. You will then apply the various statistical learning approaches covered in class to find the most effective way to answer these questions.
- Detailed guidelines concerning the proposal, presentation, and report will be announced after the midterm exam.

Course Policies

Course Policies

- The standards and requirements set forth in this syllabus may be modified at any time by the course instructor. Notice of such changes will be posted on Blackboard.
- Although you are expected to complete the work on your own, I understand that a certain amount of collaboration may occur. However, you must turn in **your own work** which presumably reflects your understanding of the material.
- Any violation of basic standards in the university policy is not allowed.

Course Policies: Copyright

- Materials used in connection with this course may be subject to copyright protection. Materials may include but are not limited to: documents, slides, homework problems and solutions, images, audio, and video.
- When it comes to teaching university classes, copyright laws are a little more liberal. If you make this course material available online, you may run into copyright issues.
- Thus, unauthorized retention, duplication, distribution, or modification of course materials is strictly prohibited.
- See the document posted on Blackboard.

Schedule

Tentative list of topics and schedule

The preliminary schedule of lectures below serves as a guide. Depending on the class needs and progress through the semester, the **contents may vary**.

Week	Contents
1	Introduction
2	Estimating mean functions and covariance operators
3	Functional principal components
4	Basis expansions and nonparametric smoothing
5	Hilbert space framework for functional data
6	Functional regression models
7	Functional regression models
8	Midterm
9	Functional dimension reduction
10	Dependent functional data
11	Sparse functional data
12	Sparse functional data
13	Functional time series
14	Spatial functional data analysis
15	Project presentation
16	Final

Questions are welcome and highly encouraged.