AE 6721 - Syllabus

Evaluation of Human Integrated Systems. 3 Credit Hours.

General Information

Description

Evaluation of human integrated systems including translating research questions into measurable objectives, overview of evaluation methods and data analysis techniques applicable to such systems. Credit not allowed for both AE 6721 and ISYE 6231.

Pre- &/or Co-Requisites

No Pre-Requisite (Introduction to Statistics is helpful, but not required. E.g. ISYE6739)

Course Goals and Learning Outcomes

Provide students with the knowledge and skills to:

- Choose the appropriate evaluation method given your research question.
- Interpret commonly cited statistical measures in research papers.
- Identify and conduct commonly used data analysis techniques in human subject investigations beyond those found in introductory statistics courses, such as
  - Friedman's ANOVA of Ranks
  - Logistic Regression
  - Wilcoxon signed-ranks test
  - Kruskal Wallis test
- Plan and conduct an ethical and effective human-subject experiment.

Please note that although qualitative methods are extremely important for human subjects evaluation they are beyond the scope of this course.

Course Requirements & Grading

Note: Graded components of a course may vary with each offering. The example below is typical but subject to change.

Description of Graded Components

This course is a graduate level course on the measurement and evaluation of human integrated systems. It is **a project-based course**. It is also a **"flipped" course** where students are responsible for readings every week so that classroom time can be used to provide students opportunities to master and practice the skills covered in the form of short, in-class assignments. And finally, it is a course graded using **specification grading**.

Assignments

In support of each of the course goals the following assignments are set. Each assignment will be assessed Satisfactory/No Credit, with descriptions of each given in an assignment specific rubric.

Weekly readings quizzes & data analysis assignments: Every week there will be a short online quiz to assess your comprehension of your readings for the current week, and in the last half of the class these will also include elements from the prior week's data analysis assignments. These will

be available on Monday and due on Wednesday before class. At the end of these quizzes, we will ask for questions that you have from the prior week.

Project: Students will conduct projects in groups of 2 individuals (or possibly 3 if an odd number of students register). The results of the experiment are to be represented as either a Technical Report (25+ pages) or a conference quality publication (following the format of either AIAA, IEEE, ASME or HFES) (5-15pages). *Note: you may not publish the results of any study unless you obtain IRB approval of your protocol prior to subject recruitment and data collection, which may not be possible in class due to time constraints. Consider this a great opportunity to run a pilot study.*

The Quantitative Evaluation of some Human-Integrated System including at least 3 forms of data analysis

- Determine the system you wish to evaluate
- Determine the research questions and objectives
- Determine the most appropriate evaluation method
- Design the evaluation instrument (must result in some quantitative data)
- Design the data analysis
- Conduct the evaluation
- Conduct the data analysis
- Report your results

Students are encouraged to select a project relevant to their own research. Students should take charge of their own project; they are urged to schedule meetings with the instructor throughout the term to solidify and confirm the project's focus and to clarify any feedback received. Project milestones are included in the course timeline.

Grading Scale

Element	For an A	For a B	For a C
Weekly Quizzes	Pass 8/10	Pass 6/10	Pass 4/10
Class Participation	Participate in 18/25 classes	Participate in 16/25 classes	Participate in 12/25 classes
*RQ & DCP	Earn A	Earn A or B	Earn A or B or C
*Exp. Packet	Earn A	Earn A or B	Earn A or B or C
*Data Analysis Plan	Earn A	Earn A or B	Earn A or B or C
Final Paper	Earn A	Earn A or B	Earn A or B or C
Final Presentation	Earn A	Earn A or B	Earn A or B or C

Topics Covered

Note: The exact topics covered in a course may vary with each offering. The example below is typical but subject to change.

- Class & Research Process Overview
- IRB & Ethics Training
- Variable Types, Reliability & Validity
- Common Evaluation Parameters
- Physiological Measures & Choice of Evaluation Techniques

- Surveys, Focus Groups, & Interviews
- Ethnographic Methods
- Cog Walkhrough and Usability studies
- Research questions revisited -- choosing the right design/method
- Formal HITL Experiment
- "Statistics in a Nutshell -basics of multivariate (parametric) statistics"
- Statistics in a Nutshell & Data Analysis
- Intro to R & Reproducible Results
- Graphics in R
- Data Analysis & Transforming Data
- Assumption Checking
- Statistical Modeling - basic parametric tests, correlation
- Regression
- Analysis of Variance
- GLM / Repeated Measures Designs
- Mixed Effects Models & Multi-Level Modeling
- Count Data
- Non-parametric Tests

Course Materials

Textbook

- Spicer, John. ***Making Sense of Multivariate Data Analysis***. Sage Publications. 2005 ($25-$40 used, Online through library)
- Ritter, Frank E., Kim, Jong W., Morgan, Jonathan, H., and Carlson, Richard A. ***Running Behavioral Studies with Human Participants: A practical guide***. Sage Publications. 2013 ($34 Kindle / Online through library) https://gatech-primo.hosted.exlibrisgroup.com/permalink/f/1vgrnp4/01GALI_GIT_ALMA51278467300002947
- Crawley, Michael J. ***The R Book***, *2nd Ed*. John Wiley & Sons, Ltd. 2003 (Available in PDF on the web & Canvas, or Online through the Library) ($38 paperback)
- Touchon, Justin C. **Applied Statistics with R**: A practical guide for the life sciences. Oxford Press. 2021 (Available online through the library).

Course notes

All materials for the course are available on Canvas.