Analytical Methods in Human Factors Research

INTR5330/ROAS 5900

Lecturer

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Course overview

The course will cover a wide range of analytical methods in human factors research and discuss a number of widely used models regarding human's behaviors, cognitive process and decision making. The students will gain an understanding of the procedures, objectives and limitations of different research methods. The course will include case studies so that students can gain first-hand experience in applying the methods in projects. Through this course, the students will have a brief understanding of the analytical methods used in human factors discipline, basic practices of these techniques, brief understanding of human's cognitive and visual characteristics, and research trends at the current stage. The course will cover the following topics: Brief descriptions of analytical methods in human factors research; Some basic statistical tools for data analysis; Methods for estimating thresholds of discrimination; Scaling; Knowledge elicitation; Visual behavior analysis; Questionnaire design; Information theory; Signal detection theory; Mental workload and situation awareness and Manual control.

The lectures will cover contents from three optional textbook:

1. Wickens, C.D., Helton, W.S., Hollands, J.G., & Banbury, S. (2021). Engineering Psychology and Human Performance (5th ed.). Routledge.) and the state-of-art research in human factors areas.
2. Fox, J. (2015). Applied Regression Analysis and Generalized Linear Models. Sage Publications.
3. Stanton, N. A., Salmon, P. M., Rafferty, L. A., Walker, G. H., Baber, C., & Jenkins, D. P. (2017). Human Factors Methods: A Practical Guide for Engineering and Design. CRC Press.

Grading

- In-class projects: 2% each x 13
- Homework: 5% each x 4
- Case study: 17% each x 2
- Final Project: 20%

Course Schedule

Title	Hours	Content	Assignments
Module 1 - Course Introduction			
Introduction	3	Introduction of human factors, psychology, commonly used methodologies and how to make a choice	-
Module 2 – Statistics Tools for Data Analysis			
Mixed Linear Model	3	Review Mixed Linear Model and its application in experimental data analysis	Homework 1
Generalized Linear Model	3	Review Generalized Linear Model and its application in experimental data analysis	Homework 2 Homework 1 due
Non-Parametric Models	3	Review some non-parametric models, and their application in experimental data analysis	Homework 3 Homework 2 due
Cluster Analysis	3	Review the basic of cluster of analysis, and their application in experimental data analysis	Homework 4 Homework 3 due
Module 3 – Analytical Tools in Human Factors Research			
Thresholds Discrimination	3	Methods for Estimating thresholds of discrimination	Homework 4 due
Scaling	3	Concepts of different scaling methods	
Knowledge Elicitation	3	Methods used for knowledge elicitation	
Questionnaire Design	3	Techniques for questionnaire design	Case study 1
Module 4 – Basic Human Factors and Psychological Theories			
Information Theory	3	Information theory and absolute judgement, calculation of information transmission with loss and noise	
Signal Detection Theory	3	Signal detection theory (SDT), its application and implication, and the calculation of d' and ß in SDT	Case study 2 Case study 1 due
Mental Workload & Situation Awareness	3	Concepts of mental workload (MW) and situation awareness (SA) and analytical methods to quantify MW and SA	
Manual Control Behaviors and Visual Behaviors	3	Models of human's manual control behaviors and visual behaviors	Final Project Case study 2 due