International Summer School- Manipal University Jaipur [ISSMUJ]-2024

[Hybrid Mode]

Course Overview

Name of Course- Foundational methods in frequentist statistics

Name of Instructor: Mr. Vivek Singh Sikarwar

Session: June-July 2024

Language of instruction: English

Number of contact hours: 36

Credit awarded: 03

Pre-requisite: *(Participants are expected to have prior experience using linear mixed models, possess proficiency in R programming, and be capable of fitting multiple regressions.)*

Objective of Course/Project:

The primary objective of this course is to offer thorough training in both the theory and practical application of statistics, with a particular emphasis on the linear mixed model.

Syllabus:

Introduction: Some important facts about distributions, Discrete random variables, Binomial distribution, mean and variance of the Binomial distribution, Continuous random variables, Normal distribution, standard normal distribution, uniform distribution, chi-square distribution, t-distribution, F-distribution, Bivariate and multivariate distributions. likelihood and maximum likelihood estimation. Useful R functions relating to univariate distributions.

Hypothetical repeated sampling and the t-test: The one-sample t-test, Type I, II error, and power, The p-value, Searching for significance, the two-sample t-test vs. the paired t-test.

Linear models and linear mixed models: From the t-test to the linear (mixed) model, Sum coding, Checking model assumptions, From the paired t-test to the linear mixed model.

Linear mixed models:

Model type 1: Varying intercepts, The formal statement of the varying intercepts model,

Model type 2: Varying intercepts and varying slopes, without a correlation

Model type 3: Varying intercepts and varying slopes, with correlation

Shrinkage in linear mixed models

Contrast coding: Default contrast coding: Treatment contrasts, Sum contrasts,Cell means parameterization and posterior comparisons, The hypothesis matrix, Repeated contrast, Polynomial contrast, centered contrast, orthogonal contrast, contrast coding with two predictor variables.

Organization of Course

Total contact Hours: 36		
1st week:	4 hrs (classes)	5 hrs (self-study/project)
2nd week:	6 hrs (classes)	3 hrs (Mid-term exam/assessment/discussion)
3rd week:	4 hrs (classes)	5 hrs (self-study/project)
4th week:	6 hrs (Classes)	3 hrs (End term exam)

Mode of lectures: Hybrid mode lecture/videos/case study/ discussion/ workshop/ hands-on

Course/Project Plan

Lecture no.	Topic	Lecture mode	Instructor
L: 1-3	Some important facts about distributions, Discrete random variables, Binomial distribution, mean and variance of the Binomial distribution, Continuous random variables, Normal distribution, standard normal distribution	Hybrid	Vivek Singh Sikarwar
L: 4-5	Discussion, Exercises and self study	Hybrid	
L: 6-7	uniform distribution, chi-square distribution, t-distribution, F-distribution, Bivariate and multivariate distributions. likelihood and maximum likelihood estimation. Useful R functions relating to univariate distributions.	Hybrid	
L: 8-9	Discussion, Exercises and self study	Hybrid	
L: 10-11	The one-sample t-test, Type I, II error, and power	Hybrid	
L:12-13	Exercises and self study	Hybrid	
L:14-15	The p-value, Searching for significance, the two-sample t-test vs. the paired t-test.	Hybrid	
L: 15-19	Discussion, Exercises and Project	Hybrid	
L:20-21	LMM (From the t-test to the linear (mixed) model, Sum coding, Checking model assumptions, From the paired t-test to the linear mixed model), Project	Hybrid	
L: 22-25	LMM (Model type 1, Model type 2 and Model type 3)		
L: 26-30	GLMM (Generalized linear mixed models) , Self study/Project		

L: 31-34	Contrast coding: Default contrast coding: Treatment contrasts, Sum contrasts,Cell means parameterization and posterior comparisons, The hypothesis matrix, Repeated contrast, Polynomial contrast, centered contrast, orthogonal contrast, contrast coding with two predictor variables.		
L: 35-36	Problem discussion and Project Evaluation		

Brief profile of the instructor with Photograph:

Mr. Vivek Singh Sikarwar
Assistant Professor (selection grade)

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I hold a Master's degree in Robotics from IIIT – Allahabad and am currently pursuing my Ph.D. in the field of Cognitive Science at IIT Kanpur.

My research focuses on developing corpora-based measures for Indic languages, along with the exploration of rating-based measures for the languages. My work delves into understanding the role of these factors in Indic languages Word Recognition and Reading.