INFO I590

Statistical Methods in BioMedical Data Analysis

Department of BioHealth Informatics
Indiana University School of Informatics and Computing
Indianapolis
Fall 2015

Section No.: 27594
Day: Thursday
Time: 6:00pm to 8:40pm
Location: IT 355
First Class: August 27th 2015
Website:
Instructor: Meeta Pradhan, Ph.D., Assistant Research Professor
Office Hours: Appointment
Office: WK 306, Walker Plaza Building
719 Indiana Avenue, Indianapolis, IN 46202
Phone: (317) 278-0148 (Office), Office Hours - ???
Email: mpradhan@iupui.edu
Prerequisites: High School Maths

COURSE DESCRIPTION

The ability to understand, analyze and interpret businesses from data has become increasingly important in the health-care domain. Big-data analytics remains a primary focus of the healthcare industry, both in terms of delivering effective outcomes and controlling the costs. Handling, understanding and extracting knowledge from data requires the application of statistical principles. This course will teach students with how to apply biomedical analytics methods to understand biohealth data. This course introduces the basic and advance statistical methods and provides hands-on experience of working with real data. The course aims to equip students with highly demanded health analytics skills to select, prepare, analyze, interpret, evaluate, and present data for the purposes of improving outcomes. The data will be analyzed using the statistical computing tool R.

Statistical Methods for Health Care Research: Barbara Hazard Munro

**Reference Book:** Discovering Statistics Using R by Andy Field, Jeremy Miles and Zoe Field

OpenIntro Statistics – David M Diez, Christopher D Barr, Mine Cetinkaya- Rundel

Introductory Statistics with Randomization and Simulation- David M Diez, Christopher D Barr, Mine Cetinkaya-Rundel

**EXPECTATIONS, GUIDELINES, AND POLICIES**

**ATTENDANCE**

- Class attendance is required for classroom-based courses.
- Attendance shall be taken in every class. If you do not sign the attendance sheet while in class, you shall be marked absent.
- Signing the attendance sheet for another student is prohibited.
- The instructor is required to submit to the Registrar a record of student attendance, and action shall be taken if the record conveys a trend of absenteeism.
- Absences must be explained to the satisfaction of the instructor, who will decide whether omitted work may be made up.
- Missing class reduces your grade through the following grade reduction policy:
  - You are allowed ONE excused or unexcused absences.
  - Regardless of the reason, a 2nd absence results in a 25% reduction in your final grade.
  - A 3rd absence results in a 50% reduction.
  - Further absences result in an F in the course.
  - Missing class may also reduce your grade by eliminating opportunities for class participation.

**CLASS PREPARATION**

- You are expected to read the chapters and the material given in the class
• Research shows that regular attendance, preparation and active class participation have a positive impact on your final grade for a course.
• Ask whatever questions you have pertaining to the course, while we are face to face.
• When not in class, ask on the class forum and ask your questions and receive answers. In this way, the entire class can benefit from your question. There are no silly questions!!!!

LATE ASSIGNMENTS AND SUBMISSION OF ASSIGNMENTS

• All work (unless otherwise noted) should be submitted via an attachment in the Assignments area.
• Class Work will be due by 11:55 PM of the specified day. If your Class Work is late, your respective assignment will be assessed a 25% late penalty. Any assignment that is not turned in by 24 hours after the due date will not be accepted and you will receive a zero (0) for that particular assignment. Also, if I give out a solution and you have not submitted your work, you will not be able to turn in the late work and you will also receive a zero (0) for that particular assignment.

IN CLASS ASSIGNMENT AND FINAL EXAM

Each class assignment needs to be completed in the class and there will be one final exam on the last day. There are no make-up exam or assignment.

GRADE ALLOCATION

- Attendance  5%
- Quiz  15%
- Assignment  15%
- Mid-Term  15%
- Final Exam  15%
- Paper Presentation  15%
- Project  20%

GRADING SCALE

- A+  100% - 97%
- A  96.99% - 93%
- A -  92.99% - 90%
• B + 89.99% - 87%
• B 86.99% - 83%
• B - 82.99% - 80%
• C + 79.99% - 77%
• C 76.99% - 73%
• C - 72.99% - 70%
• D + 69.99% - 67%
• D 66.99% - 63%
• D - 62.99% - 60%
• F 59.99%

ACADEMIC INTEGRITY STATEMENT

Cheating is absolutely not tolerated at IUPUI!

The IUPUI Code of Ethics is based on the need for trust in an academic community. IUPUI's system is developed by and maintained for the welfare of its students, and all students should make sure that they read and understand the provisions outlined in the Student Handbook. The code, which is available in the Office of the Dean of Students and in all school office, spells out what constitutes unacceptable behavior and the procedures to be followed when there are alleged cases of misconduct. The dean of students also has some very brief pamphlets on key areas of the code. The link that follows is not the code but rather abbreviated and paraphrased statements on key elements of the code: academic and personal misconduct as well as a section on what students should do if they believe that other students, faculty, or staff have violated their rights. The code also explains the procedures employed and how students may appeal decisions. For more information, consult the Code of Student Rights, Responsibilities, and Conduct as well as brochures located in the Office of the Dean of Students.

Indiana University Purdue University Indianapolis Code of Conduct

Any form of cheating/plagiarism on an assignment, homework or quiz will result in both a zero score for the assignment, and a one-letter grade penalty in the course. The case will be reported to the Chairman of the School of Informatics and Computing and a letter describing the infraction will be placed in your student file. Further disciplinary action will be pursued according to university policy as described in Part III of the Code of Student Rights, Responsibilities, and Conduct (Issued August 15, 1997). Cheating, or helping another student to cheat, are considered equal cases of academic dishonesty and will be dealt with as noted above.
What constitutes cheating?

Giving another student access to your computer account, or negligently permitting another student to access your computer account constitutes cheating on your part if that other student copies any files that become implicated in a cheating case. Protect your account as if your academic career depends on it!

Giving another student your code "just to look at" has resulted in serious problems for both students in the past—even with the best of intentions. Do not give your code to other students.

If you are confused as to the difference between helping each other (which is encouraged) and plagiarism (which will not be tolerated), please ask me.

**PRINCIPLES OF UNDERGRADUATE LEARNING (PUL)**

Learning outcomes are assessed in the following areas:

1. Knowledge and skills mastery  Major emphasis
2. Critical thinking and good judgment  Moderate emphasis
3. Effective communication  Some emphasis
4. Ethical behavior

**Learning Outcomes:**

Upon completion of this course, students will

<table>
<thead>
<tr>
<th>PGPL</th>
<th>Assessment</th>
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<tbody>
<tr>
<td>1. Understanding the different data and their types</td>
<td>1, 2</td>
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<tr>
<td>2. Different types of distribution</td>
<td>1, 2</td>
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<tr>
<td>3. Numerical data and Categorical data</td>
<td>1, 2</td>
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<tr>
<td>4. Parametric test, non-parametric tests,</td>
<td>1, 2</td>
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<tr>
<td>5. Population, sampling, paired tests and hypothesis</td>
<td>1, 2</td>
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<td>6. Exploration and visualization techniques</td>
<td>1, 2</td>
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<td>7. Logistics Regression concepts and analysis</td>
<td>1, 2</td>
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<td>8. Hands-on application on biological and clinical data</td>
<td>1, 3, 4</td>
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<td>9. Paper presentation</td>
<td>1, 2, 3, 4</td>
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<td>10. Project Designing, Writing, Analysis and presentation</td>
<td>1, 2, 3, 4</td>
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<td>11. Write programs to perform data analytics on large, complex datasets in R</td>
<td>1, 2</td>
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### Weekly Class TimeTable

- **Quiz**: 6:00 pm to 6:20 pm
- **Instructor Teaching**: 6:30 pm to 7:50 pm
- **Paper Presentation**: 7:55 pm to 8:40 pm

### WEEKLY SCHEDULE (subject to change)

<table>
<thead>
<tr>
<th>Dates</th>
<th>Content</th>
<th>Paper Reading</th>
<th>Assignment</th>
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</thead>
<tbody>
<tr>
<td>8-27-2015</td>
<td>Introduction to role of Statistics in the field of Bioinformatics and Clinical data analysis. Introduction to Data and Data-types</td>
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<tr>
<td>9-3-2015</td>
<td>Quiz 1, Introduction to R, Introduction to Probability, Random Variables and Commonly used Statistical Distribution</td>
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<td>HW -1 Assigned</td>
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<td>9-10-2015</td>
<td>Quiz 2, Inference to Foundations-Sampling, Hypothesis, Estimates, Central Limit Theorem and Inference to Numerical Data</td>
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<tr>
<td>9-17-2015</td>
<td>Quiz 3, Inference to Categorical data. Biological Data and Clinical Data Visualization</td>
<td></td>
<td>HW-1 Due, HW-2 Assigned</td>
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<tr>
<td>9-24-2015</td>
<td>Quiz 4, Analysis of Covariance and Introduction to Non-Parametric Test</td>
<td></td>
<td>Project Report I due</td>
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<tr>
<td>10-1-2015</td>
<td>Quiz 5, Project Overview By Students, Introduction to Sampling, Morbidity, Mortality, Epidemiology</td>
<td></td>
<td>HW-2 Due, HW-3 Assigned</td>
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<tr>
<td>10-8-2015</td>
<td>Quiz 6, Introduction to Linear Regression and Trend viewers</td>
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<td>HW-3 Due</td>
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<td>Date</td>
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<td>10-15-2015</td>
<td>Mid Term Exam</td>
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<td>10-22-2015</td>
<td>Linear Regression, Comparing two means, ANOVA and ANCOVA</td>
<td>All GROUPS WILL PRESENT THEIR PROJECT TITLE AND A BRIEF OVERVIEW</td>
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<td>10-23-2015</td>
<td>MEETING WITH DR. PRADHAN TO DISCUSS THE PROJECT</td>
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<td>10-29-2015</td>
<td>Quiz 7, Factoral ANOVA, MANOVA, Exploratory Factor Design</td>
<td>HW-4 Assigned</td>
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<td>11-5-2015</td>
<td>Quiz 8, Microarray and Genomic Data Analysis</td>
<td>Project Report II Due</td>
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<td>11-12-2015</td>
<td>Clinical Data Analysis</td>
<td>HW-4 Due, HW-5 Assigned</td>
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<td>11-26-2015</td>
<td>Thanksgiving Break</td>
<td>HW-5 Due</td>
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<tr>
<td>12-3-2015</td>
<td>Project Presentation</td>
<td>Final Project Report DUE</td>
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<td>12-10-2015</td>
<td>Final Exam ??</td>
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<tr>
<td>12-17-2015</td>
<td>Final Exam</td>
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