Biostatistics (BSTA)

Courses

BSTA 001 Population Health Data Science I 3 Credits
Students will learn the fundamentals of probability theory, univariate statistics, statistical computing/programming/visualization, and machine learning. A mix of traditional and experiential learning will focus on how to build an analysis pipeline to answer pressing questions in population health. In-class examples and projects will use real data sets. Students will propose a small data-driven project focused in population health, and use their newly-acquired data science skills to collect, analyze, and present their work. Must be taken in conjunction with BSTA 002.
Corequisites: BSTA 002

BSTA 002 Population Health Data Science I Algorithms Lab 1 Credit
Students will apply statistical concepts learned in BSTA 001 Population Health Data Science I to describe, visualize, and draw inferences on a variety of health datasets using Python3. Datasets that students will study include: influenza-like illness and confirmed positive cases of COVID-19 tracked by the Centers for Disease Control and Prevention, and a repository of potentially hazardous chemicals found in commercial products. Lab is to be taken concurrently with lecture (BSTA 001 Population Health Data Science I).
Corequisites: BSTA 001

BSTA 005 Statistical Literacy in Health 3 Credits
This course is designed to introduce students with a fear of all things mathematical to the importance of statistics in health research. Students will learn how to read and understand basic statistical concepts and methods used in health research, such as probability, sampling, hypothesis testing, and correlation. Students will also learn to interpret tables and statistical findings in the health literature.

BSTA 101 Population Health Data Science II 3 Credits
Students will expand their statistics and machine learning toolkit by learning how to compare univariate distributions, build traditional regression models for continuous and binary data, explore supervised learning methods such as: Tree-based learning, KNN/Collaborative filtering, and Feed forward Neural networks, and understand how to manipulate, ask, and answer questions from big datasets. Students will be expected to propose a population health project mid-semester, and apply and present techniques they learned in class. Must be taken in conjunction with BSTA 103.
Prerequisites: BSTA 001 and BSTA 002
Corequisites: BSTA 103

BSTA 103 Population Health Data Science II Algorithms Lab 1 Credit
Students will apply regression and machine learning models learned in BSTA101 Population Health Data Science II to health datasets using Python3. Datasets that students will study include: the National Health and Nutrition Examination Survey, influenza-like illness and confirmed positive cases of COVID-19 tracked by the Centers for Disease Control and Prevention, and the National Health Interview Survey. Lab is to be taken concurrently with lecture (BSTA101 Population Health Data Science II).
Prerequisites: BSTA 001
Corequisites: BSTA 101

BSTA 120 (CGH 120, EPI 120, POPH 120) Independent Study or Research 1-4 Credits
This course can be directed readings or research in Biostatistics or an experiential learning experience that puts student's understanding of Biostatistics into practice. Department permission required.
Repeat Status: Course may be repeated.

BSTA 130 Internship 1-4 Credits
In this introductory course, students will engage in supervised work in Biostatistics. Placements will be arranged to suit individual interests and career goals. Potential internship sites include government agencies, non-profit organizations, and the private sector. A written report is required, and a preceptor evaluation will be required. Department permission is required.
Repeat Status: Course may be repeated.

BSTA 150 Special Topics in Biostatistics 3-4 Credits
In this course, students will engage in an intensive exploration of a topic of special interest that is not covered in other courses. Topics addressed will be at an intermediate level.
Repeat Status: Course may be repeated.

BSTA 160 Biostatistics Study Abroad 1-3 Credits
Biostatistics focused course taken during an abroad experience.
Repeat Status: Course may be repeated.

BSTA 300 Apprentice Teaching 1-4 Credits
Repeat Status: Course may be repeated.

BSTA 305 Population Health Data Science III 3 Credits
In this course, students are introduced to Bayesian statistics and computational techniques, ensemble learning (boosting, bagging, stacking), how to handle missing data, and how to build reproducible analysis pipelines via Makefiles. The statistical and machine learning techniques taught will be applied to a variety of real population health datasets; students will apply these techniques and submit a research-style manuscript. Students will investigate a current problem in population health and provide a data-driven solution.
Prerequisites: BSTA 101 or BSTA 103
Corequisites: BSTA 306

BSTA 306 Population Health Data Science III Algorithms Lab 1 Credit
Required programming lab course for students enrolled in BSTA 305 Population Health Data Science III.
Prerequisites: BSTA 101 or BSTA 103
Corequisites: BSTA 305

BSTA 307 Applied Machine Learning for Health Sciences 3 Credits
Machine learning uses interdisciplinary techniques to create automated systems that can sift through large amounts of data at high speed to make predictions and decisions with minimal human intervention. Machine learning is increasingly pervasive and impactful in public health and precision medicine. This class will provide students with a broad cross-section of practical machine learning skills while giving them an appreciation of how machine learning is being applied in the context of public health research today.
Prerequisites: BSTA 101

BSTA 308 Advanced R Programming 3 Credits
R language syntax and structure. R programming techniques. Emphasis on structured design for medium to large programs. R package development fundamentals. Capstone development project.
Prerequisites: BSTA 101 and BSTA 103

BSTA 309 Outbreak Science & Public Health Forecasting 3 Credits
This course aims to introduce students to models that describe the spread of a pathogen through a population, and how models can support public health decisions. The course will be split into four parts: (i) the factors that motivate public health actions, (ii) epidemic models such as the Reed-Frost and SIR, (iii) statistical time series and forecasts, (ii) a focus on ensemble building. Students will be expected to complete mathematical/statistical exercises and write code that simulates infectious processes.
Prerequisites: BSTA 101 and BSTA 103

BSTA 320 (CGH 320, EPI 320, POPH 320) Independent Study or Research in Biostatistics 1-4 Credits
This course can be directed readings or research in Biostatistics or an experiential learning experience that puts student's understanding of Biostatistics into practice. Department permission required.
Repeat Status: Course may be repeated.

BSTA 330 Internship 1-4 Credits
In this advanced course, students will engage in supervised work in Biostatistics. Placements will be arranged to suit individual interests and career goals. Potential internship sites include government agencies, non-profit organizations, and the private sector. A written report is required, and a preceptor evaluation will be required. Department permission is required.
Repeat Status: Course may be repeated.

BSTA 350 Special Topics in Biostatistics 3-4 Credits
In this course, students will engage in an intensive exploration of a topic of special interest that is not covered in other courses. Topics addressed will be at an advanced level.
Repeat Status: Course may be repeated.

BSTA 360 Biostatistics Study Abroad 1-3 Credits
Upper-level biostatistics focused course taken during an abroad experience.
Repeat Status: Course may be repeated.

BSTA 396 1-4 Credits
Repeat Status: Course may be repeated.

BSTA 402 Health Data and Computational Science 3 Credits
This course provides an introduction to the use of statistics in health. Topics include descriptive statistics, probability distributions, parameter estimation, hypothesis testing, analysis of contingency tables, analysis of variance, regression models, and sample size and power considerations. Students develop the skills necessary to perform, present, and interpret statistical analyses; and attain autonomy in handling real-world data using a statistical computing environment.

BSTA 403 Applications in Statistical Learning 3 Credits
This course will explore common statistical models used to analyze both continuous, discrete, and time to event data: simple and multivariate linear regression, logistic regression, poisson and negative binomial regression, and survival models. An emphasis will be placed on supervised learning. Throughout the semester, students will apply the theoretical background they learn in class to population health data sets, generating their own hypotheses and testing them with rigorous statistical methods.
Prerequisites: BSTA 402

BSTA 404 Data Architecture, Mining, and Linkage 3 Credits
This course will focus on collecting, storing, and formatting data for use in population health data analysis. Students will learn fundamental concepts and best practices for working with data, how to use Python to scrape the internet for data related to population health and learn how to link a diverse set of data together to test novel hypotheses students themselves pose during class.

BSTA 409 Outbreak Science & Public Health Forecasting 3 Credits
This course aims to introduce students to models that describe the spread of a pathogen through a population, and how models can support public health decisions. The course will be split into four parts: (i) the factors that motivate public health actions, (ii) epidemic models such as the Reed-Frost and SIR, (iii) statistical time series and forecasts, (ii) a focus on ensemble building. Students will be expected to complete mathematical/statistical exercises and write code that simulates infectious processes.

BSTA 450 Special Topics in Biostatistics 3 Credits
In this course, students will engage in an intensive exploration of a topic of special interest that is not covered in other courses. Topics addressed will be at an advanced level.
Repeat Status: Course may be repeated.