**MASTER OF URBAN SPATIAL ANALYTICS (MUSA)**

**MUSA 500 Spatial Statistics and Data Analysis**
This hands-on course will provide an introduction to statistical methods and will serve as a prequel to ESE502. Topics covered will include exploratory univariate analysis, correlation and Chi-square analysis, t-tests and ANOVA. Non-parametric alternatives to the standard tests will be discussed. OLS regression, including assumptions and diagnostics, will be covered in detail. Heavy emphasis will be placed on the application of each method covered. The course will conclude with an introduction to spatial statistical methods and a brief overview of linear algebra and matrix notation for OLS and spatial regression. Students will learn to use JMP-IN, ArcGIS and GeoDa for data analysis.

Taught by: Eugene Brusilovsky
Course usually offered in fall term
Activity: Lecture
1 Course Unit

**MUSA 501 Introduction to Applied Statistics**
This hands-on course will provide an introduction to statistical methods and will serve as a prequel to ESE502. Topics covered will include exploratory univariate analysis, correlation and Chi-square analysis, t-tests and ANOVA. Non-parametric alternatives to the standard tests will be discussed. OLS regression, including assumptions and diagnostics, will be covered in detail. Heavy emphasis will be placed on the application of each method covered. The course will conclude with an introduction to spatial statistical methods and a brief overview of linear algebra and matrix notation for OLS and spatial regression. Students will learn to use JMP-IN, ArcGIS and GeoDa for data analysis.

Taught by: Eugene Brusilovsky
Course usually offered in spring term
Activity: Lecture
1 Course Unit

**MUSA 503 Modeling Geographical Objects**
This course offers a broad and practical introduction to the acquisition, storage, retrieval, maintenance, use, and presentation of digital cartographic data with vector-oriented (i.e., drawing based) geographic information systems (GIS) for a variety of environmental science, planning, and management applications. Previous experience in GIS is not required.

Taught by: Tomlin or Hillier
Course usually offered in fall term
Activity: Lecture
1 Course Unit

**MUSA 504 Business and Crime Geographics**
In this hands-on course, students will learn how to use ESRI Business Analyst software and data to undertake real estate and social service market studies, business location studies, and consumer expenditure profiles. New this year, the course will also explore techniques and software for tracking and forecasting crime; and deploying police resources.

Taught by: Amos
Course usually offered in spring term
Prerequisites: Prior experience with ArcGIS.
Activity: Seminar
1 Course Unit

**MUSA 505 Web-based Mapping**
This hands-on course will teach students how to develop and implement web-and internet-based mapping tools and applications using ESRI's ArcGIS Server and ArcGIS Online products as well as the Google Maps Applications Programming Interface (API). Students will learn how to use web-based tools to build spatial databases, analyze and display spatial data at multiple scales, mix web-based vector and raster data with image data, conduct spatial analysis and develop urban and environmental planning applications.

Taught by: Landis and Dailey
Course usually offered in spring term
Prerequisite: CPLN 670 / LARP 743
Activity: Laboratory
1 Course Unit

**MUSA 507 Spatial Analysis for Urban and Environmental Planning**
This course builds on prior knowledge of GIS and basic statistics to help students to develop GIS and spatial analysis applications for use in urban and environmental planning and management. Each weekly session will focus on a particular analytical approach (e.g., buffering, geo-processing, map algebra, network analysis) as applied to a particular urban or environmental planning task (e.g., identification of development opportunities, prioritizing conservation lands, urban growth modeling, housing price modeling). The format of the class includes weekly lectures/in-class demos; and weekly homework assignments. The course will make extensive use of ArcGIS and associate Extensions, especially Spatial Analyst, Network Analyst, and Business Analyst. One-year student versions of ArcGIS and ArcGIS extensions will be available free of charge at the City Planning Office. ArcGIS runs best on Windows machines; those with Macs will need to install a Windows emulator.

Taught by: Steif
Course usually offered in fall term
Prerequisite: MUSA 501 or CPLN 503 or equivalent
Activity: Lecture
1 Course Unit

**MUSA 610 Javascript Programming for Planning Applications**
This hands-on course will teach students how to develop and implement city planning, MUSA and design graduate students to Java and Javascript. Students will learn the logic and syntax of the Java programming language for use in simple web applications (Weeks 1 to 7), as well as how to program database and map-oriented web and desktop applications using Javascript (Weeks 8 to 14). The “hands-on” uses of Java and Javascript in urban planning applications will be emphasized. Students will hone their programming and applications development skills through a series of bi-weekly assignments.

Taught by: Faculty
Course usually offered in spring term
Activity: Laboratory
1 Course Unit
**MUSA 611 Java Script Programming for Planners and Designers**

This course will introduce City Planning, MUSA and design graduate students to Javascript. Students will learn the logic and syntax of the Java programming language for use in a simple web application (weeks 1 to 7), as well as how to program database and map-oriented web and desktop applications using Javascript (weeks 8 to 14). The "hands-on" uses of Javascript in urban planning applications will be emphasized. Students will hone their programming and applications development skills through a series of bi-weekly assignments.

Taught by: Faculty  
Course usually offered in fall term  
Activity: Lecture  
1 Course Unit

**MUSA 620 Data Wrangling and Visualization**

The purpose of this course is to familiarize students with the "pipeline" approach to data science. This involves the process of gathering data; sorting the data; analyzing the data and visualizing the data such that non-technical managers can make use of it for decision making. The first part of the course teaches students how to gather data by way of scraping, APIs, Google Big Query, Twitter and other unstructured sources. The second part of this course, teaches students how to store and retrieve these data in a database. The third part of the class teaches some more esoteric machine driven analytics. The fourth and final component of the class is data visualization both in state and dynamic (web-based) form. The students will be expected to replicate this pipelines on a data set of their own choosing for their final project.

Course usually offered in spring term  
Prerequisites: Prerequisites include a working knowledge of R and ArcGIS.  
Activity: Seminar  
1 Course Unit

**MUSA 800 MUSA Capstone Project**

One-term course offered either term  
Activity: Seminar  
1 Course Unit

**MUSA 801 MUSA Seminar**

Course Description: the purpose of this course is to have students to work with city and non-profit clients on analytical projects that convert client data into actionable intelligence. Groups of 3-4 students will work with the client to understand the business process, wrangle data, develop spatial and spatial analytics and serve these outputs to non-technical decision makers through the medium of data visualization. Students will be mentored by MUSA Faculty and advised by someone from the partnering agency. Prerequisites: students must have a working knowledge of R and experience building both spatial and statistical models including machine-learning models. In order to be eligible for this course, students must have taken the following courses - 1) MUSA-507/ CPLN-590 and either CPLN-505 or MUSA-500. Students must have taken or be enrolled concurrently in MUSA-601 or MUSA-800. Students without these specific prerequisites are asked to contact the instructor.  
Admission into the course: for spring 2018, there are initially 16 open seats with the possibility of another 4 opening up. To be admitted into the course, students are asked to pick one of the practicum projects and write no more than 300 words about why the use case is of interest, how they might go about solving the problem, and its usefulness to the city. Please also discuss which data-drive skills are your sharpest. The essay should be turned into the City Planning Office in Meyerson Hall.

Projects (subject to change): Louisville, Kentucky-Traffic Flows and Smart Signal Modeling: students will have access to high-resolution traffic data from Waze and historical traffic signal information from the City. The goal is to understand the traffic pattern that might result from a given traffic signal configuration. Can discover a configuration that is amenable to mode choice like walking or biking? Minneapolis, Minnesota-Code Enforcement: Minneapolis has a problem where too many construction projects are happening illegally. Unpermitted construction work may result in unsafe living conditions and worse. This project is to help the city predict where illegal work may be happening and how inspectors can better enforce existing permit regulations. Philadelphia, PA-Equitable Bike Share Planning: one of the policy goals of Philadelphia’s bike share system is to expand into neighborhoods where bike share demand may not be profitable but where the subsidies might induce more sustainable mode choice in the future. Working with the Bike Coalition of Greater Philadelphia, the goal of this project is for students to build an algorithm, which can predict bike share demand for any location.

Taught by: Ken Steif  
Course usually offered in spring term  
Prerequisites: MUSA-507/CPLN-590 and either CPLN-505 or MUSA-500  
Activity: Seminar  
1 Course Unit