

GEOG 479 - Spatial Data Science for Cyber and Human Social Networks

This is a sample syllabus.

This *sample syllabus* is a *representative* example of the information and materials included in this course. Information about course assignments, materials, and dates listed here is subject to change at any time. Definitive course details and materials will be available in the official course syllabus, in Canvas, when the course begins.

Overview

This course teaches students the fundamentals of network analysis, and how its products can be beneficial for more informed decision making in the field of Geospatial Intelligence. The course will be taught over 10 weeks, and activities will include mostly individual work.

This course will teach students the following concepts:

- How real-world entities and relationships can be viewed and analyzed as a network
- the role and use of Geospatial Intelligence in the cyber domain ranging from cyberwarfare to cyberterrorism, disaster response, and humanitarian relief
- the impact of increased flow of information across the world and the risks associated with that increase
- the degree and impact of Internet censorship in various parts of the world and how it is commonly measured

Objectives

At the end of this course, students will be able to:

- apply the fundamentals and principles of cyber geography;
- classify the spatial aspects of information;
- interpret/uncover cyber events using the relationship to location on the earth where the start, end, and content of the interactions provide meaning;
- compare expectations and rights of individuals and governments related to the use of geolocation technologies, data, and privacy from various perspectives;
- describe ways to model and visualize the increase of information resources;
- discuss ways the Intelligence Community collects and analyzes cyber information;
- demonstrate the application of geospatial intelligence to cyberspace operations;

- evaluate potential technology paths to mitigate Intelligence blind spots;
- perform social media network analysis using application software to create analytic products.

Required Materials

The materials listed here represent those that may be included in this course. Students will find a definitive list in the course syllabus, in Canvas, when the course begins.

Required Textbook

Hansen, Derek L., Shneiderman, Ben, and Smith Mark A., *Analyzing Social Media Networks with NodeXL*, Morgan Kaufmann Publishers, Copyright 2020 Second edition, Paperback, ISBN 978-0-12-817756-3.

The book is freely available through the Penn State library. It is also available on sites such as Amazon.

Optional Supplemental Textbook

Newman, M. (2018). *Networks* (2nd ed.). Oxford University. The book is freely available through the Penn State library: [Networks by Mark Newman](#)

Required Software

Some version of Excel, 2007 or later is required. The software used in the course is compatible with these versions only. Versions of Excel prior to 2007 are not compatible at this time.

NodeXL Pro is available for download at a cost of \$39 for a one-year license. You can [download NodeXL](#) through the Social Media Research Foundation website.

Prerequisites

Acceptance into the Geospatial Intelligence Program or by approval.

Expectations

We have worked hard to make this the most effective and convenient educational experience possible. How much and how well you learn is dependent on your attitude, diligence, and willingness to ask for clarifications or help when you need them. We are here to help you succeed. Please keep up with the class schedule and take advantage of opportunities to communicate with us and with your fellow students. You can expect to spend an average of 8 - 12 hours per week on class work.

Major Assignments

The course is separated into three sections. The first section contains 4 chapters, in which the fundamentals of social network analysis are presented. The second section consists of four case studies and projects. The third part is a final project that you will have to prepare during the last two weeks of the course.

- 7 Assignments: 35%
- 4 Case Studies: 35%
- Project Proposal: 10%
- Final Project: 20%

Course Schedule

| Week | Topic | Assignment |
|------|---|---|
| 1 | Introduction to Networks <ul style="list-style-type: none">• What is a social network?• Common Networks• Types of Networks• Network Representations | <ul style="list-style-type: none">• Assignment 1 - Download and install NodeXL• Assignment 2 – Draw a network graph. Write a report with some preliminary conclusions |
| 2 | Geographic Dependent Networks <ul style="list-style-type: none">• Social Network Dependencies• Nodes/Points on the map – how to build a network• Geography as Edges | <ul style="list-style-type: none">• Assignment 3: Construct a spatially dependent network. Present your arguments about your approach.• Assignment 4: Spatial considerations on senate co-voting network |
| 3 | Network Metrics and Characteristics <ul style="list-style-type: none">• Centrality• Transitivity | <ul style="list-style-type: none">• Assignment 5: Re-analyze the network from assignment 1 using network statistics. Write a post in the forum with your report. |

| Week | Topic | Assignment |
|------|--|---|
| | <ul style="list-style-type: none"> Clustering Reciprocity Similarity Homophily | <ul style="list-style-type: none"> Assignment 6: Analyze the social network of “Les Misérables”. |
| 4 | <p>Network Structure</p> <ul style="list-style-type: none"> Paths Components Degree Distributions Small World Phenomenon | <ul style="list-style-type: none"> Assignment 7 – Is this a small world after all? |
| 5 | <p>Case Study 1</p> <ul style="list-style-type: none"> Use NodeXL to evaluate the behavior of an extreme political party | <ul style="list-style-type: none"> Project 1: Analyze the twitter network and create a map with the most “central” actors |
| 6 | <p>Case Study 2</p> <ul style="list-style-type: none"> Terrorist network analysis (NodeXL and TEVUS database) | <ul style="list-style-type: none"> Project 2: Analyze a bimodal terrorist network. Find the central actors and map their activity locations |
| 7 | <p>Case Study 3</p> <ul style="list-style-type: none"> Power grid structure stability | <ul style="list-style-type: none"> Project 3: Perform a stability analysis of a power grid network |
| 8 | <p>Case Study 4</p> <ul style="list-style-type: none"> Emergency preparedness network planning | <ul style="list-style-type: none"> Project 4: Create an emergency respond network and provide solutions to emergency scenarios Submit your project proposal |

| Week | Topic | Assignment |
|------|---------------|--|
| 9 | Final Project | <ul style="list-style-type: none"> Finish your project, record and upload your video. |
| 10 | Final Project | <ul style="list-style-type: none"> Finish your project, record and upload your video. |