

**UNIVERSITY OF NORTH TEXAS**  
**Department of Geography**

**GEOG 4580: GIS in Health**

Location: LIB 116 (Lecture); EAD 703 (Lab)

Office Hours: TBA

Instructor: Chetan Tiwari (320H EESAT, [Chetan.Tiwari@unt.edu](mailto:Chetan.Tiwari@unt.edu), 369-8103)

**Course Description**

GIS in Health is an advanced course in the applications of spatial analysis and geographic information system (GIS) methods for public health. This course is designed for upper-level undergraduate and graduate students in geography and public health with interests in learning about methods for analyzing the spatial patterns of disease burdens and their relationships to environmental hazards. This course will also address issues related to the accessibility of public health facilities and the role that GIS-based information systems play in addressing contemporary public health problems.

**Course Goals**

The course will consist of lectures and labs that will broadly cover the following topics:

- Public health applications of GIS
- Spatial databases for Public Health
- Methods for mapping health information
- Methods for analyzing spatial clusters of health events
- Methods for analyzing environmental hazards
- Methods for analyzing the locations and access to health services
- Designing information systems for health surveillance
- Translational research in GIS and Public Health

**Course Objectives**

At the end of this course, students will have an understanding of the key issues in public health surveillance. They will be able to create maps that describe the spatial patterns of disease burdens and environmental hazards. Students will also understand the data and information processing needs for developing health surveillance systems, and how these technologies can be used to alleviate contemporary public health problems.

**Required Text**

Title: GIS and Public Health

Authors: Ellen K. Cromley and Sara L. McLafferty

Publisher: The Guilford Press; 1 edition (February 6, 2002)

ISBN-10: 1572307072

## **Grading**

The course is a combination of lectures and practical exercises. Quizzes will be given to ensure that you understand the background material. The grading schema is as follows:

Exercises and Assignments: 30%

Quiz 1: 20%

Quiz 2: 20%

Final Exam: 30%

## **Accommodations**

The Department of Geography, in cooperation with the Office of Disability Accommodation, complies with the Americans with Disabilities Act in making reasonable accommodations for qualified students with disabilities. Please present your written accommodation request before the 12th class day.

## **Extra Credit**

The Department of Geography does not allow extra credit assignments (work not specified on a course syllabus).

## **Academic Dishonesty**

Students caught cheating or plagiarizing will receive a "0" for that particular assignment or exam. Additionally, the incident will be reported to the Office of Student Rights and Responsibilities for further penalty. According to the UNT catalog, the term "cheating" includes, but is not limited to: (a) use of any unauthorized assistance in taking quizzes, tests, or examinations; (b) dependence upon the aid of sources beyond those authorized by the instructor in writing papers, preparing reports, solving problems, or carrying out other assignments; (c) the acquisition, without permission, of tests or other academic material belonging to a faculty or staff member of the university; (d) dual submission of a paper or project, or resubmission of a paper or project to a different class without express permission from the instructor(s); or (e) any other act designed to give a student an unfair advantage. Altering a returned test and claiming a grader or scanning machine made an error is also considered cheating. The term "plagiarism" includes, but is not limited to: (a) the knowing or negligent use by paraphrase or direct quotation of the published or unpublished work of another person without full and clear acknowledgment; and (b) the knowing or negligent unacknowledged use of materials prepared by another person or agency engaged in the selling of term papers or other academic materials.

**Classroom Courtesy:** Please follow these guidelines to avoid disrupting the class:

1. Turn off cell phones before arriving.
2. Do not arrive late or leave early (except for a bathroom break or emergency).
3. Do not sleep during class.
4. Do not work on other assignments during class.
5. Do not talk or whisper to neighbors (except for formal class interaction).

## Schedule

Week	Topic
1	Introduction <ul style="list-style-type: none"> <li>• GIS Review</li> <li>• Map projections</li> <li>• Map symbolization &amp; cartographic design</li> <li>• Spatial analysis using ArcGIS</li> </ul>
2	Introduction to spatial data and databases for public health <ul style="list-style-type: none"> <li>• Raster and vector data processing</li> <li>• Geographic data quality</li> <li>• Health data</li> <li>• Health services data</li> <li>• Database integration and sharing</li> </ul> Exercise: Using ArcGIS for mapping health data
3	Disease Mapping – I <ul style="list-style-type: none"> <li>• Introduction to disease mapping</li> <li>• MAUP and the problem of mapping small numbers</li> </ul> Exercise: Choropleth mapping
4	Disease Mapping – II <ul style="list-style-type: none"> <li>• Spatial autocorrelation and smoothing methods</li> <li>• Mapping spatial patterns of disease burdens</li> </ul> Exercise: Spatial filtering
5	Disease Clustering – I <ul style="list-style-type: none"> <li>• Clustering using areal data</li> <li>• Clustering using point data</li> </ul>
6	Disease Clustering - II <ul style="list-style-type: none"> <li>• Use of spatial clustering methods</li> <li>• Challenges</li> </ul> Exercise: Cluster detection using SatScan
7	Analyzing Environmental Hazards – I <ul style="list-style-type: none"> <li>• Environmental risk and environmental hazards</li> <li>• Public health surveillance process – Thacker Model</li> <li>• Modeling fate, transport and environmental quality using GIS</li> </ul>
8	Analyzing Environmental Hazards – II <ul style="list-style-type: none"> <li>• GIS and exposure modeling</li> <li>• GIS and outcome surveillance</li> <li>• GIS and environmental risk management</li> <li>• GIS and environmental hazard mapping</li> </ul> Exercise: Exploring the TOXMAP repository
9	Issues in linking hazards to outcomes <ul style="list-style-type: none"> <li>• Effects of geocoding</li> <li>• Effects of spatial misalignment</li> </ul>

	<ul style="list-style-type: none"> <li>• Issues of environmental justice</li> </ul> <p>Exercise: Geocoding</p>
10	<p>Analyzing access to health care services - I</p> <ul style="list-style-type: none"> <li>• Mapping service locations</li> <li>• Mapping health needs and services</li> <li>• Assessing access to health care services</li> <li>• Assessing health care utilization</li> </ul>
11	<p>Analyzing access to health care services – II</p> <ul style="list-style-type: none"> <li>• Health care shortage areas</li> <li>• Normative models of facility location and service delivery</li> <li>• Incorporating normative models of facility location and service delivery in GIS</li> </ul> <p>Exercise: Location-allocation for health delivery</p>
12	<p>Designing information systems for environmental health surveillance</p> <ul style="list-style-type: none"> <li>• Introduction to Information Systems</li> <li>• Spatial data handling issues for integrating data on health and the environment</li> </ul>
13	<p>Syndromic Surveillance</p> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Review of Syndromic Surveillance Applications including BioStorm, RODS and ESSENCE</li> </ul>
14	<p>Translational research in GIS and public health</p> <ul style="list-style-type: none"> <li>• Public participatory GIS</li> </ul>
15	<p>Emerging trends</p> <ul style="list-style-type: none"> <li>• Knowledge representation (Gene Ontology Project)</li> <li>• Visualization and Grid computing</li> </ul>