CS225: Spatial Computing

Course Outline

Instructor: Amr Magdy

Computer Science and Engineering

www.cs.ucr.edu/~amr/

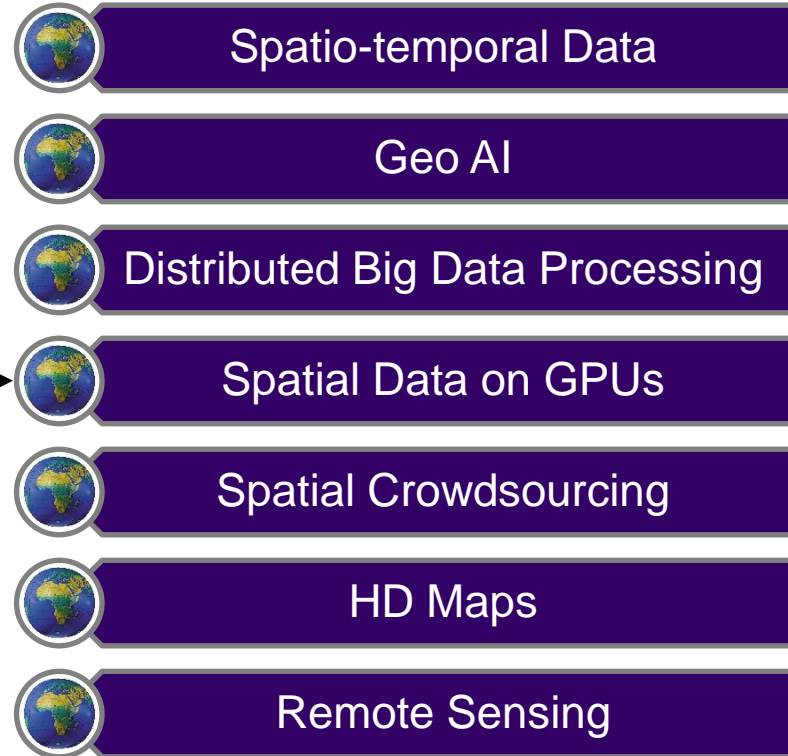# **Welcome to CS 225**

› **Instructors**: Amr Magdy, Yongyi Liu
Office: WCH 328 (WCH 362)
http://www.cs.ucr.edu/~amr/
Email: amr@cs.ucr.edu, yliu786@ucr.edu
(**Include [CS225] in the subject**)

› Office hours: TBA

› **TA**: Alhassan Satii Alshareedah
alhassansatii.alshareedah@email.ucr.edu

Office hours: TBA

› Course Website: https://www.cs.ucr.edu/~amr/#teaching

› Slack: linked on eLearn
https://elearn.ucr.edu/courses/168369/external_tools/57226

Course Content

- Introduction to Spatial Computing

- Spatial Relationships and Data Models

- Spatial Data Storage and Indexing

- Spatial Query Processing

- Spatial Networks

- Geo-visualization

- Spatial Data Mining

- Trends and Innovations in Spatial Applications

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> Introduction to Spatial Computing

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> Trends and Innovations in Spatial Applications

| Spatio-temporal Data |
| Geo AI |
| Distributed Big Data Processing |
| Spatial Data on GPUs |
| Spatial Crowdsourcing |
| HD Maps |
| Remote Sensing |

Course Content

› Course Research Elements:

  › "Introduction to Research" lecture

  › Paper reviews practice

  › Presenting research papers

  › Writing technical papers (survey and/or final report)

  › Lecture contents on new trends on spatial-related research

Grading and Policies

> Course work

> > Class Participation (10%)

> > Evaluating others (5%)

> > Paper Reviews (7.5%)

> > Hands-on on Spatial Technologies (7.5%)

> > Presentation (10%)

> > Project (50%)

> > Final exam (10%)

> Delivery policies:

> > **Groups of 3 students are required for the project.**

> > Delivery instructions and policies announced per assignment.

> Cheating is not allowed and will be reported

> > If you are using any external source, you must cite it and clarify what exactly got out of it.

> > You are expected to understand any source you use.

Paper Reviews and Presentations

> Two review assignment (7.5%)
>> Summarization of paper research elements
>> Paper critique

> Presentations (10%)
>> Papers are presented in groups, different from project groups.
>> Each group member must present.
>> Involve presenting research papers as well as relevant articles.
>> Open for new title suggestions.

Hands-on on Spatial Technologies

› Any spatial technology is fine, check instructor approval

› Any reasonable-sized hands-on is fine as well

› Candidate technologies

- › Spatial Databases
  - › PostGIS, Oracle Spatial, SpatiaLite, MonetDB/GIS, etc
- › GIS Software
  - › ArcGIS, QGIS, etc
- › Maps
  - › Google Maps, Bing Maps, ESRI Maps, etc
- › ESRI Story Maps
- › Big Spatial Data Systems
  - › Simba, SpatialHadoop, GeoSpark, SpatialSpark, etc
- › GeoSpatial Analysis Tools
  - › PySAL, GeoPandas, Fiona, Shapely, GeoDa, SSN & STARS, SP and SF R packages, OGR GDAL

Final Exam

> Lectures content & presentations discussion questions

Sample Survey Papers

› In-Memory Big Data Management and Processing: A Survey. Hao Zhang, Gang Chen, Beng Chin Ooi, Kian-Lee Tan, and Meihui Zhang. TKDE, vol. 27, no. 7.

› A survey of top-k query processing techniques in relational database systems. Ihab F. Ilyas, George Beskales, Mohamed A. Soliman. ACM Computing Surveys (CSUR), Vol. 40, Issue 4, No. 11, Oc. 2008.

› Crowdsourced Data Management: A Survey. Guoliang Li, Jiannan Wang, Yudian Zheng, Michael J. Franklin. TKDE, vol. 28, issue 9.

R'GeoSpatial Student Club

WHAT'S GIS?

GIS stands for Geographic Information system. The software is used for both gathering and visualizing data. The most common example that is applicable to our lives is Google maps. Whenever you look up directions or try to figure out where you are, that's the byproduct of GIS.

GOAL OF THE CLUB:

R'geospatial is a relatively new club on campus that aims to show the utility and transferability of GIS skills to students' careers. The club will cover how to use the software and also how it applies to your major and future professional endeavors.

If interested, please add us on Highlanderlink and feel free to reach out to us if you have any questions!

Useful Resources

› ESRI GeoAI tools

  › **ArcGIS and Microsoft AI: Scalable GeoAI in the Cloud**

    › https://www.youtube.com/watch?v=m7GqaC5_fFU

  › **Geo Artificial Intelligence**

    › GeoAI medium blogs

    › GeoAI Demonstration Gallery

  › **Geospatial Data Science**

    › Spatial Analysis and Data Science

    › R-ArcGIS Bridge

    › Bridging Into New Realms: R-ArcGIS Bridge and Microsoft R

    › R Notebooks in ArcGIS Pro for Spatial Data Science

    › ArcGIS API for Python – A powerful python library for spatial analysis, mapping and GIS

Useful Resources

> ESRI GeoAI tools
>> Online Lessons:
>>> [Use Deep Learning to Assess Palm Tree Health](#)
>>> [Extracting Information using Image classification](#)
>>> [Downscale Climate Data with Machine Learning](#)
>>> [Predict Seagrass Habitats with Machine Learning](#)
>>> [Identify and Ecological Niche for African Buffalo (with R-ArcGIS Bridge)](#)
>>> [Analyze Crime using Statistics and R-ArcGIS Bridge](#)
>>> [Analyzing violet crime using hot spot analysis and space time cube](#)

Credits

› Prof. Shashi Shekhar course

  › http://www.spatial.cs.umn.edu/Courses/Spring18/8715/index.php

  › http://www.spatial.cs.umn.edu/Courses/Fall21/5715/index.php