# CS260-002: Spatial Data Modeling and Analysis

# Course Outline

Instructor: Amr Magdy

Computer Science and Engineering

www.cs.ucr.edu/~amr/

# Welcome to CS 260



> **Instructor**: Amr Magdy
> Office: Tomas Rivera Library, 159B
> http://www.cs.ucr.edu/~amr/
> Email: amr@cs.ucr.edu
> (**Include [CS260] in the subject
> – no spaces**)
> Office hours [tentative]: WF: 5:30 - 6:30 PM

> **TA**: None

> Course Website:
> http://www.cs.ucr.edu/~amr/courses/18SCS260/

# 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

# Course Content

- Course Research Elements:

  - "Introduction to Research" lecture

  - Surveying the literature methodology

  - Paper reviews practice

  - Presenting research papers

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

  - Project stages
    (identifying idea, literature survey, tackling the problem, and documenting the results)

  - Lecture contents on new trends on spatial-related research

# Grading and Policies

- Course work
    - Project (60%)
    - Paper reviews and presentations (15%)
    - Hands-on on spatial technologies (10%)
    - Final exam (15%) [tentative]

- Delivery policies:
    - Groups of two required **for the project only**.
    - 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.

# Project: Grade Breakdown

› Idea Proposal (with potential revision cycles) (5%)

  › extra credit up to 10% for exceptional ideas and above-average quality ideas

› Outline of project deliverables (0%)

› Preliminary literature survey (10%)

› Project deliverables (35%)

› Final report (5%)

› Final presentation (5%)

# Project: Categories

- ## Novel Research
  - Preliminary investigation for a novel research idea

- ## Literature Survey Paper
  - Surveying the literature of a certain spatial topic

- ## Literature Experimental Evaluation
  - Experimentally compare major techniques of a certain spatial topic

- ## SIGSPATIAL Cup
  - Work on SIGSPATIAL cup problem

- ## Vision Analysis
  - Track the advances in topics of a vision report (e.g., CCC Spatial Computing 2020 Workshop)

- ## Interdisciplinary project
  - Apply spatial computing technologies to a non-CS field

# Project: Deliverables and Assessment

- › Novel Research
  - › Clearly identifying and presenting the research elements
  - › Preliminary solution idea
  - › Preliminary evaluation results

- › Literature Survey Paper
  - › Comprehensive list of papers
  - › Literature classification
  - › Manuscript quality (writing, figures, organization,...etc)

- › Literature Experimental Evaluation
  - › Long and short lists of papers
  - › Evaluation outline and corresponding implementations from the short list (or a subset)
  - › Evaluation results

# Project: Deliverables and Assessment

> ## SIGSPATIAL Cup

>> Same criteria and deliverables of SIGSPATIAL cup winner teams

> ## Vision Analysis

>> Itemized analysis of the vision report

>> Quality of surveying work on each topic

> ## Interdisciplinary Project

>> Clear problem definition and importance

>> Survey of related work

>> Quality of the main deliverable, e.g., script, program, etc

# Paper Reviews and Presentations

› Two review assignment (10%)

  › Summarization of paper research elements

  › Paper critique

› One presentation per person (5%)

  › Large papers might be assigned to two persons

# 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

# Hands-on on Spatial Technologies

UCR GradSuccess
GradQuant

## Geospatial Data Analysis Workshop Series

*presented by*

**Dr. Sergio Rey**
**UCR Center for Geospatial Sciences**

> If interested, sign up at

https://UCR.MYWCONLINE.COM

INTRODUCTION TO GEOSPATIAL DATA PROCESSING IN PYTHON
TUESDAY, APRIL 24 | 9:10 – 11:00 AM

GEOVISUALIZATION WITH PYTHON
TUESDAY, MAY 1 | 9:10 – 11:00 AM

EXPLORATORY SPATIAL DATA ANALYSIS WITH PYSAL AND PYTHON DATA STACK
TUESDAY, MAY 15 | 9:10 – 11:00 AM

INTRODUCTION TO SPATIAL ECONOMETRICS WITH PYSAL
TUESDAY, MAY 22 | 9:10 – 11:00 AM

ALL WORKSHOPS WILL BE HELD IN LIFE SCIENCES 1425
TO SIGN UP, VISIT HTTPS://UCR.MYWCONLINE.COM

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# Final Exam

- › Lectures content

# 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.

# Credits

›   Prof. Shashi Shekhar course

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