Old Class web site
Gauchospace Site

Analytical and Computer Cartography is an upper division Geography class designed to enrich students knowledge and skill in the theory and practice of cartography. Class will consist of lectures that present the concepts behind computer mapping and laboratories in which students use open source mapping software to produce maps for themselves. Grades will be assigned on the basis of a mid-term and a final (each worth 25% of the grade) and five laboratory assignments, each worth 10%. Students are expected to create personal web-sites, and to add the completed maps they create to the site as the quarter progresses.

Occasional PDF files of papers will be added to the Gauchospace site under “Extras”, as coordinated to the lectures. While most of the readings are included because they will be mentioned in class, nevertheless you should read and absorb their content. The “Extras” links are for assorted web and other materials that I will mention in lectures and labs.

The class goals are: (1) to create students who can skillfully and knowledgeablely create high quality maps and graphics for other classwork, and for professional posters and presentations, both during and after their UCSB experience; and (2) to demonstrate that cartography consists of both theory (analytical cartography) and practice (computer cartography).

Lectures: T R 12:30-1:45 ELLSN 3621 Instructor: Keith Clarke http://www.geog.ucsb.edu/~kclarke/
Lab 1: 50732 W 3:00-4:50 ELLSN 2610 TA: Haiyun Ye
Lab 2: 50740 W 5:00-6:50 ELLSN 2610 : TA Marcela Suárez

Instructor Announcements
Text Book

Week One

Download Files
(no files available to download)

Latest news
Add a new topic...
(No news has been posted yet)
What you will learn

- The cartographic side of Geographic Information Science
- What AC is, where it came from, and where it's going
- Aspects of cartographic transformations
- Some extra details on 3D representation
- Several Open Source mapping packages
- How to build a map portfolio
The class

• Lectures 2x a week, video posted on old site
• Labs once a week
• 5 labs, 2 weeks per lab
• Labs are far more self-help based than 176. Use your intelligence!
• Web site
• Papers will be distributed on Gauchospace
• Gauchospace site
Your instructors

Keith Clarke, Professor

Marcela Suarez, TA

Haiyun Ye, TA
The lab work
ArcGIS/Open source/Freeware
Portfolio of maps
Many Choices

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The Class

• Taught as *Analytical Cartography* (Geog 482) at the University of Michigan by Waldo Tobler late 1960s on

• Topic of paper by Tobler in 1976, published the curriculum (more detailed than actual class!)

• Adopted by Keith Clarke at Hunter College in 1982, after taking the class at Michigan

• Led to *Analytical and Computer Cartography* 1990 textbook. 2 editions

• Moved the class to UCSB in 1996, taught in several other universities, including CUG Wuhan

• Many subsequent additions to the literature
Geog 482

COURSE OUTLINE

Analytical Cartography. Geography 482. 3 credits. Prof. Waldo R. Tobler University of Michigan, Ann Arbor, Michigan 48109, U.S.A.

Week I. Introduction. Relation to mathematical geography, geodesy, photogrammetry, remote sensing. Replacement of map data storage by computer data storage. Technological change and the need for theoretical approach. Historical perspective.


Week III. Geographical Matrices. Triagonal, quadrilateral, hexagonal, and Escher types. Notation, neighborliness property, topological invariance. The varieties of geographical data: nominal, binary, scalar, complex, colored, N-valued, and infinite-valued matrices. Isomorphism to the surface of the earth.

Week IV. Geographical Matrix Operators. Functions of matrices: algebraic, logical, differentiable, invertible; linear, local, spatially invariant (translationally and rotationally). Parallel processing, windows, edge effects. Finite difference calculations.


Week VI. Sampling and Resolution. Fourier interpretations of aliasing, band limited functions. Nyquist limit, comb functions. The sampling theorem, random plane sampling, invisible distributions.
Week VII. Quantization and Coding. Analogue and digital processing. Quantization error, reduction of. Information theory: how many aerial photographs are there? Huffman coding, higher order statistics, spatial autocorrelation functions. Television and choropleth maps.


Week IX. Pattern Recognition. Preprocessing, enhancement, feature extraction; discrimination and classification (linear, Gaussian); signal-to-noise ratios; perceptrons.


Week XI. Generalized Geographical Operators. Expansion of matrix operators to irregular point sets, to interval data, in such a manner as to include matrix as a special case. Generalized two-dimensional sampling theorem and reconstructions from sampled data.

Week XII. Geographical Coding. Information theoretical content of Latitude / Longitude, street address, ZIP code, telephone number, Public Land Survey, and the like.
Topological and metrical properties of place naming schemes. Gaussian coordinates. A variety of plane coordinate schemes. Formulae for working on sphere and ellipsoid.


*Week XV. Geographical Information Systems.* Band width requirements; dollar requirements; hardware and software. Input schemes, manipulation algorithms, output schemes. Historical overview and examples: TIROS-ERTS, CATS-PJ-BATS, CLIMLADS-DIME. Analytical approaches to using geographical data: optimization techniques, sensitivity testing, regionalization, spatial trend analysis, dynamic simulation, growth models, regional forecasting.
Curriculum

• Week 1:
  – Review: Geodesy and Scale
  – Review: Map Projections

• Week 2:
  – Review: Coordinate Systems
  – A transformational view of cartography

• Week 3:
  – What is Analytical Cartography?
  – Data storage and representation
• Week 4:
  – Spatial Data Structures for Mapping
  – Algorithms, mosaicing, and conflation

• Week 5:
  – Mid-Term
  – Geometric map transformations

• Week 6:
  – Open Source Cartography
  – Generalization and structure-to-structure transformations
• Week 7:
  – Grids, interpolation and extrapolation
  – Cartography’s institutions and past
• Week 8:
  – 3D Mapping and modeling
  – Technical Issues for 3D rendering
• Week 9:
  – The NSDI and A Digital Earth
  – Current research in Analytical Cartography
• Week 10:
  – A selective history of computer cartography, GIS and remote sensing
  – Class summary and review for final
The labs

- Topics: Map projections for grids, the fractal nature of line generalization, terrain analysis and rendering, more terrain analysis
- Software: ArcGIS, MapShaper, MapWindow GIS, Excel, MicroDEM, Landserf (on UNIX server)
- Instruction template as word doc—read carefully!
For example: Map Shaper
What I expect of you

- Stay up to date with the class, readings, lectures, labs
- Turn in labs on time
- Do original work
- Ask questions, come to office hours
- Use Gauchospace completely
- Try experiments
- Work hard, but work smart not too hard