Geog 176A: Introduction to GIS, Fall 2016
Prof. Dr. Werner Kuhn and Teaching Assistants

Lab 6: Granularity & Accuracy

Objectives

Through this lab, you will gain a deeper understanding of granularity and accuracy of geographic information by experimenting with the location, field, network, and event data from previous labs. Each question will revisit previous work and ask you about how applying and thinking about granularity and accuracy may change your previous conclusions. Granularity refers to the spatial and temporal level of detail of information. Having information at finer granularity means more detail and less generalization. Accuracy describes how faithful a representation is to the represented phenomenon.

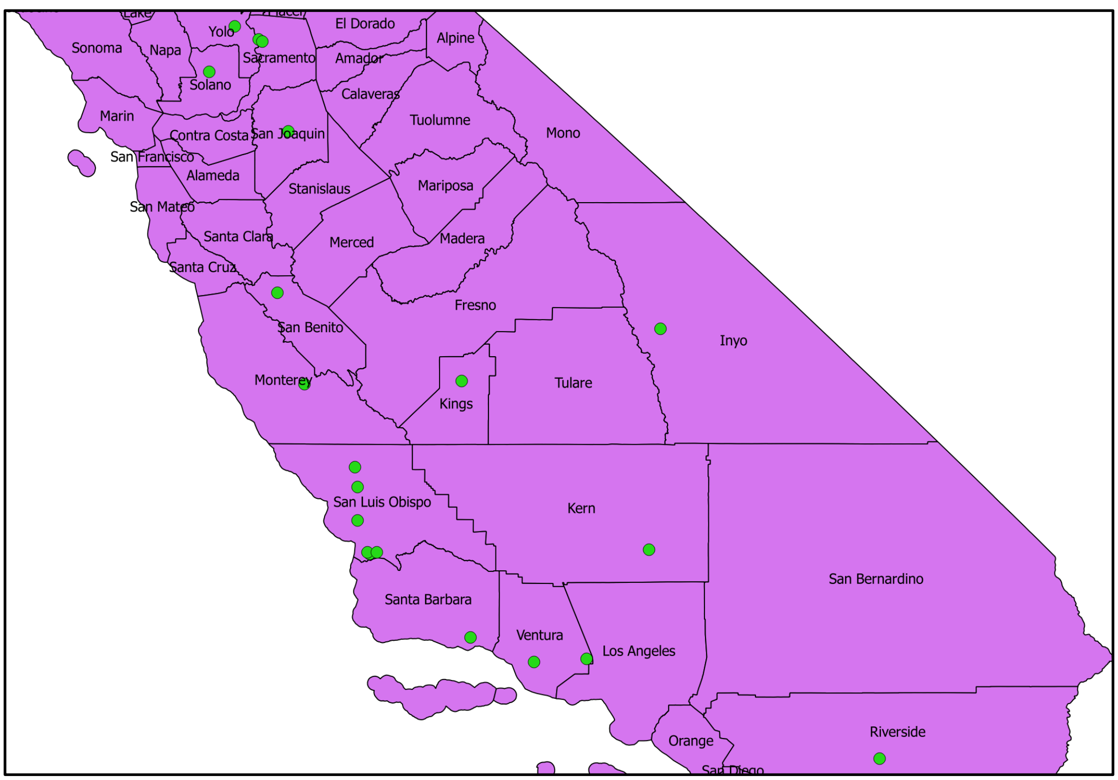
Tasks

Provide a technical report (as a single pdf uploaded in GauchoSpace) with precise answers to the following questions. Purple asterisks (*) indicate that the question requires a screenshot (45 points).

1. Revisit **location** information from Lab 1 as follows:
    a. Revisit your location answer in task 1a of Lab 1. First, restate your location for a friend who lives nearby. Next, state your location for somebody who lives abroad, has not talked to you in three years, and wants to know where you are now. How are these differences in description related to granularity? Is one of the two statements more accurate than the other? How would you determine the accuracy of each? (5 points)
    b. Write down your home address, then coarsen its granularity step by step and write down the results. How many steps can you take until the information no longer says anything meaningful about your home's location? (2 points)
    c. Recall task 9 from Lab 1 describing the Well-Known Text data structure. What part of the following Well-Known Text expression encodes information about granularity of the position: POINT(34.405285 -119.843856)? Does the WKT expression explicitly encode information about the accuracy of the position? (2 point)
    d. A professor's Skype profile says that he is at Latitude: 43.008508, Longitude: -78.783330. Determine what department this professor is in by using Google Maps to resolve the coordinates. In order for the professor's statement to be

accurate, by how far (what distance) is he allowed to move during the day? This page, particularly the "Degree precision versus length" table, shows how coordinate granularity translates to distances on the ground. How would you coarsen the granularity of this location information? (4 points)

2. Think about your work with **field** information in Lab 2.
    a. Open this web app and experiment changing the granularity of the DEM. *Report the coarsest resolution scalar value at which you can still reasonably interpret geographic features in the DEM and take a screenshot. What features are visible and what do the pixel values represent? (3 points)
    b. In Lab 2, you downloaded a DEM. When you zoom in to the DEM, does the granularity of the data change? Why or why not?. (2 points)
    c. How would you determine the accuracy of the pixel *values* in the Digital Elevation Model? Describe what data you would need to do so. (2 points)
    d. Revisit your air quality station point data and California counties within the map below. For which county of California would you expect the air quality estimation to be the most accurate? Why? (2 points)



3. Revisit your work with **object** information in Lab 3.
    a. Remember that slope information was one of the fields used in combination with other information to deduce optimal object rooftops for solar

installation. If you had been supplied with a slope field with a coarser granularity than the one you used, why could this be problematic when determining solar energy potential? (1 point)

b. You produced *slope* and *aspect* data from your original DEM. Why can't these data ever have an accuracy as as high as that of the original DEM? (2 points)
c. The rooftop polygons exhibit granularity by their shape. What is the relation between granularity and shape complexity ? (2 points)
d. Why does the accuracy of the rooftop shapes matter for the purposes of assessing solar energy potential? (2 points)

4. The **network** information from Lab 4 is more involved regarding granularity and accuracy.
    a. If you ask three people for driving directions to get from UCSB campus to Los Angeles, you are likely to get directions at different granularities. List three example snippets of directions with varying granularities of your origin and destination. (3 points)
    b. How does temporal granularity relate to the service area polygons you generated at the end of the network lab? (1 point)
    c. Give examples from the network lab dataset for *nominal* values of edge attributes. Describe what the possible attributes of nominal values indicate about the thematic granularity of a network. (2 point)
    d. State two ways in which edges in the road data of lab 4 could be inaccurate. (2 points)

5. When it comes to **events (Lab 5)**, information *quality* plays a key role for decision making.
    a. Recall the time slider activity from task 6 in Lab 5. Do the Thiessen polygons (representing campus service areas of wireless access points) have a fixed or variable spatial granularity? Is their temporal granularity fixed or variable? (2 points)
    b. How accurately do the trajectories computed from the connection events represent the paths taken by the device owners? (1 points)
    c. Imagine a power outage at the Davidson Library. How will the spatial granularity of the wireless service area polygons change overall in response to this event? (2 points)
    d. At a display rate of around 30 frames per second and higher, the human eye interprets sequences of still photos as depicting motion. Assuming that a frame requires 2 megabytes of storage space, estimate the storage required for a realistic animation lasting 1 day. Show your calculation steps and your answer for what the total storage amount is in GB. Assess the accuracy of

your estimate by explaining which assumption(s) in your computation introduced uncertainty when calculating your storage estimate. (3 points)