Exercise 2: Digitizing and Image Interpretation

112 Points scaled to 20 Points

Introduction

In this exercise, you will digitize, or draw, new geospatial vector data via interpretation of geospatial data layers. Two separate tasks will be explored: interpretation of high spatial resolution aerial orthophotography to digitize a college campus and interpretation of light detection and ranging (LiDAR)-derived hillshades to map valley fill faces resulting from surface coal mining. In the last section, you will solve some problems relating to photogrammetry.

Objectives

- *Interpret geospatial data to create new, vector layers representing features of interest*
- *Create new feature classes or vector files to draw into with defined geometry types, coordinate reference systems, and attribute columns*
- *Create a map layout to display your results*
- *Work with web map services*

Prerequisite Materials

- Modules: Aerial Imagery and Photo Interpretation
- Videos
  - Lab 2 Intro: https://youtu.be/MNNjMwWQizo
  - Digitizing: https://youtu.be/8b9IM-WVcRc

Data

Campus Map

- **Alderson_Broaddus**: feature class showing extent of campus as a rectangular bounding box
- **wv_imagery_WVGISTC_leaf_off_mosaic**: high spatial resolution image mosaic for entire state of West Virginia made available as a web service by the West Virginia GIS Tech Center (https://www.mapwv.gov/gis_services.html)

Highwalls Map

- **highwalls**: example highwalls mapped as line features

- **wv_imagery_WVGISTC_leaf_off_mosaic**: high spatial resolution image mosaic for entire state of West Virginia made available as a web service by the West Virginia GIS Tech Center (https://www.mapwv.gov/gis_services.html)
- **wv_hillshade_1m_mosaic**: 1 m spatial resolution hillshade for West Virginia derived from the best currently available data. Provided by the West Virginia GIS Tech Center as a web service (https://www.mapwv.gov/gis_services.html)

ValleyFills Map

- **example_vfills**: example digitized valley fill faces within adjacent extent
- **DrawingGuide**: square grid to aid in drawing and navigating
- **vfill_region_to_digitize**: new region needing interpreted
- **wv_hillshade_1m_mosaic**: 1 m spatial resolution hillshade for West Virginia derived from the best currently available data. Provided by the West Virginia GIS Tech Center as a web service (https://www.mapwv.gov/gis_services.html)

Task 1: Campus Digitizing

Your first task is to draw or digitize features within the Alderson Broaddus University campus in Philippi, West Virginia (Figure 1). Here is a link to a labelled map of the campus to reference as you draw: https://ab.edu/campus-map/4/

Figure 1. Alderson Broaddus University Campus

You will need to do the following:

- Create new layers or feature classes in which to draw your features. You should create the following: buildings, athletic facilities, roads, sidewalks, and point features.
- Digitize all academic buildings, administrative buildings, and residence halls. Create an attribute in the table to differentiate academic buildings, administrative buildings, and residence halls.
    - Academic Buildings: Whitescarver Hall, Kemper-Redd Hall, Paul Jones Hall, Picket Library, Withers-Brandon Hall, and Myers Hall.
    - Residence Halls: Blue, Gold, University, Benedum, Priestley, Kincaid, and Battler
    - Administrative Buildings: Burbick Hall, Wilcox Chapel, Heiner Hall, and Erikson Alumni Center.
- Digitize all the athletic fields/facilities: Multi-Sport Performance Stadium, Practice Fields, and Tennis courts.
- Digitize all roads into a line feature class.
- Digitize all sidewalks into a line feature class.
- Digitize the following point features: Apollo statue and UHK bandstand.
- You do not need to digitize the parking lots.

Create a map layout to show your result. It will be graded using the following rubric:

- Different symbology is used to differentiate the three building types. (6 Points)
- The athletic facilities are displayed differently than buildings. (2 Points)
- Sidewalks and roads are distinguished. (4 Points)
- Include labels for the buildings, athletic facilities, and point features. (4 Points)
- Include a legend explaining all symbology. (6 Points)
- Along with the map, include the following in the map layout: scale bar, north arrow, title, your name, and citation for the orthophotography (cite the WV GIS Tech Center). (6 Points)
- Map should be overall neat and well organized. (6 Points)
- All line and polygon features should be accurately and neatly digitized. (6 Points)

Task 2: Valley Fill Face Digitizing

In the second component of the assignment, you will interpret hillshade images to digitize geomorphic features resulting from surface mining. Specifically, you will

digitize valley fill faces, which result from mountaintop removal mining and subsequent reclamation. Note that that Highwall map has just been provided as an example. You do not need to use it to complete the exercise. Figure 2 provides an example of the provided data and extent to digitize while Figure 3 shows an example valley fill face. Please see this paper for a discussion of valley fill face mapping:

Maxwell, A.E., M.S. Bester*, L.A. Guillen*, C.A. Ramezan, D.J. Carpinello*, Y. Fan*, F.M. Hartley*, S.M. Maynard*, and J.L. Pyron*, 2020. Semantic segmentation deep learning for extracting surface mine extents from historic topographic maps, *Remote Sensing*, 12(24): 1-25. https://doi.org/10.3390/rs12244145.

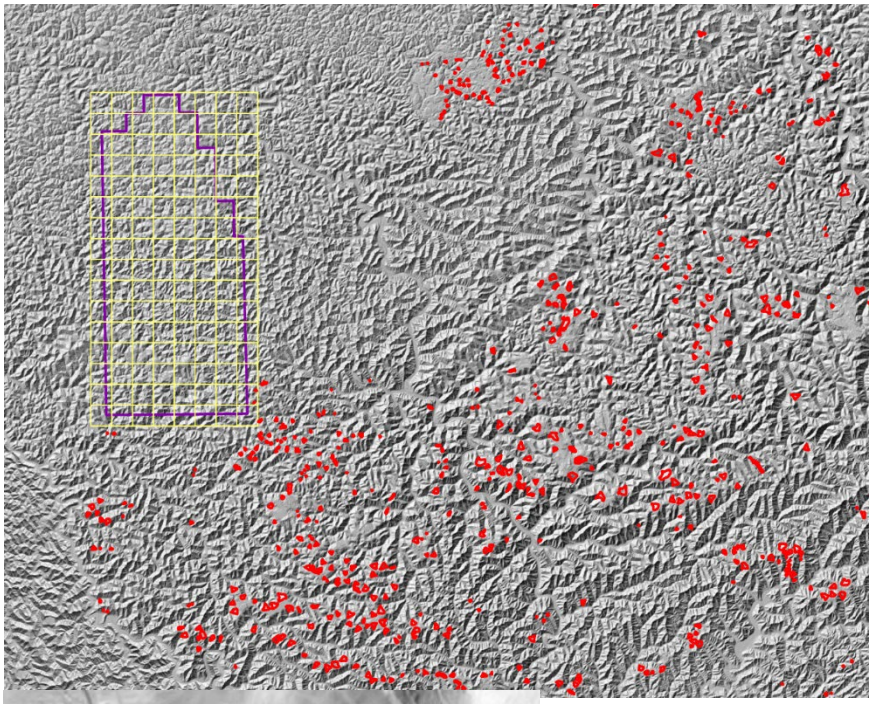

Figure 2. Extent to digitize, guide grid, and example valley fill faces.

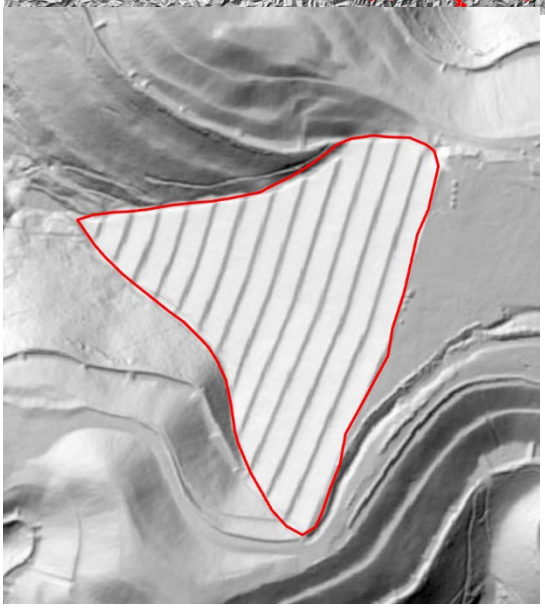

Figure 3. Example digitized valley fill face.

You will need to do the following:

- Create a new layer in which to digitize valley fill faces occurring in the new extent. Use the provided examples to guide you in the digitization.
- Digitize at least 6 valley fills faces in the new extent. You do not need to digitize all of them.
- Calculate the area of each fill in the attribute table in hectares.

Create a map layout to show your result. It will be graded using the following rubric:

- Create a layout containing six maps. Each map should be zoomed in to show one digitized valley fill face. (8 Points)
- Include a scale bar and north arrow for each map. (4 Points)
- Include an inset map with extent indicators showing the location of each of the six fills in the new region to digitize. This should include the region boundary and the extent indicators for the six maps. (10 Points)
- Include a title, your name, and cite the WV GIS Tech Center as the source of the hillshade data. (6 Points)
- The map should be overall neat, well organized, and use space well. (6 Points)
- Features should be digitized well. The level of detail should be similar to that of the example data. (6 Points)

Photogrammetry problems

Answer the following questions using the provided information and photogrammetric equations.

Assume that two road intersections shown on a photograph can be located on a 1:24,000 scale topographic map. The measured distance between the intersections is 50.8 mm on the map and 80.6 mm on the photograph.

Question 1: What is the scale of the photograph? (4 Points)

Question 2: At that scale, what is the length of a fence line that measures 100.2 mm on the photograph? (4 Points)

A camera equipped with a 180 mm focal length lens is used to take a vertical photograph from a flying height of 3000 m above ground level. The terrain is flat and located at an elevation of 700 m.

Question 3: What is the scale of the photograph? (4 Points)

Assume that a vertical photograph was taken at a flying height of 4500 m above sea level using a camera with a 180 mm focal length lens.

Question 4: Determine the photo scale at point A, which lies at an elevation of 1200 meters. (4 Points)

Question 5: Determine the photo scale at point B, which lies at an elevation of 1960 meters. (4 Points)

Question 6: What ground distance corresponds to a 13.2 mm photo distance measured at each of these elevations? (4 Points)

A camera equipped with a 160 mm focal length lens is used to take a vertical photograph from a flying height of 3000 m above ground level. The average elevation of the terrain is 400 meters

Question 7: What is the average scale of the photograph? (4 Points)

Assume the relief displacement for a water tower is 1.78 mm, and the radial distance from the center of the photo to the top of the tower is 51.22 mm. The flying height is 2000 m above the base of the tower.

Question 8: Find the height of the tower. (4 Points)