Aerial/Satellite Imagery Retrieval

CS513 Geospatial Vision / Visualization
Assignment 3

Jiaxing Wu(A20398273) / Jingwen Pickens(A20349887) / Sumukh Ballal(A20442681) / Hyesoo Noh(A20360464)

Introduction

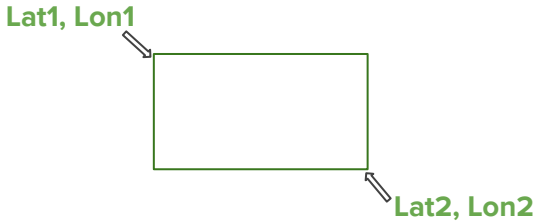
- For this assignment, we wrote a program that automatically downloads aerial imagery with maximum resolution available given a user input bounding box
- Input
  - Latitude/longitude pair for the top left corner of the bounding box
  - Latitude/longitude pair for the bottom right corner of the bounding box
- Output
  - An aerial imagery within the bounding box defined by the user

Background / Motivation

- Bing Maps provides a world map that users can directly manipulate to pan and zoom
- When an user inputs latitude and longitude, we always want to output an image with the highest zoom level
- Having chosen the projection and scale to use at each level of detail, Bing Map can convert geographic coordinates into pixel coordinates
- To optimize the performance of map retrieval and display, the rendered map is cut into tiles pixels
- To optimize the indexing and storage of tiles, the two-dimensional tile XY coordinates are combined into one-dimensional strings called quadtree keys

Approach

Part 1 : Image Retrieval

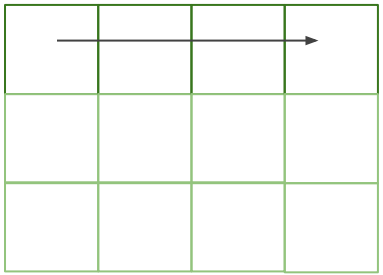


- Take two lat/lon coordinates which define a bounding box
- Start at the max level of detail (level=23) and decrement the level until the max level of detail available is found for the given bounding box
  - At each level, do:
    - Convert lat/lon coordinates to pixel coordinates, then tile coordinates at this given level
    - Convert the generated tile coordinates to quadkeys
    - Check whether the image downloaded using the quadkeys are valid
      - If the images are null images, decrement level and repeat the process
      - If the images are valid, we have found the max level available for this bounding box
- Once the max level of detail is found for this bounding box, tile images are retrieved for this bounding box one row at a time

Approach

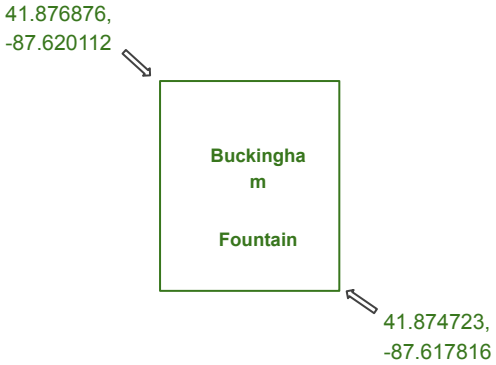
Part 2 - Image Stitching

- In the image retrieving step, tile images are downloaded one row at a time



- Since all tile images are of the same level of details and have the same width and height, rows of tile images are simply stitched together using numpy.concatenate() with axis=0

Results



- The highest level of detail available for this bounding box is level 20
- The final aerial image of this bounding box is composed of 72 individual tile images at level 20

Conclusion

- Level 20 is the max level of detail for all bounding boxes tested for varies Chicago and NYC locations
- Quadkeys generated at levels above 20 returns null tile images for all bounding boxes tested

Reference

- Bing Maps Tile System

  https://docs.microsoft.com/en-us/bingmaps/articles/bing-maps-tile-system