Drone Image Querying using Spatial Indices

Problem

- We are trying to find the set of all images, covering a specific GPS point/points.
- This can be framed in the following manner “Hey Drone, Give me all your images which capture (lat,long)”

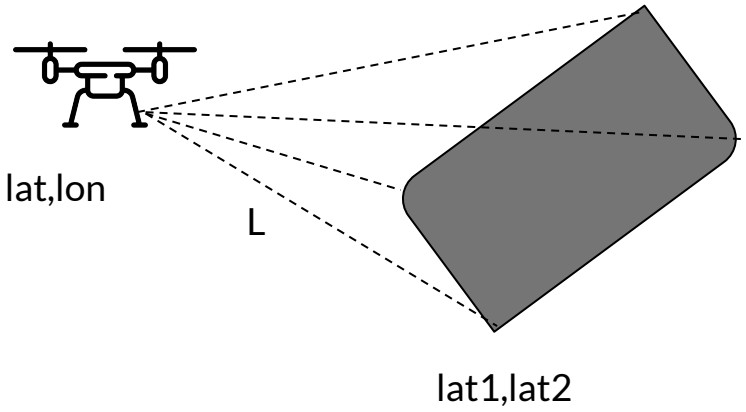
Approach 1

- Find the boundary GPS points of images.
- For every query by the user, we need to check if the query point falls within the boundary GPS points of each image.

Image Id	Drone GPS	bt_left	tp_left	tp_right	bt_right

Demerits of Approach 1

1. Inaccuracies
   Estimating distances from a single monocular image is extremely inaccurate.



2. For a set of 81,000 images, calculating 4 boudary points is expensive.

Spatial Indexing

- Spatial indices are a family of algorithms that arrange geometric data for efficient search.

- Example : “return all buildings in this area”, “find 1000 closest gas stations to this point”, and returning results within milliseconds even when searching millions of objects.

- Typically two types of queries a

  A. Range queries

  B. Nearest Neighbour Queries

How does this fit our need?

- Data changes are usually much less frequent than queries, so incurring an initial cost of processing data into an index is a fair price to pay for instant searches afterwards.

- After indexing data our queries would be of the form:
  “Hey Drone, give me all the images you took which are close to lat_Q,lon_Q”.

- This should return us a set of images which are closest to the lat_Q,lon_Q

- This is quicker and the data structure object can be once created and used for any number of queries.

Literature Review for the above

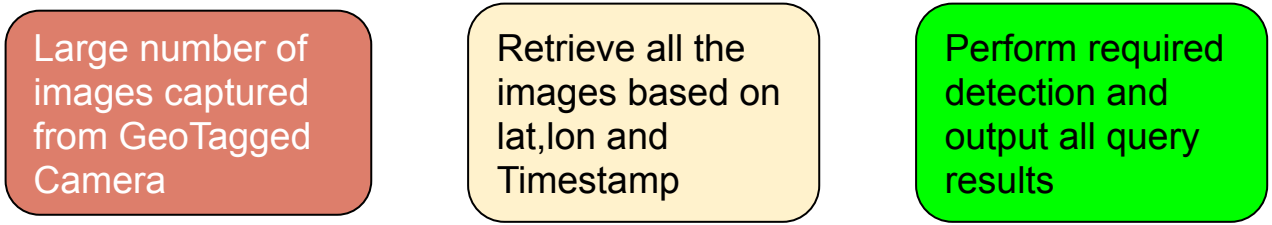
- Efficient Indexing and Querying of Geo-tagged Aerial Videos
- Querying geo-tagged videos for vision applications using spatial metadata

(To read more for new ideas)

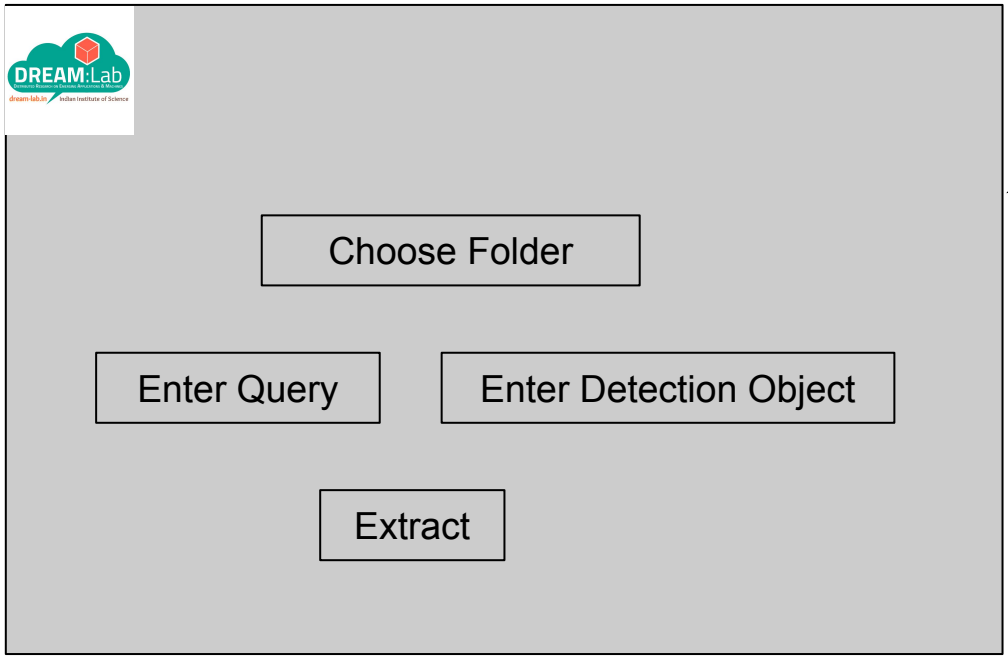
What else can be done?

- Instead of just an algorithm as a lab we can develop an entire application/pip-package called QDrone (Query Drone) where users can drop down their files, and we provide a querying interface for them.

- We can add querying objects, For example
  ‘Hey Drone, give me all the cars you detected at lat_Q, lon_Q around this HH:MM’



QDrone Tool



Input: GPS Sheet and images

Output: All FOV as per Query with bounding boxes