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CSCI-UA 476
Professor Malavet

Big Data Project Proposal

Project Title
Aircraft Traffic Routes Analysis

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Project Description

This application will digest publicly available tracking data for commercial aircraft across the globe, and analyze the most heavily trafficked geographic segments of the sky. Based on the frequency of travel by planes through certain segments (within a certain degree of precision), I will establish the most commonly used routes. My initial analysis will looks at the most commonly traveled flight segments in various geographical regions (e.g., Northeastern United States). I will also join secondary datasets with additional metadata such as what aircraft model and what airline is operating a certain flight. From there I can also stratify my analysis by airline and aircraft type.

Who will benefit from your analytic?

There are multiple groups that may be interested in this analysis. First, airlines and air traffic controllers would be interested in the commonly traveled flight segments so that alternative routes can be established that may avoid congestion. Additionally, the general population may be interested to know where aircraft frequently travel because a heavily trafficked tract of sky may lead to higher levels of air and noise pollution for residents who live there.

What insight will you derive from the data?

The most common segments of the sky that commercial aircraft traverse based on region, airline, or aircraft type.

Describe how you will check the goodness of the analytic. i.e., why do you believe that the results are accurate and can be trusted?

I will compare the commonly traveled segments that I find to the routes established by government authorities (e.g. the FAA in the United States). This will verify that the popular segments I find fall within the bounds of where aircraft are expected to travel.

In addition, one can identify common air routes used by aircraft by applying a clustering algorithm called DBSCAN on the flight trajectory data, according to several research papers. Applying this algorithm to the flight data and comparing the results may also provide valuable insight into the validity and accuracy of my results.

Research papers

- "From aircraft tracking data to network delay model: A data-driven approach considering en-route congestion" (https://doi.org/10.1016/j.trc.2021.103329)
- "Trajectory Clustering and Classification for Characterization of Air Traffic Flows" (https://doi.org/10.2514/6.2016-3760)
- "Characterizing air traffic networks via large-scale aircraft tracking data: A comparison between China and the US networks" (https://doi.org/10.1016/j.jairtraman.2017.12.005)

Data sources

Flight tracking data (main dataset)
Source: https://www.adsbexchange.com/data/#sample
Full schema: https://www.adsbexchange.com/version-2-api-wip/
Relevant fields:

hex	the 24-bit ICAO identifier of the aircraft, as 6 hex digits
flight	callsign, the flight name or aircraft registration as 8 chars
r	aircraft registration pulled from database
t	aircraft type pulled from database
lat	the aircraft position in decimal degrees
lon	the aircraft position in decimal degrees

Aircraft database

Source/schema: https://openflights.org/data.html#plane

Relevant fields:

Name	Full name of the aircraft.
IATA code	Unique three-letter IATA identifier for the aircraft.
ICAO code	Unique four-letter ICAO identifier for the aircraft.

Airline database

Source/schema: https://openflights.org/data.html#route

Relevant fields:

Name	Name of the airline.
Alias	Alias of the airline. For example, All Nippon Airways is commonly known as "ANA".
IATA	2-letter IATA code, if available.
ICAO	3-letter ICAO code, if available.
Callsign	Airline callsign.
Country	Country or territory where airport is located. See Countries to cross-reference to ISO 3166-1 codes.

Extra datasets (may or may not use)

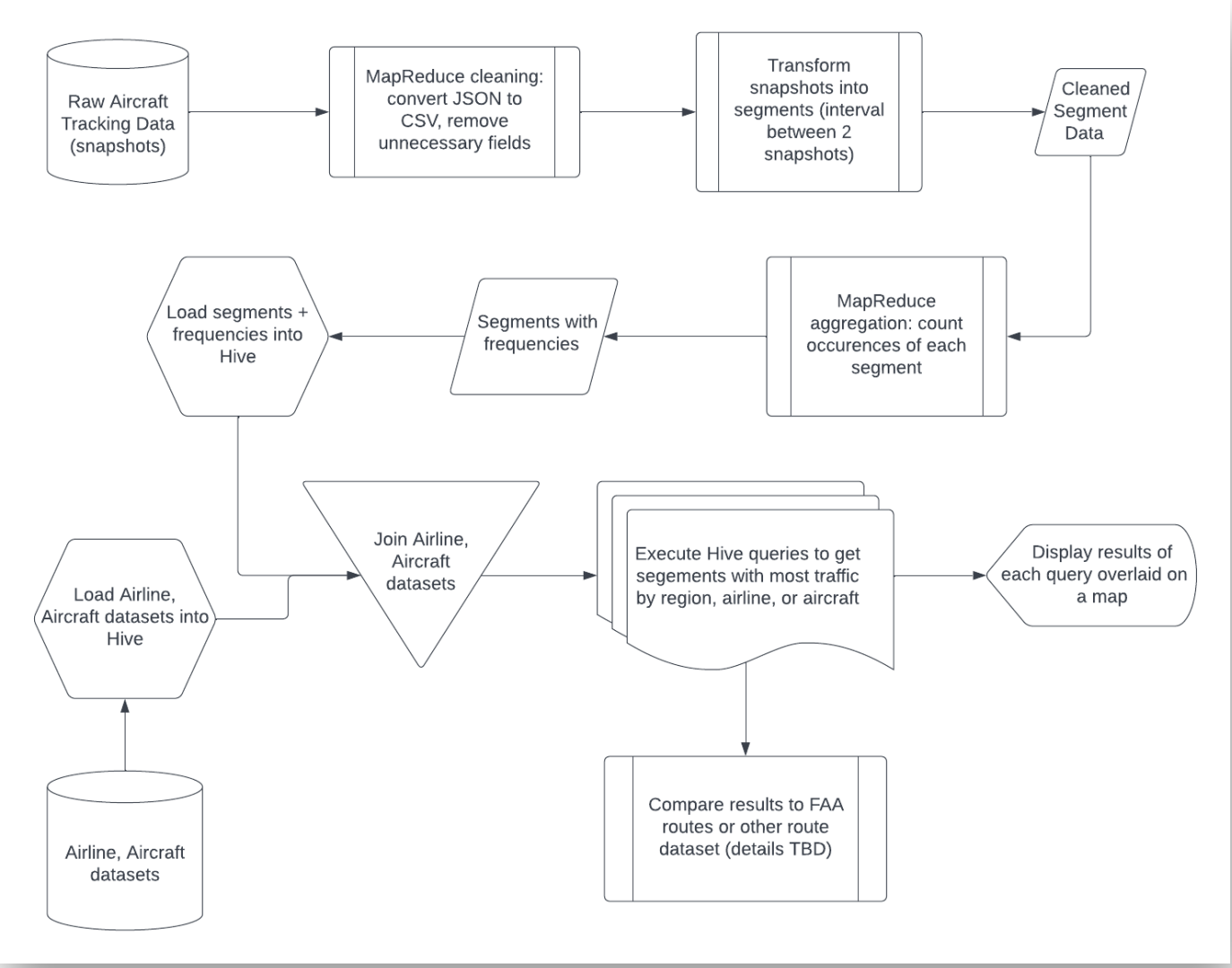
Countries: https://openflights.org/data.html#country

Routes: https://openflights.org/data.html#route

FAA Routes: https://www.fly.faa.gov/rmt/nfdc_preferred_routes_database.jsp

FAA Waypoints: https://www.faa.gov/air_traffic/flight_info/aeronav/aero_data/Loc_ID_Search/Fixes_Waypoints/

Initial design diagram



Initial Task List