Aerolyzer Problem Statement

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Abstract

Atmospheric aerosols are tiny particles suspended in the atmosphere. They originate from natural sources such as volcanic eruptions and unnatural source such as pollution. Concentrations of aerosols can act as sites for chemical reactions, some of which degrade the ozone layer, reflect sunlight, and cool or warm regions beyond their natural weather patterns. One can witness the effects of aerosols in their scattering effect of sunlight which visibly reddens sunset and sunrises. Generally, horizons with vibrant colors indicate a high concentration of aerosols. Aerosol analysis is performed through a combination of satellite, aircraft, and ground-based instruments. In the context of a typical citizen, the data collected by these instruments is largely unavailable or ambiguous to understand. Currently, there is no way to judge local atmospheric quality using regional aerosol analysis without in-depth atmospheric knowledge. Moreover, delayed or inaccurate atmospheric reports complicate getting reliable local atmospheric information. Atmospheric aerosols are constantly changing and interact with the Earth's climate. One strategy to bridge this information-gap is to analyze the horizon's color from a local location by crowd-sourcing cell phone images.

I. Problem Definition

The Aerolyzer project requires a python library that provides local air quality information based on zip codes by analyzing images of the horizon. The secondary goal of the Aerolyzer project is to develop a web-based application that fully utilizes the python library. The atmospheric analysis shall presented to the user in a clear set of visualizations and values. Currently, available mobile applications to judge air quality based on smart phone images uses color-sensitive algorithms to approximate air quality. While this is useful, there is a need for a tool that a) focuses on images where aerosol analysis can be performed (namely clear images of the horizon), b) combines existing weather APIs to extrapolate greater information about the local weather, and c) compile said data into a central database for trend-analysis.

II. Proposed Solution

The web-end UI shall present two options to the user: contribute to the Aerolyzer project by uploading their image of the horizon, or look up local air quality by zip code. The Aerolyzer web application shall use a classification algorithm to filter out images that do not contain the horizon or images that are not of sunrises or sunsets. Acceptable images shall be stored and categorized in a database for future analysis. Users who want to view an estimate of their local air quality shall be able to input their zip code into the Aerolyzer web application. The server-side python API shall then perform an analysis on relevant images in its database based on date, location, and 3rd party APIs.

The Aerolyzer python library shall be able to identify sunrises, sunsets, the horizon, and atmospheric phenomena. The library hopes to gather additional information on aerosols by analyzing the color of the sky. The Aerolyzer application that will utilize the python library has been developed in Django and will have to be expanded in order to properly display the atmospheric data in a appealing manner.Images and other data from available sources will assist in the inferences of atmospheric aerosol composition, as well as aid in determining the type of atmospheric phenomenon the image displays.

III. Performance Metrics

When completed, this library shall identify sunsets and sunrises in pre-loaded images with a minimum of 50% degree of certainty. This certainty shall also be verifiable through a series of regression tests to prove the accuracy of horizon detection. The library will be able to provide general weather data amassed from public API regardless of whether the user provides a image or not. The color analysis of user input images will only be available on images that are identified as sunsets or sunrises. To further standardize future development, a development environment shall be crated.

SIGNATURES

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