CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
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Project Number
S1512

Project Title
Image-Based Air Quality Prediction Algorithm

Abstract

Objectives/Goals
Air pollution is a concerning global issue with increasing public awareness and serious health consequences. As air quality and smog levels fluctuate throughout a city within a matter of hours, with pollutants circulated by wind and trapped by buildings, it is difficult to know whether it is safe to breathe the air. Air quality index (AQI) values representing the concentration of particles as small as 2.5 micrometers are recorded by sensors. We attempt to estimate the AQI using only the visual characteristics of an image representing the region.

Methods/Materials
The single image haze removal with dark channel prior algorithm uses the assumption of the #dark channel# in the three color channels within a window to estimate the levels of atmospheric degradation per color channel, which is then used to remove the haze and create a depth map relative to the amount of atmospheric interference calculated. This calculated atmospheric value can be used to estimate the AQI. Using a set of images covering years# worth of smog in Beijing, China, alongside data gathered from the Beijing US Embassy covering hourly AQI values, we created a model of the relationship between the atmospheric values outputted by the dehazing algorithm from the images and the corresponding AQI values.

Results
Our results show that there is relationship between the atmospheric and AQI data, but easily loses accuracy in its predictions when any source of error is introduced through discrepancies in the data, such as different locations or times. With adjustments made to flag known sources of error, an accurate linear model was developed to predict AQI levels based on the characteristics of the given image.

Conclusions/Discussion
The ability to quantify smog levels from an image introduces many possibilities with which this data and process can be used or improved upon for the benefit of smog-afflicted citizens.

Summary Statement
I developed a targeted algorithm to use only the visual characteristics given by a digital image representing a region to quantify and estimate the smog levels as the air quality index of the region.

Help Received
I was advised and mentored by Dr. George Cutter from the South West Fisheries Science Center, a branch under the National Oceanic and Atmospheric Association.