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EMPIRICAL CORRELATIONS AND ANOMALIES BETWEEN GEO-ECOLOGICAL FACTORS AND SKIN CANCER INCIDENCE RATES

Abstract

This study investigates the correlation between the rate of skin cancer cases and the pollution index ozone layer thickness, i.e. whether pollution is a direct factor in skin cancer cases. Pollution's effect on skin cancer cases is established on a theoretical level. It's known that UV-B initiates skin cancer, finding that every 1% decrease in ozone corresponds to a 2% increase in UV-B irradiance and a 2% increase in skin cancer incidence. Current studies show that UV-A interacts with airborne pollutants to initiate skin cancer. There is a strong theoretical basis to justify that skin cancer incidence is directly proportional to pollution and ozone depletion. With 700,000 new cases in the U.S.A. (1993), there is an obvious importance in finding all causes of skin cancer.

The data is based on in-flight analysis of images aboard the ISS. The methodology for oceans is to observe the luminosity reflected by the water, using the Raspberry Pi HQ camera's longwave ultraviolet sensitivity ($255 - 300$nm), therefore measuring the albedo. In turn, more reflected radiation implies the lack of ozone (which would otherwise absorb lower wavelengths). The continental part is studied using NDVI, a quantitative variable for vegetation that shows the presence of healthy plants; which, along with its geographical position, conveys the influence of pollution. The Coral-ML accelerator has been employed for image classification to run an image recognition model on multiple 40×40px segments of the same picture.

The study found a significant correlation between the pollution level/ozone layer thickness and the melanoma of skin cancer incidence. Analysing the images via proxy variables obtained accurate results along with some interesting anomalies that have been further explained. Numerically, each weighted Pearson coefficient $|\rho_{XY\to Z}|, |\rho_{X\to Z}|, |\rho_{Y\to Z}| > 0.41$ meaning that there is a moderate correlation between pollution-levels ozone and skin cancer cases. Additionally, $\rho_{X\to Z} < 0.51$ shows a moderate-high negative correlation, where increasing pollution levels increase skin cancer cases. Surprisingly, the partial Pearson correlation coefficient was $\rho_{XY\to Z} < \rho_{X\to Z} \wedge \rho_{XY\to Z} < \rho_{Y\to Z}$ smaller than the individual correlation coefficients for melanoma of skin and ozone layer thickness independently/individually affecting skin cancer cases. This means that there exist cases where pollution and ozone layer thickness cancel each other. If the pollution level is moderate, it may fix a possible ozone layer hole, solving the ozone-related problem and preventing high CO_2 levels.