JAYPEE INSTITUTE OF INFORMATION AND TECHNOLOGY

Bachelor of Technology, 5th Semester

AGRICULTURAL BURNING AND ITS EFFECT ON AIR QUALITY OVER NORTHERN INDIA

Group details:

Soumya Agarwal(17103347)

Meetanshi Mittal(17103343)

Shivam Bisht(17103199)

Submitted to:

Dr. Ankita Verma

Dr. Megha Rathi

Guided by:

Dr. Parmeet Kaur

RELEVANCE

Most of the air pollution that is responsible for public health emergencies in Delhi every winter is caused by crop burning in neighboring states, scientists at Harvard University say in a recent study.

Although Delhi witnesses a spike in particulate matter PM 2.5 limits round the year, the ambient PM2.5 concentrations show spikes in October-November, which is also the peak season for paddy harvesting, when abundant crop residue is burnt by farmers to prepare for the next crop.

Since the harvesting season coincides with the post-monsoon conditions which favours stagnation of wind in northern India, these conditions allow smoke to slowly permeate throughout the Indo-Gangetic region including Delhi. This smoke mixes with existing pollution from cars and factories creating a thick, deadly haze.

Despite a national ban and regulations by National Green Tribunal Act of 2010, the practice continues as farmers and government remain at loggerheads over a cost-effective alternative.

RESEARCH PAPER SUMMARY

- **Agricultural Burning and Air Quality over Northern India: A Synergistic Analysis using NASA's A-train Satellite Data and Ground Measurements**

In the recent years, New Delhi, the capital city of India, has ranked among the most polluted cities in the world regarding its air quality related to the submicron Particulate Matter (PM2.5). Using NASA's A-train satellite data (MODIS, OMI, and CALIOP), ground-level PM2.5 measured in New Delhi , and back-trajectory calculations, we show that the PM2.5 over New Delhi is strongly affected by the agricultural fires in the northwestern Indian states of Punjab and Haryana during the post-monsoon season (October and November). The mass concentration of PM2.5 escalates from ~50 µg m–3 measured prior to the onset of residue burning in early October to as high as 300 µg m–3 (24-hour averaged, 7- day running mean) during the peak burning period in early November. A linear regression analysis reveals that the variations in PM2.5 over New Delhi can be attributed to the concurrent changes in the satellite retrievals of fire counts and aerosols over the crop burning area. The back-trajectory analysis shows that most clusters (> 80%) of the northwesterly flow near the ground intercepted the crop burning region before arriving at the receptor location in New Delhi; this further corroborates the transport patterns inferred from the satellite data. A 15-year long satellite record (2002–2016) reveals an increasing trend in agricultural fires (~617 per year) and aerosol loading (0.031 and 0.04 per year in aerosol optical depth and UV aerosol index) in November. Increasing levels of crop residue burning and resulting particulate matter pollution at an alarming rate over northern India is a pressing concern demanding corrective measures to substantially reduce or completely diminish the crop burning through an effective residue management system.

WORK PLAN

What we have already done:

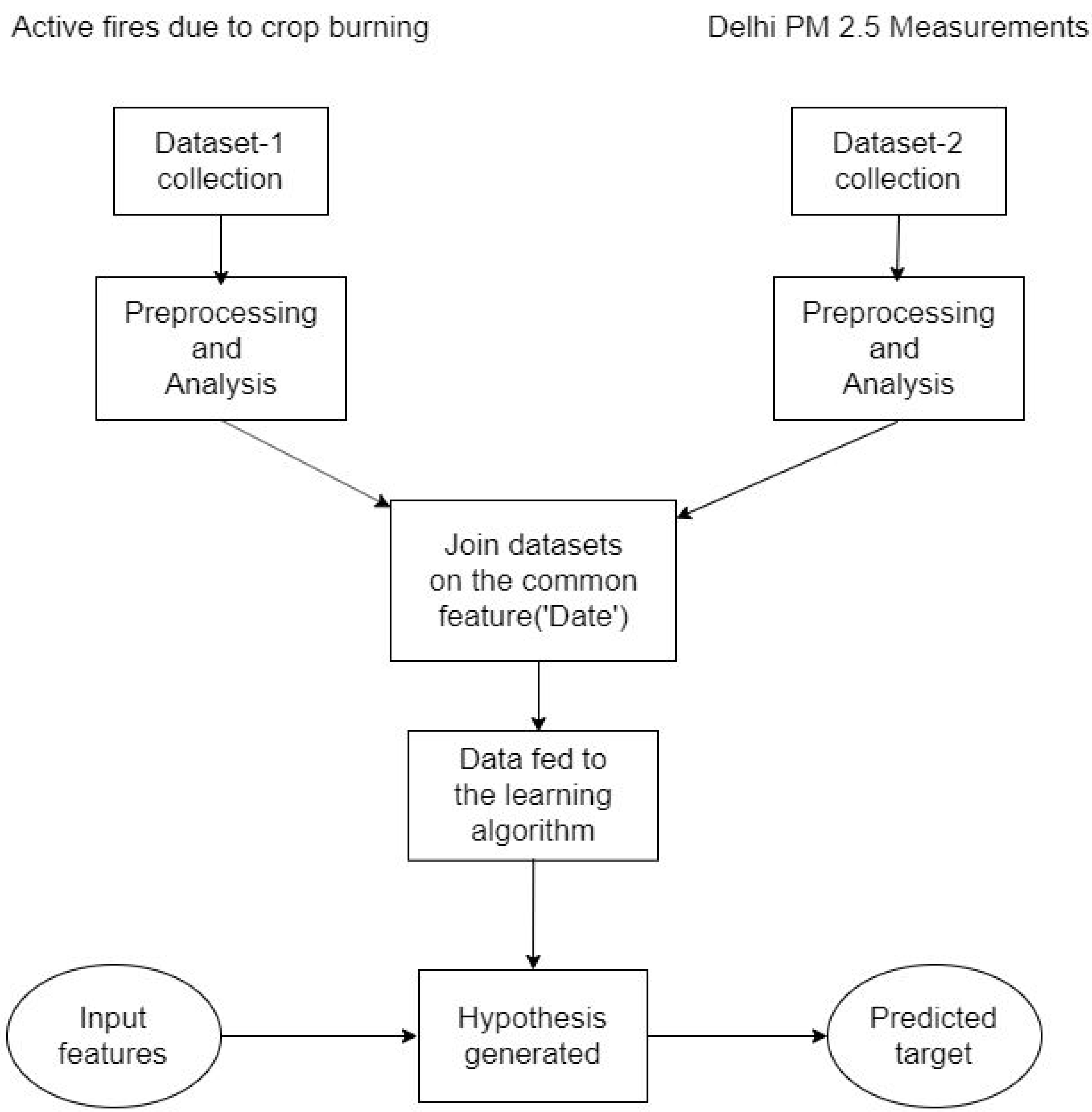
- Collection of datasets
- Preprocessing and analysis
    - Visualization
    - Correlation matrix
    - Feature extraction
- Establishing relationships between datasets
- Mapping of datasets using python libraries

Project link: https://github.com/Meetanshi18/crop-burning-analysis

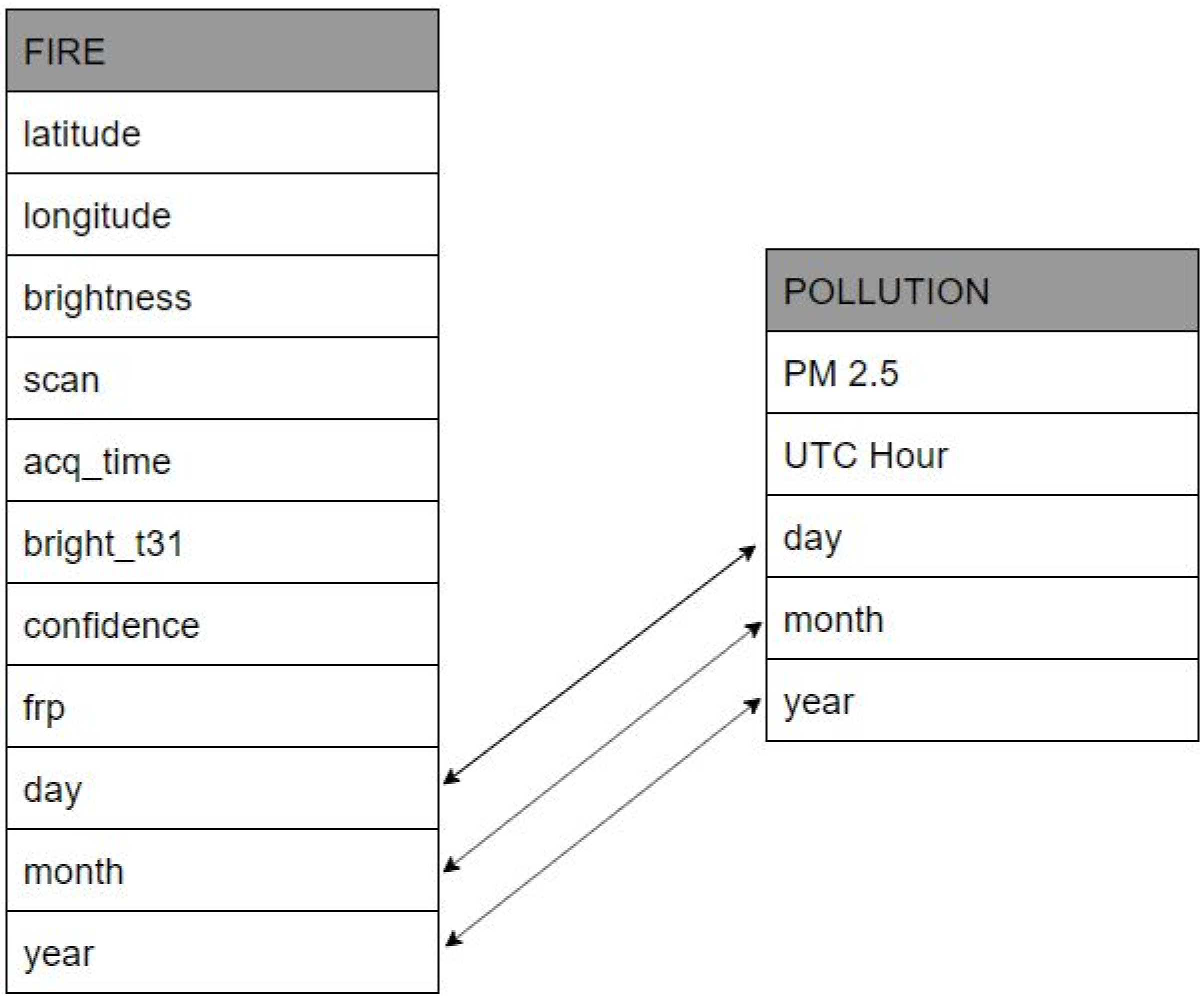
What are we planning to do:

- Preprocessing of dataset 2
- Joining the two datasets
- Training the dataset
- Predicting the effect of crop burning on Delhi pollution

WORKFLOW


Active fires due to crop burning
Delhi PM 2.5 Measurements
Dataset-1 collection
Dataset-2 collection
Preprocessing and Analysis
Preprocessing and Analysis
Join datasets on the common feature('Date')
Data fed to the learning algorithm
Input features
Hypothesis generated
Predicted target

DATASET JOIN



BRIEF DESCRIPTION OF DATASETS

1. Active fires due to crop burning:

   The MODIS sensors aboard the Terra and Aqua platforms detect fire spots at 1 × 1 km2 spatial resolution globally on a daily basis. The fire detection is performed using a contextual algorithm (Giglio et al., 2003, 2016) that exploits the strong emission of mid-infrared radiation from fires. The algorithm consists of a series of spectral tests and classification of each pixel of the MODIS image. Ultimately, it assigns one of the following classes to each pixel: missing data, cloud, water, non-fire, fire, or unknown.

2. Delhi PM 2.5 measurements

   Hourly concentration observations are provided for Delhi. All times are expressed in UTC time. This data is based on the regional interpolation of real-time observations by ground-level monitoring stations. As the intent is to capture regional variations in air quality, be aware that individual air quality monitors may report somewhat higher or lower values for PM2.5 concentrations than the values represented by the local averages reported here. Since real-time data is used, these time series should be regarded as preliminary and subject to change.

MACHINE LEARNING ALGORITHM TO BE USED

Supervised Learning Algorithm

Supervised learning is the machine learning task of learning a function that maps an input to an output based on example input-output pairs. It infers a function from labeled training data consisting of a set of training examples. In supervised learning, each example is a pair consisting of an input object (typically a vector) and a desired output value (also called the supervisory signal). A supervised learning algorithm analyzes the training data and produces an inferred function, which can be used for mapping new examples. An optimal scenario will allow for the algorithm to correctly determine the class labels for unseen instances.

Our problem statement is a regression problem

In a regression problem we will try to predict results within a continuous output, meaning that we will try to map input variables to some continuous function(hypothesis).

CONCLUSION

By this project we want to showcase the adverse effect that burning of crops have on air pollution level of New Delhi.

REFERENCES

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