Prediction of the burned area of forest fires using meteorological and other data

ABSTRACT

Forest fires are unpredicted, unwanted, uncontrollable fire in combustible vegetation and sometimes its extent to wildlife. Usually, forest fires occur when all elements of a fire come together in a susceptible area: an ignition source is brought into contact with a flammable material such as vegetation, that is subjected to enough heat and has an adequate supply of oxygen from the air. A high moisture content usually prevents ignition and slows propagation, because higher temperatures are needed to evaporate any water in the material and heat the material to it fire threshold. Less dense material such as grasses and leaves are easier to ignite because they contain less water than denser material such as branches and trunks. Hence by this we get few factors on which forest fires depends -Temperature, Humidity, Wind, Rain.

In Case study, we see about how much factors effect forest fires and can we predict the forest fires if other factors are known. I am using Machine Learning- Decision and Random forest algorithms to study the stated problem. A decision tree algorithm is used to determine a course of action. Each branch of the tree represents a possible decision, occurrence or reaction while random forest is a method that operates by constructing multiple decision trees during the training phase. Both algorithms can be used for both clustering and regression.

Here I have a dataset of Montesinho park provided by UCI Machine Learning Repository. This dataset is publicly available for research. It has various features

1.X - x-axis spatial coordinate within the Montesinho park map: 1 to 9
2. Y - y-axis spatial coordinate within the Montesinho park map: 2 to 9
3. Month - month of the year: 'Jan' to 'Dec'
4. Day - day of the week: 'mon' to 'sun'
5. FFMC - FFMC index from the FWI system: 18.7 to 96.20
6. DMC - DMC index from the FWI system: 1.1 to 291.3
7. DC - DC index from the FWI system: 7.9 to 860.6
8. ISI - ISI index from the FWI system: 0.0 to 56.10
9. Temp - temperature in Celsius degrees: 2.2 to 33.30
10. RH - relative humidity in %: 15.0 to 100
11. Wind - wind speed in km/h: 0.40 to 9.40
12. Rain - outside rain in mm/m2: 0.0 to 6.4
13. Area - the burned area of the forest (in ha): 0.00 to 1090.84

We are training and testing our models on these features and finding out which will give us best model.

Keywords: Forest fires, Decision tree, Random forest, Machine learning