

Forest Combustion Recognition using AI

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ABSTRACT

Forest are the main natural resources which they give us various direct & indirect benefits and work as a important role in the life of an human being on earth. It is our main duty to in acts and save our earth form the vanishing of forests from the major hazard of combination takes place to save the wildlife animals, people situated around and protect rare species of planet from being dead. A forest fire has a huge and serious impact on the environment, and it also affects the future for decades. AI techniques are used to visualize/recognize whether the forest are with fire or without fire through the images which we give the model to predict. We can avert or put a stop to combustion of forest by providing machines with suitable algorithms on how we wanted our model to be used and developed by automatic code generation techniques.

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I. INTRODUCTION

Forests paly a crucial role in our daily life. In the past early humans were dependent on the forests for their needs such as food, clothing and shelter. Forest prevents soil erosion and food. Roots of their trees tie up their soil particulars together and prevent the soil from being washed or danzed. Trees helps to balance the climate of a place. They take water from their roots, and then they open some of it as water vapor. By this process they manage to keep the surroundings cool. Trees are very responsible for brining the rain by saving the water vapor content of the atmosphere. Forest firesare always caused by one of two ways naturallyand human caused. Natural fires are started by lightening with a very small percentage started by spontaneous combustion of dry fuel such as saw dust and leaves. On the other hand, human caused fires can be due to any number of reasons. A fire needs three things: fuel, oxygen and heat. Sometimes, fires occur naturally, ignited by heat from the sun or a lightningstrike. However, most wild fires are because of humancarelessness such as arson, campfires, discarding lit cigarettes, not burning debris properly, playing with matches or fireworks. We need to recognize forest fires and to help the nature cycle of wood growth and replenishment. They release seeds or otherwise encourage the growth of certain tree species.

II. SURVEY ON FOREST COMBUSTION RECOGNITION

[6] Sakr, George et.al in their work presented an effective forestfire detection method using AI presents a description and analysis of forest fire prediction methods based on artificial

intelligence. These Forest fires are a fundamental part of many ecosystems such as boreal forests, temperate forests, Mediterranean ecosystemsetc.Forestfire prediction, prevention and management measures have become more important. Now a days systems for forest fire danger prediction represent an essential tool to predict forest fire risks, they support the forest fire monitoring and extinction phase, and also they assist the fire control planning and resource allocation and a system for automatic recognition of fire smoke using artificial neural networks applied to advanced very high resolution radiometer. The idea was to build a fire spread simulator and to search for good decision policies. Any forecast mechanism bases its prediction on a continuous observation of a number of specific features. In this paper the aim is to reduce the number of monitored features, and to eliminate and require for weather prediction mechanisms. In the simplest form, SVM (Support Vector Machine) uses a linear hyperplane to create a classifier with a maximal margin. In other cases, where the data is not linearly separable, the SVM maps the data into a higher dimensional space called the feature space. The weather data provided by theLebanese Agricultural Research Institute(LARI) covers the Lebanese territory and reaches nine years between 2000 and 2008. For each day of weather data from LARI corresponds to a specific number of fires that is extracted from the fire list. The daily number of fires over the nine years is used to create the four scales of danger on which the prediction takes place.SVM is the relationship between the weather parameters of today and the number of fires of the upcoming days. The paper presented a forest

fire risk prediction mechanism, based only on meteorological data and independent of any weather prediction mechanism. The results demonstrate the ability to predict forest fire risk with a limited amount of data and has shown that support vector machines can be used for a two class prediction of fire risk with a very high accuracy of up to 96% for August as well as four classes prediction with a low error on the number of fires as well as on the predicted scale. [7] **Seric et.al** discussed the advantages of using machine learning and artificial intelligence techniques in forest fire observers. The system architecture describes three main parts i.e, the data is analyzed network observer or proprioceptor who checks upon validity of system parts and data available from sensors, phenomenon observer for detection of scenario taking place in the environment that is monitored and system observer for analysis of system usefulness and identification of future improvement of the system. In all of these three parts ML/AI techniques are used. Detecting forest fires from a single or series of digital images has led many scientists to work on applying image processing and computer vision techniques in search for algorithms to detect fire or smoke. In these researches scientists aim their focus on exactness and correctness of proposed algorithms. Besides the exactness and correctness detection algorithm, it must involve mechanisms for observation of vital parts and automatic recovery in case of failure. Artificial intelligence and machine learning have found many ways to enter many fields of research and technology. Traditionally artificial intelligence deals with making programs and performing tasks that need intelligence when done by humans and this is done by automating human path in decision making. Machine learning has recently become the most popular field of artificial intelligence, mostly due to the availability of digitized data, also known as big data. Machine learning algorithms or data are used on a set of training data and aim to give output that can be used as a part of an intelligent algorithm. Forest fire monitoring and observations are important tasks of forest management where forest owners want to prevent and minimize the damages caused by forest fires. Artificial Intelligent forest fire monitoring and surveillance system is a software system supporting cameras mounted on pillars on monitoring locations in the forest. There are some task that followed by software system those are: 1. collecting data from the monitoring locations, 2. analyzing validity of data collected from the monitoring location, 3. data processing in search for visible signs of smoke and fire, 4. data archiving and storing for future use, 5. presenting the results of the processing to the users via web interface. Design and development of an intelligent

system is nowadays unimaginable without employing some sort of machine learning. Machine learning techniques consist of training a model on collected data and using the model in analysis, prediction and decision making. While the development of a mathematical model and evaluating it on data collected in the usage time is a traditional approach, nowadays data is needed in both parts of design and evaluation. The modern approach improves the accuracy of detection and simplifies maintenance of the system. [8] **Alkhitib et.al** discussed the forest fires Detection are the Forests defenders of earths ecological balance. They cause irreparable damage to the environment and that atmosphere of 30% Co2 comes from forest fires. These forest fires are a great menace to ecologically healthy grown forests and protection of the environment. There are some most frequently used for fire detection techniques are 1. Controlled burning 2. Watch towers 3. Infrared, 4. Spotter planes, 5. Water tankers, 6. Optical smoke detection In Australia the fire does not harm any humans or properties it is left to burn until it dies alone.

In this paper we know about some parts i.e, Authorities fire suppression and detection Techniques, Satellite Based System, Optical Sensor and Digital Camera, Wireless sensor networks Millions of hectares of forest are destroyed by fire every year. Areas destroyed by these fires are large and produce more carbon monoxide than the overall automobile traffic. In Authorities fire suppression and detection techniques they discussed the most Frequently used fire detection and in satellites based systems earth orbiting satellites and even air floating division have been employed for observation and detection of forest fire. In optical sensor and digital camera surveillance and wireless sensor network. There are a number of detection and monitoring systems used by authorities. These include observers in the form of patrols or monitoring towers, aerial and satellite monitoring and increasingly promoted detection and monitoring systems based on optical camera sensors, and different types of detection sensors or their combination. [9] **Mahmoud et.al** discussed the accurate forest fires detection algorithms remain a challenging issue, because some of the objects have the same features with fire, which may result in high false alarms rate. These forest fires detection algorithms remain a challenging issue. This paper presents a new image processing forest fires detection method, which consists of four stages. First, a background subtraction algorithm is applied to detect moving regions. Secondly, candidate fire regions are determined using CIE Lab colour space. Thirdly, special wavelet analysis is used to

differentiate between actual fire and firelike objects, because candidate regions may contain moving firelike objects. Finally, a support vector machine is used to classify the region of interest to either real fire or nonfire. Forestfires warns to human lives, environmental systems and infrastructure. The objects have the same features with a fire detection method contains of four stages, Background subtraction algorithm is applied to detect moving regions, Candidate fire regions are determined using CIE Labcolour space, special wavelet analysis used to differentiate b/w control fire and fireobjects, Support vector machine is used to classify the region of interest to either real fire or nonfire. image processing. In this they used background subtraction and special wavelet analysis, The forest fire detection method achiever a good detection rate(93.46%). And a low falsealarm rate (689%) in firelike objects. The future work and the methods accuracy could be improved by extracting more fire features and increasing the training data set. [10]Abidet.al discussed and presenting a comprehensive type of survey based on machine learning algorithms based on forest fire prediction and detection systems. The forest fires are breaking out so frequently nowadays. Forest fires are causing major environmental damages. Every year millions of hectares are being hit in several parts of the world and there is a threat of fauna and flora species their lives are being affected because of forest fire consequences. deduction has became old methods in terms of an emergency considering this they have implemented wireless sensor networks (WSNs) and unmanned aerial vehicles (UAVs) these are proposed because these consists of automatic deduction of forest fires. Almost all types of machine learning methods are exploited for these issues so we have to follow the trend which is towards the integration of artificial intelligence. In other work different machine learning models were introduced for the identification of burned forest areas (MLP, SVM, RBFN) were investigated and have been deducted and collected 7920 burned forest areas in between 2009 and 2018 the report results consists of success rate between 53.02% 62.89% and the global accuracy 65%. So MLP is chosen as the best model in machine learning algorithms. In our country in the month of April may is the time where forest fires takes place in various parts of the country this is due to dry soil caused by a weak monsoon is benign seen as one and it will also happen in extremely prone areas which leads to forest fires in India which comes under very highly prone category that takes upto 26.2% of forest to fire which is 1,72,374 sq km. The main reason forthe forest fire is human activities. Globally climate change leads to pollution and it

leads to rising instances of fires. Extreme heat and dryness created by rubbing of branches are also possible causes and we had a lack of soil moisture also becoming a key factor for forest fires.From the year 2019 satellite information was also being given when a major part of fire is being spotted in forests. We have required various forest fire detection and prediction. We also discussed the factors that will be influencing the occurrence and risks of forest fire.Finally nowadays artificial intelligence to predict the automate and detect the occurrence of fire in had itself. [11] Hariyawanet.al discussed the forest fires have become frightening and endanger all species of the world. Which is damaging the ecosystem and extension of forest experiences a lot of forest fires to solve this problem a new type of detection system is involved wireless sensor network (WNS). This sensor consists of a transmitter/receiver, microcontroller and three sensor measurements of gasoline. methane, CO and CO2 used as a main indicator for the early detection of forest fires. RF modules in a shown area are 310m at 230m and 90m at 19,200bps. In terms of current technological developments of some sustainable programs require to a system to analyze and be capable of monitoring indication of forest fires. Currently we have wireless technologies that are able to send the data without using wires. This technology has become one of the best developments of applied technology which can support forest fires conservation programs. Wireless sensor network (WSN) is a computing, communication and measurement process that provides administration capabilities to a device, observation and any treatment for an events and phenomena and environment using wireless technologies. WSN technologies provides the foundation to conduct experiments on the environment. Overall human activities and action requires monitoring wsn systems here we have some type of sensors based on temperature, pressure, humidity, position, optic, radiation, movement and vibration. Each node of wns systems generally consists of communication, sensing, power and processing. The system process is the most important part of the wsn system. There are several options for the processor digital signature processor, field programmable gateway micro controller. The main part of the wireless sensor network is system processing which can affect the energy consumption. Some of the processors are Microcontroller, Digital signal processor, Applicationspecific IC, Field programmable gate array. To detect forest fires they perform measurement of temperature, flame, gas oil, co2, co and methane from the burning peat. In this way the wireless sensor network(WSN) is working to detect

the forest fire before hand itself to avoid massive damage which could affect the whole ecosystem. [12] Yan, Xiaofei, et.al discussed that the Human observation is a traditional method to detect forest fire, but risky conditions when fire occurred make people pull back. The various human observations of forest like novel sensing technologies and such as: cameras, infrared, detectors, satellite based remote sensing, wireless sensor networks etc(WSN), cameras etc. the monitoring variation of smoke or fire in forest by using Machine Vision Method (MVM). Some disturbances by landscape, smoke produced from industries, weather conditions, social activities may deflect the accuracy of machine visionbased systems. We have an alternative technique for fire and forest and post fire recovery by satellite based remote sensing. This Remote sensing method normally scans the image by using satellites at an interval of one or two days. In recent times a satellite operated by the Japan Meteorological Agency has a special feature where it can deduct fire hotspots within 10 minutes, and also written data over entire hemisphere. This is the example that is acceptable for real time forest deduction although a wide area of around of 0.1 hectare with location error about one kilometer takes one pixel of remote sensing based images which contains fire or smoke at the beginning stage of fire occurrence. Nowadays monitoring of forest fire using Wireless Sensor Network(WSN) is an alternative technique which is becoming more and more popular for real time applications Modules that can collect humidity, air pressure, wind direction and speed, temperature, smoke, gas concentration and some solar powered nodes integrated with sensors are integrated inside WSN. These data is communicated, stored, and processed with control centers through nodes of wireless networks. If in case there is any occurrence of fire the control centers will automatically detect those hotspot areas. Sensors can be monitored in both dynamic and static parameters, which are very useful for detecting and eradicating forest fires. Some previous studies of forest fires say that to maintain high accuracy and efficiency we should monitor air temperature and smoke density etc. Artificial Neural Network(ANN) is defined as a mathematical model designed in such a way that it can perform every work as the human brain does. Generalisation capability, self organization, adaptive learning are the features in Artificial Neural Network(ANN) . It is considered to be a good classifier because it deducts smoke and flaming phases with high accuracy according to the sensor measured data. The both training and testing phases of (ANN) were performed using matlab tool, which has an excellent processing of numerical models and large data sets. [13]Barmpoutiset.al To

detect the fires in the forest we have many technologies. In this paper We have used optical remote sensing techniques. Terrestrial System: A terrestrial system is a very early detection system that consists of individual sensors or a network of ground sensors. Those sensors which are used are handled carefully and are placed to achieve adequate visibility. The sensors are used in watchtowers, which is used to monitor highrisk detection is not only used for detection but also used for verification and localization of reported fires. We have different types of cameras used for the detection of forest fires like Optical cameras and IR cameras that can capture data which is ranging from low to ultrahigh resolution. Optical cameras that provide colour information.IR cameras that provide Thermal Radiation. Unmanned Aerial Vehicles: A terrestrial imaging system can be able to detect both flame and smoke but it is very much impossible to view in a timely manner.By using UAVs we can have broader and more accurate perception. We can also use it for detecting many technologies for fire and smoke detection by Geostationary Satellites and by using Cubesats. Finally, by this paper, we can conclude that we can have adetailed comparison between three categories of fire detection in terms of Accuracy, Volume of work, Future potential, Minimum free Size, Covered Area, and Response time. [14]Hanamaraddi et.al In this paper detected of forest fires by using Image Processing. We can say that forests can purify water, stabilize soil, cycle nutrients, moderate climate, and store carbon. Nowadays, due to forest fires, the ecological balance is disturbing so that many people are facing many health problems. By using Image processing for forest fire detection using YCBCR colour model,adopted rule based colour model due to its less complexity and effectiveness.By using Image Processing we can identify the quality of fires by the colours. We can detect the fire quantity like high or low. Image Processing is processing of images using mathematical operations like signal processing for which the input is an image, Photograph or video. The output of Image Processing is either an image or set of characteristics or parameters which was related to that image. In Image Processing the input was taken as a 2D signal and then are applied standard techniques. A colour model is a mathematical model thatdescribes the colours that which describes as tuples. 1.CMYK colour model 2.RGB colour model 3.YCBCR colour model The Identification of Forest Fire Based on Digital Image Processing: In this we can easily identify the forest fire by the design and practical implementation by using the Image Processing functionality.Based on continuous image sampling by CCD camera. We can get configuration characteristics, dynamic

characteristics and colour information by Image Processing algorithm. The source of the fire can be easily identified by their characteristics. In this paper we have discussed the uses of YCBCR colour spaces separating luminance from chrominance. [15] **Basu, M. Trinath, et.al** have found that in a survey 80% of losses are due to the forest fires. If the fire was identified we can take action. Node MCU based IoT empowers fire indicator and observe framework for the issue. The work has assembled a fire finder by Node MCU which is an interface with a temperature sensor, a smoke sensor, and a signal. The temperature sensor detects the warmth and the smoke sensor detects any smoke produced because of fire. Whenever a fire is activated it consumes adjacent and produces smoke from candlelight or oil light which was used by a family. When warm force is high then the alerts go on. When bell or alert is killed when the temperature smoke level decreases. We have additionally interfaced LCD show to the Node MCU board with the assistance of IoT innovation. When we have recognized smoke or fire then it alarms the client about the fire through the ethernet. The wireless sensors can easily detect early wildfire. We can conclude that this work we

III. CONCLUSION

This paper gives an insight of possible techniques which were implemented for Forest Combustion Recognition using techniques like image processing, temporal variation, wireless sensors, spatial data, cnn, ann and svm techniques. There are the techniques to detect for forest combustion and recognition depending on their accuracy and success rate. Detect the fire techniques/methods has high accuracy and success rate in detecting forest fires in present days where as in future there will be more advanced techniques/methods which may have high accuracy and success rate to detect the fire based on the advanced techniques in future.

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