



Artificial Intelligence Assisted Weather Based Plant Disease Forecasting System

M. Juno Isabel Susintra

Assistant Professor, Department of Computer
Science, Bon Secours College for Women,
Thanjavur, Tamil Nadu, India

S. Vinitha

II-MSC Computer Science, Bon Secours
College for Women, Thanjavur, Tamil Nadu, India

ABSTRACT

The hazard of fungal and bacterial crop syndrome can be predicted using risk models with exact ecological parameters such as temperature, relative humidity, solar radiation, wind speed, and leaf wetness duration. The ecological Parameter has recognized as key in the management of crop disease. Air temperature and moisture pressure the preponderance of fungal place diseases. In ecological factors mainly condensation also impacts pest populations, as well as contamination deposits. a lot of parameters are well unspoken, readily defined, and effortlessly measured. The trouble and vagueness connected with monitoring ecological aspects at the local leaf balance and the complication of up scaling to the crop stage stop obtainable disease risk models from life form used with consistency. One nonparametric arithmetical move toward in receipt of scant notice for the modeling of crop paddy syndrome forecast is that of artificial intelligence. In this project AIs estimate this key environmental variable at local crop scales, using local and regional weather station data and site-specific sensing data. The ultimate goal is to embed the AI into a highly-portable tool, designed to predict leaf wetness duration in conjunction with local weather stations, and as input to real-time decision support systems.

Keywords: *artificial intelligence, highly-portable tool, site-specific sensing data*

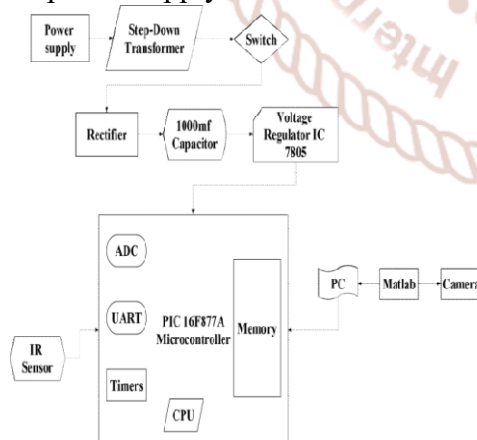
INTRODUCTION

Reliable and appropriate forecasts provide significant and useful input for proper, foresighted and informed development, more so, in agriculture which is full of uncertainties. Agriculture now-days has become highly input and cost intensive. Without sensible use of fertilizers and plant protection measures, agriculture no longer remains as profitable as before. New pests and diseases are emerging as an added risk to the production. Under the improved scenario today, predicting of many features involving to agriculture are becoming important. But in-spite of strong need for reliable and timely forecasts, the current project is far from suitable. For most of the zones, there is no organized system of forecasting. Disease forecasting is essential part of disease controlling system. It is in fact a support system for decision making and provides an indication when the disease is likely to appear and when it go critical. The prediction of disease outbreak, combined with knowledge of disease epidemiology, allows control measures to be applied in time when they are most effective, reducing cost of production and the impact of fungicides/pesticides on environment. The objective was to develop a disease forecasting system from plant and analyze it using the AI based model established and output disease risk. In our proposed method we are using artificial intelligence into a highly-portable tool, designed to predict leaf wetness duration in combination with local weather stations, and as input to real-time decision support systems. Our proposed method analyze the disease and indication to us what disease affected the plant. So

our proposed method has increased accuracy, site-specificity of the forecasting information and real-time indication of the forecasting information.

DESIGN

The input of the circuit is taken from the main. It is a single phase 230V ac voltage. This 230 AC voltage cannot be used directly, thus it is stepped down. The Step down Transformer is used to step down the main supply voltage from 230V AC to lower value. Because the microcontroller and sensors are operated at +5V dc voltage and relays and drivers will be operate at +12V dc voltage. So first this 230V AC voltage should be stepped down and then it should be converted to dc. After converting to dc it is applied to controller, sensors, and relays. In this project we used 230/12V step down transformer. In this circuit we used voltage regulator. 7805 regulator for producing 5V dc. The output of 7805 regulator is given to PIC microcontroller. IR sensor detects the object and it send the signal to controller unit. When we show the plant in front of camera it capture and then it analyze the details from database. Then we are easily identify the which disease affected by plant. Disease will show in LCD display. All electronic devices have one thing in common they all need power supply. However the electronic circuitry inside such devices requires low voltage DC power supply. The power that we get from the wall outlet is 230 V 50 Hz. So a need arises to convert high voltage AC into low voltage DC. In this section we shall discuss the block diagram of power supply in detail.



IMPLEMENTATION

Alternaria alternate:

Alternata, growing commonly on vegetation, is a member of the imperfect fungi and is one of the most important among the allergenic fungi. Brown

segmented mycelia give rise to simple or solitary conidiophores, which may produce solitary apical spores, or a string of spores. The spores produced by imperfect fungi vary in shape, size, texture, colour, number of cells, and thickness of the cell wall. Alternaria is one of the main allergens affecting children. In temperate climates, airborne Alternaria spores are detectable from May to November, with peaks in late summer and autumn (3). Dispersion of Alternaria spores occurs during dry periods. These feature higher wind velocity and lower relative humidity, which result in peak dispersion during sunny afternoon periods.

PREVENTION:

Although impractical in the landscape, elimination of water on leaves can control Alternaria leaf spot. Always use pathogen-free plants when available. Early diagnosis of a problem is also critical, since choosing appropriate control measures depends upon an accurate diagnosis.

Anthracnose:

Anthracnose is a fungal disease that tends to attack plants in the spring when the weather is cool and wet, primarily on leaves and twigs. The fungi overwinter in dead branches and fallen leaves. Cool, rainy weather creates perfect conditions for the spores to spread.

This fungal disease affects many plants, including vegetables, fruits, and trees. It causes dark, sunken lesions on leaves, stems, flowers, and fruits. It can spread very quickly during rainy seasons. Anthracnose is a general term for a variety of diseases that affect plants in similar ways. Anthracnose is especially known for the damage that it can cause to trees. Anthracnose is caused by a fungus, and among vegetables, it attacks cucurbits. Anthracnose can survive on infected plant debris and is very easily spread.

PREVENTION:

Plant resistant plants, or buy healthy transplants. Plant your plants in well-drained soil. You can also enrich the soil with compost in order to help plants resist diseases.

Water your plants with a drip sprinkler, as opposed to an overhead sprinkler. Don't touch the plants when they are wet.

Keep ripening fruits from touching the soil.

Remember to rotate your plants every 2 to 3 years.

Bacterial Blight:

Bacterial Blight causes brown leaf spots (often surrounded by yellow areas) and rapid browning of young shoots. Newer growth is normally more severely infected. Bacterial Blight can attack a wide range of trees and is most aggressive during mild, moist growing conditions. Stress and other injuries that weaken a tree can increase the tree's susceptibility to Bacterial Blight. Examples include improper pruning wounds, frost damage, lack of nutrients (lack of proper fertilizing), other diseases, insect attacks or other physical injuries to the tree's bark. Bacterial Blight is caused by bacteria which is spread by the wind, rain, insects or pruning tools that are not properly sanitized.

PREVENTION:

To prevent the onset of Bacterial Blight, ensure proper spacing when trees are planted.

For trees with dense foliage, prune where necessary to ensure proper air circulation and be sure to sanitize the pruning tools after each branch with a mixture of 1 part bleach and 5 parts water.

Properly fertilize the tree with a TreeHelp Annual Care Kit to maintain strong healthy growth.

In the spring when conditions are favorable to the spread of Bacterial Blight, spray the tree with Liquid Copper Fungicide Spray as a preventative treatment.

If the tree becomes infected with Bacterial Blight, spray the tree with Monterey Complete Disease Control and repeat spraying every 14 to 21 days as necessary.

Cercospora leaf spot:

Cercospora leaf spot is the most devastating foliar disease of sugarbeet in Minnesota and North Dakota. The disease is caused by the fungal pathogen *Cercosporabeticola*. The fungus overwinters in infected sugarbeet debris in the field. Cercospora leaf spot develops rapidly in warm, humid and wet conditions, typically after canopy closure. The full name for this fungal disease is *Pseudocercospora angolensis*. Leaves of affected plants will produce circular spots with light brown to

grayish centers. When the rainy season sets in, these spots become dark and almost black with a yellow halo. Leaves generally fall off after a period.

PREVENTION:

In addition to cleaning up dropped fruit, it may be necessary to destroy heavily infected crops in fall.

There are also fungal sprays and dusts recommended for control of cercospora.

Treatment must begin in the wet, rainy season when temperatures have warmed. It is advised to rotate the chemicals used yearly to minimize the chance of resistance.

A second application may be required in wet, humid regions.

RELATED WORK

2.1 A fuzzy-logic based on-line disease diagnosis system for soybean Author & Year: Girish Gupta and Girish Gupta, 2009

This paper presents a fuzzy-logic based on-line disease diagnosis system for soybean. The novel fuzzy-logic approach used is the rule-promotion or empowerment methodology for improved diagnostic judgments. The system developed also uses the concepts of text-to-speech conversion tools to introduce an intelligent multimedia interface into the system. The system is developed using ASP.NET web-application framework provided in Microsoft Visual Studio. NET. The source code for O-O inference engine is written using C#.

2.2 A web-based intelligent disease-diagnosis system using a new fuzzy-logic based approach for drawing the inferences in crops Author & Year: G.K. Gupta, 2011

This paper suggests a new approach for providing intelligence in the system for diagnosis of diseases of the oilseed-crops. It reports the development of a web-based intelligent disease diagnosis system (WIDDS). The WIDDS is based on a new fuzzy logic approach. The approach is based on use of a rule-promotion methodology. This approach enables the drawing of inferences with the enhanced intelligence. The WIDDS also incorporates new features that improve the presently existing expert systems. The new features are (i) object-oriented (O-O) inference model, (ii) dynamic knowledge base creation strategy. The dynamically promoted rules

are derived from those diagnosis sessions, which resulted in successful decisions. This enables more efficient decision-making in the future sessions, (iii) audio-visual-graphical user interface using text-to-speech (TTS) conversion tools. The WIDDS results in decreasing not only the number of interactive question-answer sessions with the clients but also leads to acceptable diagnosis. Further, the inferences are drawn faster compared to the traditional approach, which is the expert based reasoning method. The suggested WIDDS, which is based on rule-promotion approach, has been tested for three oilseeds crops – soybean, groundnut and rapeseed-mustard.

2.3 Weather-based prediction of anthracnose severity using artificial neural network models

Author & Year: M.J.Charchar and R.Ghosh, 2004

Data were collected and analysed from seven field sites in Australia, Brazil and Colombia on weather conditions and the severity of anthracnose disease of the tropical pasture legume *Stylosanthes scabra* used by *Colletotrichum gloeosporioides*. Disease severity and weather data were analysed using artificial neural network (ANN) models developed using data from some or all field sites in Australia and/or South America to predict severity at other sites. Three series of models were developed using different weather summaries. Of these, ANN models with weather for the day of disease assessment and the previous 24 h period had the highest prediction success, and models trained on data from all sites within one continent correctly predicted disease severity in the other continent on more than 75% of days; the overall prediction error was 21.9% for the Australian and 22.1% for the South American model.

2.4 Neural networks that distinguish infection periods of wheat tan spot in an outdoor environment.

Author & Year: Franel L.J., 1997

Tan spot of wheat, caused by *Pyrenophora tritici-repentis*, provided a model system for testing disease forecasts based on an artificial neural network. Infection periods for *P. tritici-repentis* on susceptible wheat cultivars were identified from a bioassay system that correlated tan spot incidence with crop growth stage and 24-h summaries of environmental data, including temperature, relative humidity, wind

speed, wind direction, solar radiation, precipitation, and flat-plate resistance-type wetness sensors. The resulting data set consisted of 97 discrete periods, of which 32 were reserved for validation analysis. Neural networks with zero to nine processing elements were evaluated 20 times each to identify the model that most accurately predicted an infection event. The 200 models averaged 74 to 77% accuracy, depending on the number of processing elements and random initialization of coefficients. The most accurate model had five processing elements and correctly predicted 87% of the infection periods in the validation set. In comparison, stepwise logistic regression correctly predicted 69% of the validation cases, and multivariate discriminant analysis distinguished 50% of the validation cases. When wetness-sensor inputs were withheld from the models, both the neural network and logistic regression models declined 6% in prediction accuracy. Thus, neural networks were more accurate than statistical procedures, both with and without wetness-sensor inputs. These results demonstrate the applicability of neural networks to plant disease forecasting.

2.5 Image recognition of plant diseases based on principal component analysis and neural networks

Author & Year: Zhanhong Ma and Xiaolong Li, 2012

Plant disease identification based on image processing could quickly and accurately provide useful information for the prediction and control of plant diseases. In this study, 21 color features, 4 shape features and 25 texture features were extracted from the images of two kinds wheat diseases (wheat stripe rust and wheat leaf rust) and two kinds of grape diseases (grape downy mildew and grape powdery mildew), principal component analysis (PCA) was performed for reducing dimensions in feature data processing, and then neural networks including back propagation (BP) networks, radial basis function (RBF) neural networks, generalized regression networks (GRNNs) and probabilistic neural networks (PNNs) were used as the classifiers to identify wheat diseases and grape diseases, respectively. The results showed that these neural networks could be used for image recognition of these diseases based on reducing dimensions using PCA and acceptable fitting accuracies and prediction accuracies could be obtained. For the two kinds of

wheat diseases, the optimal recognition result was obtained when image recognition was conducted based on PCA and BP networks, and the fitting accuracy and the prediction accuracy were both 100%. For the two kinds of grape diseases, the optimal recognition results were obtained when GRNNs and PNNs were used as the classifiers after reducing the dimensions of feature data with PCA, and the prediction accuracies were 94.29% with the fitting accuracies equal to 100%.

2.6 Detection of unhealthy region of plant leaves using image processing and genetic algorithm

Author & Year: Varsha and A. K. Misra, 2015

Agricultural productivity is that thing on which Indian Economy highly depends. This is one of the reasons that disease detection in plants plays an important role in agriculture field, as having disease in plants are quite natural. If proper care is not taken in this area then it causes serious effects on plants and due to which respective product quality, quantity or productivity is affected. Detection of plant disease through some automatic technique is beneficial as it reduces a large work of monitoring in big farms of crops, and at very early stage itself it detects the symptoms of diseases means when they appear on plant leaves. This paper presents an algorithm for image segmentation technique used for automatic detection as well as classification of plant leaf diseases and survey on different diseases classification techniques that can be used for plant leaf disease detection. Image segmentation, which is an important aspect for disease detection in plant leaf disease, is done by using genetic algorithm.

2.7 Fungus/Disease Analysis in Tomato Crop using Image Processing Techniques

Author & Year: Nidhi Seth, 2014

The crop of tomato is very often infected by a disease that leaves spots of brown, gray or off-white colors on the plant's leaves in winter. Scientifically, this disease is known as cercospora leaf spot or cercosporacruciferarum. It's a kind of fungus that often kills young seedlings. The fungus spreads by air and can also infect tomato plants. Therefore, it is important to monitor the leaf at regular intervals so as to keep track on quality of growing tomato crop. In the presented paper, a novel machine vision system has been proposed that visual inspects the leaves coming out of the soil and based on spots on

leaves, it determines the nature of fungus and its depth into the tomato stem. The size of the fungus, color depth and location and locus of the fungus on leaves give an accurate determination of crop quality under the soil. In the presented thesis work, the image of the crop leaves are taken by a good quality color camera and processed for getting a gray colored and segmented image depending upon the nature and size of the fungus. A criterion is set for acceptable and rejects crop quality based on the fungus level.

2.8 Grading Method of Leaf Spot Disease Based on Image Processing

Author & Year: ShenWeizheng and WuYachun, 2008

Since current grading of plant diseases is mainly based on eyeballing, a new method is developed based on computer image processing. All influencing factors existed in the process of image segmentation was analyzed and leaf region was segmented by using Otsu method. In the HSI color system, H component was chosen to segment disease spot to reduce the disturbance of illumination changes and the vein. Then, disease spot regions were segmented by using Sobel operator to examine disease spot edges. Finally, plant diseases are graded by calculating the quotient of disease spot and leaf areas. Researches indicate that this method to grade plant leaf spot diseases is fast and accurate.

CONCLUSION

The present project concludes image processing techniques for several plant type that have been used for identifying plant diseases. The techniques for detection of plant diseases are K-means clustering. These technique are used to analyses the healthy and diseased plants leaves. In this technique optimization for a specific plant leaf diseases, and automation of the technique for continuous automated monitoring of plant leaf diseases under real world field conditions. Our project proposes that this disease detection technique shows a good probable with a capability to detect plant leaf diseases.

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