IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Comparative Analysis of Chlorophyll Contents in Herbal Plants Using Regression Model

[1]Simran N. Maniyar, [2]Dr.Sonali B.Kulkarni, [3]Prathiba R. Bhise

[1]Research student, [2]Assistant Professor, [3]Research student

[1]Departement of Computer Science and Information technology,

[1]Dr.Babasaheb Ambedkar Marathwada University, Aurangabad, India

Abstract: Hyper-spectral non-imaging data provides the spectral range from 400-2500nnm, which has the ability to identify each and every unique material on the surface. Plant leaf identification is a critical task manually and computationally. In the work we have proposed a plant leaf identification system based on non-imaging hyperspectral data and designed our own database for experiments. In this paper we used medical plant (Asparagus, Tulsi, Neem, Panfuti, Tridax, and Justica) samples and developed hyperspectral signature by using field Spec 4 spectroradiometer. In this study we used the statistical method. We applied regression techniques for comparative analysis for Neem with other plants. As per our results, Neem Chlorophyll and Tulsi and Panfuti Chlorophyll content correlation coefficient is 0.98.

***Index Terms* – hyperspectral, linear regression, remote sensing, medicinal plants.**

I. INTRODUCTION

Neem leaves are obtained from Neem trees that are found throughout India. They are extensively used in making Ayurveda medicine. Neem tree leaves have multiple uses compared to other medicinal plants like Justica, Asparags, Tridax, Tulsi, and Panfuti. These are all small plants. They have also had medicinal uses, but, as compared to Neem, there are fewer uses. We use a field spec 4 device for spectral signatures. Non-imaging data offers a spectrum range of 350 nm to 2500 nm, allowing Hyperspectral to identify each individual material on the surface. Medical plant identification is a critical task manually and computationally. This paper is related to medical plant identification and classification systems based on non-imaging hyperspectral data to find out the medical content and signature of hyperspectral data. It helps to identify the medical plant and content available in a medical plant.

A hyperspectral image can be thought of as an image cube with hundreds of contiguous spectral bands representing the third dimension. As a result, a hyperspectral pixel is essentially a column vector with the number of spectral bands as its dimensions. Spectral information between narrow bands, for example, is quite helpful and can be utilized for spectral characterization. A hyperspectral imaging sensor combines imaging and spectroscopy in a single system that often includes large datasets and requires new processing methods. Hyperspectral datasets are often made up of around 2150 or more spectral bands with small bandwidths (5-10 nm). Plant leaf identification based on leaf has been carried out by botanists, plant specialists, and many scientists as an essential research task in recent decades. A lot of research has been conducted for the identification of leaf species using non-imaging spectroradiometer hyperspectral data. However, there are a few studies that use hyperspectral data to identify medical plant leaves because hyperspectral data has unique characteristics, such as two thousand one hundred fifty spectral values with high spectral resolution, and so on. The creation of a method for quickly and accurately identifying medical.

Dataset Information:

We are considering Dr.Babasaheb Ambedkar Marathwada university Aurangabad area for sample collection.

- Give the trees

1. Tulsi (ocimum tenuiflorum)
2. Tridax (Tridax procumbens)
3. Panfuti (Bryophyllum pinnatum)
4. Adulsa (justica Adhatoda)
5. Neem (Azadirachta indica)
6. Shatavari (Asparagus racemosus)

In this work we take a six medical plants. Plants identification and physiological status using ASD field spec 4 spectroradiometer. There are much content available in medical plants. In Tulsi contents in oleanolic acid, ursolic acid, eugenol etc. In Bryophyllum (panfuti) contents in triterpenes, phenanthrene, phenolic acid, caffeic acid, malic, oxalic etc. measurement the wavelength of all contents in spectroradiometer. Wavelength range is 350nm to 1100nmper 2 sec.

2. METHODOLOGY

2.1 Spectral Signature Acquisition

In this study, we have collected six plants as a sample which is available in Dr. Babasaheb Ambedkar Marathwada University campus. Collection of Asparagus, Tridax, Justica, Tulsi, Neem, Panfuti, We plucked one samples from each plant and one sample scan the 10 times. We used fresh leaves since it measure of chlorophyll and water which it directly effects on the spectral signature of leaf.[11] The overall dataset of 60 (10*6=60) leaf samples. During the collection process we have also considered and make the geo-tag references of each plant which will be considered as a metadata. The fieldSpec4 instrument was used for give the spectral signatures from leaf samples. The ASD Field Spec 4 spectroradiometer is used to acquire spectral signature of the samples. The wavelength of the instrument is 350-3500nm [1][6][12].White reference panel is used for optimization and calibration before sample recording. The ASD instrument provides halogen lamp with 7w.It is used to record the plant leaf samples by zenith angle of 60 degree from the distance of 45cm above the samples. The field of view is 8 degree and fibre optic cable was set as of nadir where plant samples. Each sample recorded ten times for receiving spectra and the averaged as a pure spectrum. The RS3 (version 6.3) in built software was used for recording the reflectance spectra leaves [6][13]. Finally we obtained (.asd) data file by using fieldSpec4 which possesses ASCII data format [14].

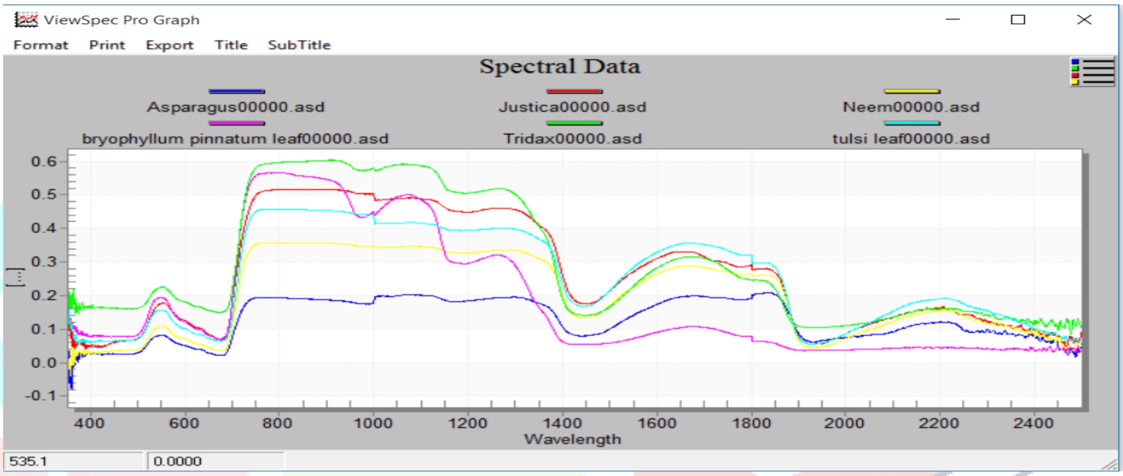


Figure 7.2: Reflectance of All plants

2.2. Data processing

The acquired 10 spectral signatures for each sample are processed by applying mean and generate one spectral signature for each sample. Then convert the spectral signature in numeric format using View spec pro software. Numeric data were opened in Microsoft Excel and process the by applying statistical mean methods for quantitative analysis of soil properties on the respective absorption wavelength range.

3. RESULT

3.1 Statistical Analysis:-

The medical plant calculated in the terms as Tulsi, Tridax, Panfuti, Neem, Asparagus and Justica. Tridax and Tulsi with average values 0.26%, 0.30% and 0.25% respectively. The percentage of Tridax concentrations were highest values than justica and Tulsi. The Tridax varied from 0.61% and 0.11%, Justica was varied from o.25% and 0.05%, Tulsi is varied from 0.46% to 0.06%. Whereas Neem percentage was 0.20% was varied with 0.36% and 0.03%. Average value of Asparagus and Panfuti were 0.18% and 0.13%.

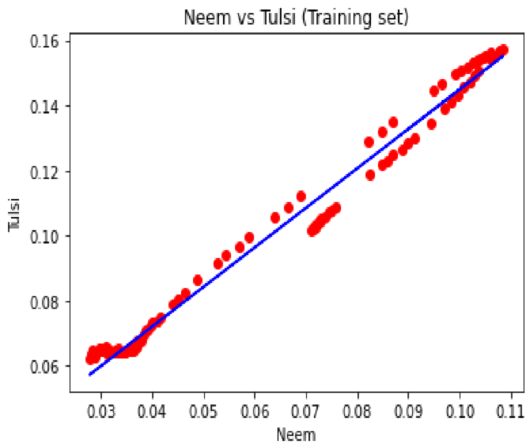
Table 1: Statistical Analysis

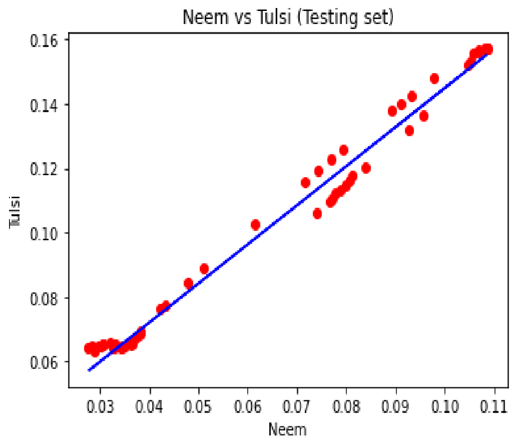
Plant	Mean	Max	Min	Median	Variance	Standard derivation
Asparagus	0.13	0.21	0.02	0.12	0.06	0.06
Justica	0.26	0.25	0.05	0.23	0.03	0.16
Neem	0.20	0.36	0.03	0.19	0.01	0.12
Panfuti	0.18	0.5	0.03	0.08	0.03	0.18
Tridax	0.30	0.61	0.11	0.21	0.03	0.18
Tulsi	0.25	0.46	0.06	0.23	0.02	0.14

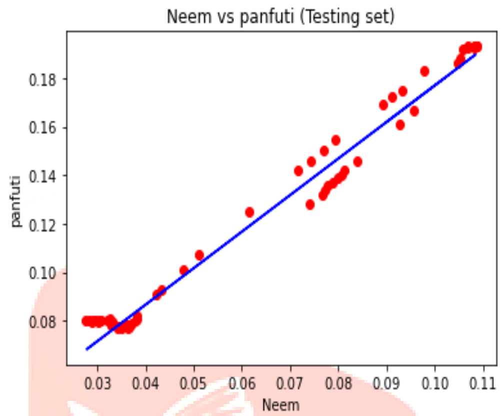
3. 2 Comparative analysis using linear regression model

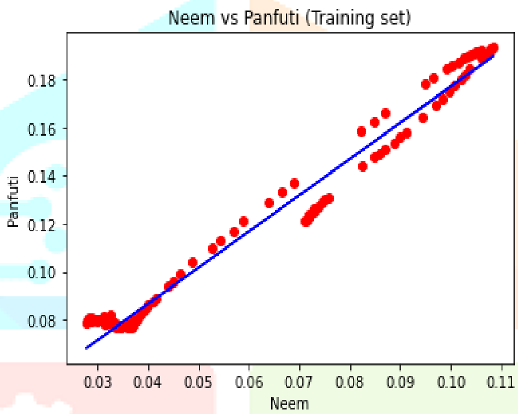
Regression models describe the relationship between variables by fitting a line to the observed data. Linear regression models use a straight line, while logistic and nonlinear regression models use a curved line. Regression allows you to estimate how a dependent variable changes as the independent variable(s) change. Simple linear regression is used to estimate the relationship between two quantitative variables**.**

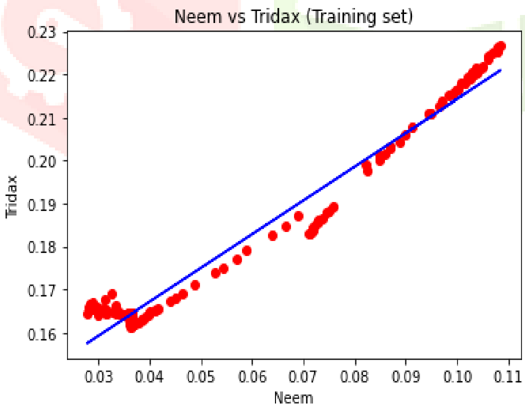
The Neem chlorophyll are independent variable and other plant chlorophyll are dependent variable. The performance of liner regression model the Neem chlorophyll and Tulsi chlorophyll are good co-related and also Tridax and Panfuti are co related to Neem. But justica and asparagus are not co related to Neem chl. Almost Neem chlorophyll and Tulsi chlorophyll are equal

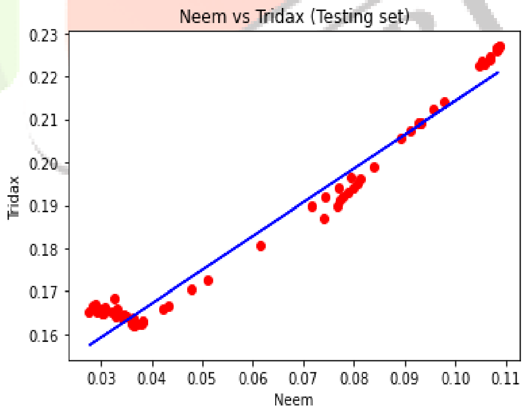

Neem vs Tulsi (Training set)
Tulsi
0.16 0.14 0.12 0.10 0.08 0.06
0.03 0.04 0.05 0.06 0.07 0.08 0.09 0.10 0.11
Neem


Neem vs Tulsi (Testing set)
Tulsi
0.16 0.14 0.12 0.10 0.08 0.06
0.03 0.04 0.05 0.06 0.07 0.08 0.09 0.10 0.11
Neem


Neem vs panfuti (Testing set)
panfuti
0.18 0.16 0.14 0.12 0.10 0.08
0.03 0.04 0.05 0.06 0.07 0.08 0.09 0.10 0.11
Neem


Neem vs Panfuti (Training set)
Panfuti
0.18 0.16 0.14 0.12 0.10 0.08
0.03 0.04 0.05 0.06 0.07 0.08 0.09 0.10 0.11
Neem


Neem vs Tridax (Training set)
Tridax
0.23 0.22 0.21 0.20 0.19 0.18 0.17 0.16
0.03 0.04 0.05 0.06 0.07 0.08 0.09 0.10 0.11
Neem


Neem vs Tridax (Testing set)
Tridax
0.23 0.22 0.21 0.20 0.19 0.18 0.17 0.16
0.03 0.04 0.05 0.06 0.07 0.08 0.09 0.10 0.11
Neem

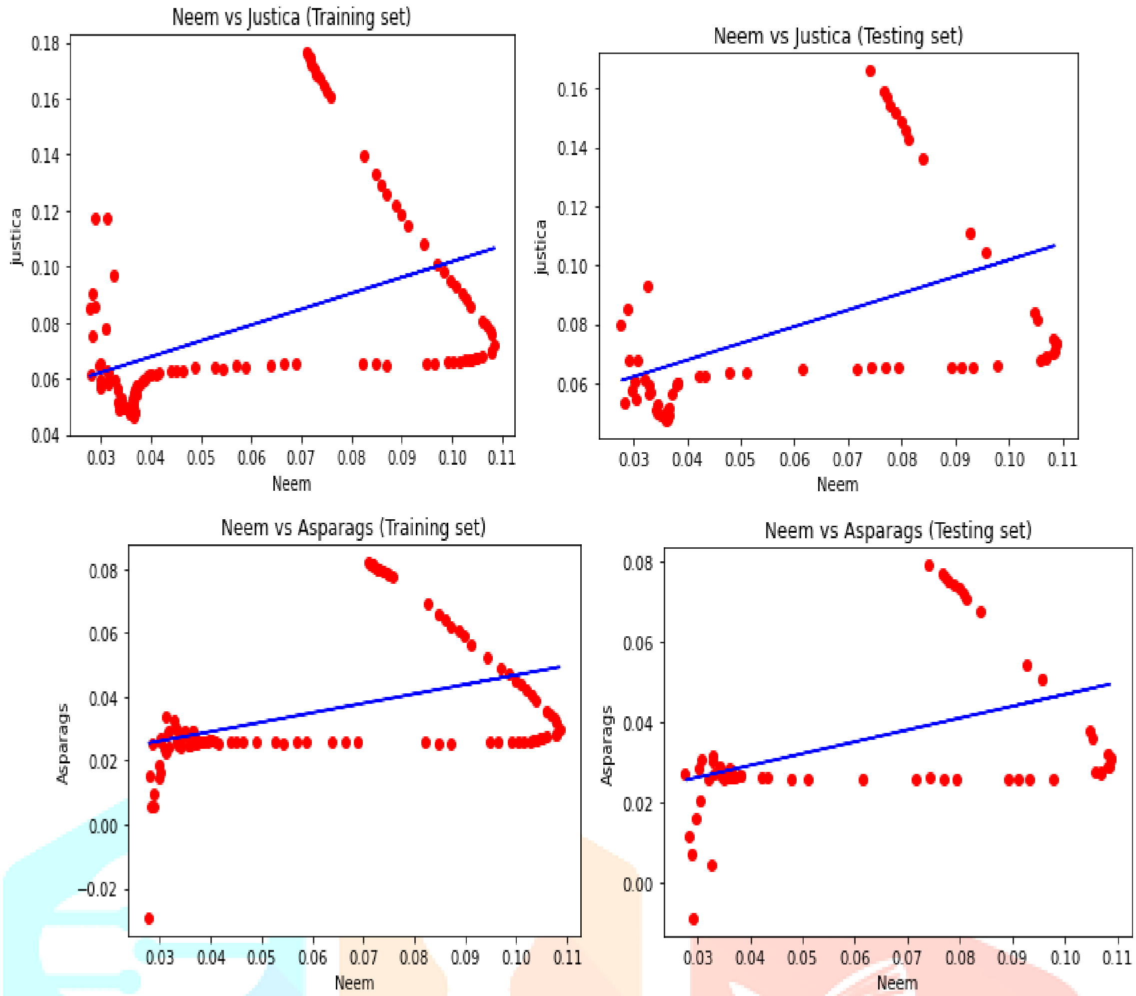


Figure 1: Linear regression of Neem and Tulsi, Panfuti, Tridax, Justica, Asparags.

The linear regression analysis correlation coefficient and goodness of fit model are calculated for finding the correlation and it represent in table 2.In this linear regression for justica and Asparags found minimum value and for Tulsi, Panfuti and Tridax maximum value.

Plant name	**Correlation-Coefficient**	**Goodness of fit**
Tulsi	0.9935	0.9871
Panfuti	0.9899	0.9800
Tridax	0.9831	0.9665
Justica	0.4239	0.1797
Asparags	0.419	0.1756

The performance of linear regression model for Neem with others plants are represented in figure 1. On the basis of regression analysis Neem is highly correlated with Tulsi, Panfuti and Tridax

Conclusion

In this research work, the results were produced on non-imaging hyperspectral data which was collected in Geospatial Technology Research Laboratory using FeildSpec4 instrument. Its gives the hyperspectral Signature of medical plant. Chlorophyll is a medicinal content in plant. The present study can be used for plant leaves chlorophyll content within time which has useful applications in agriculture. We apply statically analysis it gives the result is Tridax statistical analysis is very highly reflectance. In this study we have comparison of Neem leaf with other plants using regression analysis with the help of python. As per result Neem tree Chlorophyll content are co- related to Tulsi, Tridax and Panfuti.

References

[1] Archana R. Mate, Dr. Ratnadeep R. Deshmukh, "Analysis of Effects of Air Pollution on Chlorophyll, Water, Carotenoid and Anthocyanin Content of Tree Leaves Using Spectral Indices", ISSN 2321 3361 © 2016 IJESC Volume 6 Issue No. 5, May 2016.

[2] Amarsinh B Varpe, Yogesh D Rajendra, Amol D Vibhute, Sandeep V Gaikwad, KV Kale, "Identification of plant species using non-imaging hyperspectral data" , (MAMI) Man and Machine Interfacing, International Conference, IEEE, pp.1-4, 2015.

[3]]Amarsinh B.Varpe, Karbhari V. Kale, Amol D.Vibhute, Rupali R. Surase, Ajay D. Nagne.," Analysis of Chlorophyll in Plant Species Leaves using Hyperspectral Remote Sensing Data", ISSN , Special Issue - NCCT - 2018.

[4] Pramod N. Kamble1, Sanjay P. Giri2, Ranjeet S. Mane1 and, Anupreet Tiwana3," Estimation of Chlorophyll Content in Young and Adult Leaves of Some Selected Plants ",All Rights Reserved Euresian Publication © 2015 eISSN 2249 0256, Issue 6: 306-310,2015

[5] C. Lin1, S. C. Popescu2, S. C. Huang1, P. T. Chang3, and H. L. Wen1," A novel reflectance-based model for evaluating chlorophyll concentrations of fresh and water-stressed leaves", Biogeosciences,2015

[6]Jan-ChangCHEN1,Chi-MingYANG2,Shou-TsungWu3,Yuh-LurngCHUNG4,AlbertLintonCHARLES1,andChaur-TzuhnCHEN4," Leaf chlorophyll content and surface spectral reflectance of tree species along a terrain gradient in Taiwan's Kenting National Park",2016

[7] Rajesh K. Dhumal, Amol D. Vibhute, Ajay D. Nagne, Yogesh D. Rajendra, Karbhari V. Kale and Suresh C.Mehrotra, "Advances in Classification of Crops using Remote Sensing Data", Cloud Publications, International Journal of Advanced Remote Sensing and GIS, V olume 4, Issue 1, Article ID Tech483 ISSN 2320 – 0243, pp.1410-1418, 2015.

[8] Qiu-xiang Yi ⇑ , An-ming Bao, Qiang Wang, Jin Zhao," Estimation of leaf water content in cotton by means of hyperspectral indices",2012.

[9] Penuelas J., Baret F., and Filella I., "Semi empirical indices to assess carotenoids/ chlorphyll a ratio from leaf spectral reflectance", photosynthetica, pp.221-230, 1995

[10] Osamu Matsuda*, Ayako Tanaka, Takao Fujita and Koh Iba," Hyperspectral Imaging Techniques for Rapid Identification of Arabidopsis Mutants with Altered Leaf Pigment Status",2012.

[11] Anatoly A. Gitelson1,2*,Yuri Gritz†2, Mark N. Merzlyak3," Relationships between leaf chlorophyll content and spectral reflectance and algorithms for non-destructive chlorophyll assessment in higher plant leaves",2012

[12] Yanfang Zhai a b , Lijuan Cui c , Xin Zhou a , Yin Gao a , Teng Fei a & Wenxiu Gao," Estimation of nitrogen, phosphorus, and potassium contents in the leaves of different plants using laboratory-based visible and near-infrared reflectance spectroscopy: comparison of partial least-square regression and support vector machine regression methods", International Journal of Remote Sensing,2012.

[13] Cushnahan, T.A., Yule, I.J., Pullanagari, R. and Grafton, M.C.E," IDENTIFYING GRASS SPECIES USING HYPERSPECTRAL SENSING",page no.144,2016

[14] Driss Haboudane, Nicolas Tremblay, John R. Miller, and Philippe Vigneault," Remote Estimation of Crop Chlorophyll Content Using Spectral Indices Derived From Hyperspectral Data", IEEE transactions on geoscience and remote sensing, vol. 46, no. 2, february 2008

[15] Yachao Wang, Gang Wu," Plant Species Identification Based on Independent Component Analysis for Hyperspectral Data", JOURNAL OF SOFTWARE, VOL. 9, NO. 6, JUNE 2014.

[16] Jan-Chang Chen a, Chaur-Tzuhn Chen" CORRELATION ANALYSIS BETWEEN INDICES OF TREE LEAF SPECTRAL REFLECTANCE AND CHLOROPHYLL CONTENT".

[17] Yachao Wang, Gang Wu," Plant Species Identification Based on Independent Component Analysis for Hyperspectral Data", JOURNAL OF SOFTWARE, VOL. 9, NO. 6, JUNE 2014.

[18] Scott D. Noble1, Ralph B. Brown2 "Plant species discrimination using spectral/spatial descriptive statistics",ISSN

[19] Sandeep V.Gaikwad, Yogesh D. Rajendra, K.V.Kale, S.C.Mehrotra" Synygium Cumini Plant Photosynthetic Pigment Detection from Hyperspectral Datasets using Spectral Indices", MAMI,2017

[20] Jan Rudolf Karl Lehmann 1,*, André Große-Stoltenberg 1, Meike Römer 2 and Jens Oldeland "Field Spectroscopy in the VNIR-SWIR Region to Discriminate between Mediterranean Native Plants and Exotic-Invasive Shrubs Based on Leaf Tannin Content", ISSN 2072-4292,2015

[21] L. J. Martinez M a *, A. Ramos a, "ESTIMATION OF CHLOROPHYLL CONCENTRATION IN MAIZE USING SPECTRAL REFLECTANCE", Volume XL-7/W3, 2015

[22] Jan-Chang Chen a, Chaur-Tzuhn Chen" CORRELATION ANALYSIS BETWEEN INDICES OF TREE LEAF SPECTRAL REFLECTANCE AND CHLOROPHYLL CONTENT", Vol. XXXVII. Part B7. Beijing 2008

[23] Tao Cheng, Benoit Rivard and G. Arturo Sánchez-Azofeifa "SPECTROSCOPIC DETERMINATION OF LEAF WATER CONTENT USING CONTINUOUS WAVELET ANALYSIS".

[24] Anatoly A. Gitelson, 2,4 Olga B. Chivkunova, 3 and Mark N. Merzlyak," Non-Destructive Estimation of Anthocyanins and Chlorophylls in Anthocyanic Leaves", American Journal of Botany ,2009

[25] Kazuo Oki," Why is the Ratio of Reflectivity Effective for Chlorophyll Estimation in the Lake Water?", ISSN,2010

[26] E. Raymond Hunt Jr., Paul C. Doraiswamy, James E. McMurtrey, Craig S.T. Daughtry, Eileen M. Perry, and Bakhyt Akhmedov," A visible band index for remote sensing leaf chlorophyll content at the canopy scale",2013

[27] Elke Bauriegel * and Werner B. Herppich ," Hyperspectral and Chlorophyll Fluorescence Imaging for Early Detection of Plant Diseases, with Special Reference to Fusarium spec. Infections on Wheat", ISSN,2014

[28] Anatoly A. Gitelson1,2*,Yuri Gritz†2, Mark N. Merzlyak," Relationships between leaf chlorophyll content and spectral reflectance and algorithms for non-destructive chlorophyll assessment in higher plant leaves",200

[29] Vipin Y. Borole, Sonali B. Kulkarni, "Comparative Analysis of Soil Properties for Influence of Fertilizers using Remote Sensing Techniques", International Journal of Computer Applications (0975 – 8887) Volume 174 – No. 21,February 2021, pp. 24-34

[30] Vipin Y. Borole and Sonali B. Kulkarni, "Correlation of pH on Soil Physicochemical Properties using Linear Regression Model for Spectral Data Analysis", International Journal of Advanced Remote Sensing and GIS, Volume 10, Issue 1, 17 July-21, pp. 3492-3500

[31] Vipin Y. Borole, Sonali B. Kulkarni, "Soil Properties Classification Using Support Vector Machine For Raver Tehsil", International Journal of Advanced Trends in Computer Science and Engineering, 10(6), November – December 2021, Pg.3154 – 3159