



# Artificial Intelligence in Identification of Macro Nutrients Deficiency in Paddy Crop

IMAGES OF LEAFS OF RICE SAPPLING

Pranav Sunil Jadhav | 20/08/2023

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## ABSTRACT

Nutrient deficiency has a noteworthy impact on agriculture which results in reduced plant quality in turn reduced crop yield. A plant can have Multiple deficiencies at the same time so there is need of suggesting an appropriate Fertilizer considering all nutrient deficiencies in it. In this report I have put forth the idea for suggestion for suitable fertilizer using a Machine Learning Model, for detected nutrient deficiency from leaf images using Neural Networks. We trained our dataset using Convolution Neural Networks then the output of this network is sent to the trained model of Random Forest which suggests the suitable fertilizer. Since Potassium(K), Phosphorous(P) and Nitrogen(N) are three key nutrients required for Rice plant we considered the image dataset having leaves with N, P, K deficiencies.

## PROBLEM STATEMENT

In particular, the generation of high and constant rice yields is dependent on fertilizers for world food production. The best results are obtained by the correct use of specific fertilizers in the required quantity. Rice is often grown in India, however, without such a targeted input of nutrients. Non-scientific fertilization practices are common and result in imbalanced nutrient applications in rice fields when combined with an overall delay in adopting a widespread technology. Currently, there is still frequent blind fertilization. Consequently, increasing quantities of fertilizers have been used to achieve small rice yield increases, and rice quality has decreased as a result. The result is that small farmers – who manufacture most of the rice – are not achieving potentially achievable revenue growth.

## MARKET/CUSTOMER/BUSINESS NEED ASSESSMENTS

### 1. Nitrogen Deficiency

Nitrogen deficiency is the most commonly detected nutrient disorder observed in rice. Old leaves and sometimes all leaves become light green and chlorotic at the tip. Leaves die under severe stress. Except for young leaves, which are greener, deficient leaves are narrow, short, erect, and lemon yellowish. The entire field may appear yellowish. Nitrogen deficiency often occurs at critical growth stages such as tillering and panicle initiation, when the demand for N is large.



## 2. Potassium Deficiency

Dark green plants with yellowish brown leaf margins or dark brown necrotic spots first appear on the tips of older leaves. Under severe K deficiency, leaf tips are yellowish brown. Symptoms appear first on older leaves, then along the leaf edge, and finally on the leaf base. Upper leaves are short, droopy, and “dirty” dark green. Older leaves change from yellow to brown and, if the deficiency is not corrected, discoloration gradually appears on younger leaves. Leaf symptoms of K deficiency are similar to those of tungro virus disease. Unlike K deficiency, however, tungro occurs as patches within a field, affecting single hills rather than the whole field



## 3. Phosphorous Deficiency

Stunted, dark green plants with erect leaves and reduced tillering may signal P deficiency. Leaves are narrow, short, very erect, and ‘dirty’ dark green. Stems are thin and spindly, and plant development is retarded. The number of leaves, panicles, and grains per panicle may also be reduced. Young leaves may appear to be healthy, but older leaves turn brown and die. Red and purple colors may develop in leaves if the variety has a tendency to produce anthocyanin. Leaves appear pale green when N and P deficiency occur simultaneously



To identify these Deficiency and treat them in the right time will increase the yield of the paddy crop and thus beneficial for the farmers and would increase the quality in the market,

## TARGET SPECIFICATION/ TARGET CHATERIZATION

The proposed service will be beneficial for the Farmers, newbies who wants to start farming as these Farmers usually go with the old trends to identify the need or it has been observed that the Farmers shower the fertilizers on the crop although there is no need which eventually make loss to the soil and it may get infertile and affect the yield of a crop

Following things can be achived with proposed service:

- To Identify the actual deficiency in time
- Plan nutrition accordingly
- Help them to increase the crop yield
- Achieve less investment and High profit.

## EXTERNAL SEARCH

### BREIF SUMMARY

Similar attempts have been made to identify the macro nutrients deficiency in the paddy crops. In India, there is only one tool by Plantix which has similar approach. Also there are some other applications with different approaches, and some websites educating the identification of macro nutrients deficiency.

### - WEBSITES

- Indian Council of Agricultural Research's has provided a ebook on their website to educate the farmers about the Identification and Management of Nutrient Disorders and Diseases in Rice, A visual Diagnostic Tool.  
[https://krishi.icar.gov.in/jspui/bitstream/123456789/16653/1/identification%20n%20managment%20e\\_book.pdf](https://krishi.icar.gov.in/jspui/bitstream/123456789/16653/1/identification%20n%20managment%20e_book.pdf)
- Tamil Nadu Agricultural University has made a website to educate about the nutrients management and symptoms of the deficiency  
[http://www.agritech.tnau.ac.in/expert\\_system/paddy/nutrientmanagement.html](http://www.agritech.tnau.ac.in/expert_system/paddy/nutrientmanagement.html)

### - APPLICATIONS

- Plantix is the application which is almost similar to the proposed model with more help to a farmer to choose the fertilizers and buying them from their website and other doubt solving of a farmer with no cost. It is available in almost 11 languages in the India and 7 foreign languages,
- Farmcare is the application by yara which uses different approach to identify the deficiency in the paddy crop and suggest the amount of fertilizer for a particular deficiency using fields dimensions.

## BENCH MARKING

There are only handful of Applications which uses the similar kind of technology to the proposed one. A brief comparison of these are as follows:

Product	Type	Developed In	Feature
Plantix	Application	Germany	App-based platform offering plant disease diagnosis
<u>Pestoscope</u>	Application	India	Provides solutions for pest control in crops
<u>WithPlant</u>	Application	South Korea	App that allows users to identify plants and find answers through collective intelligence
AgroDoc	Web Application	France	Peer-to-peer networking platform providing crop diagnosis solutions using Machine Learning technology

## APPLICABLE CONSTRAINS

- Continuous data collection form the websites and databases
- Quality of Images for correct Identification
- Knowledge of the Agricultural Expert (PHD, MSc, BSc in agriculture)

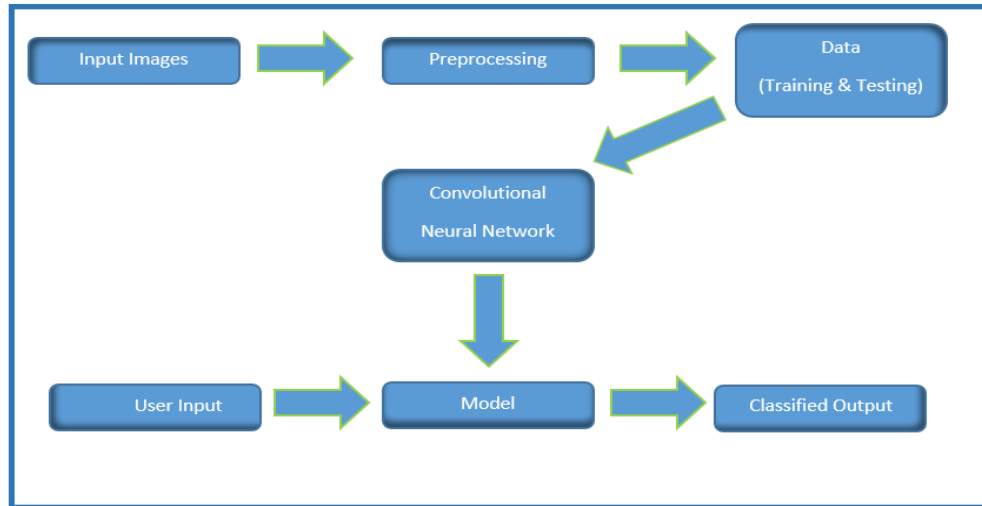
## BUSINESS MODEL

Though AI is capable enough to help build the type of service proposed. No similar service is in place in India to identify macro nutrients deficiency by an Indian firm. Therefore, it is likely that the service will make a difference in the life of farmers, and if tied-up with the local government would definitely transform the life of the farmers, and growth in Agricultural sector in India with consultation from an Agricultural Expert.

## CONCEPT GENERATION

We need to come up with a product/ model which can take the images as an input and classify them as output

## FINAL PRODUCT PROTOTYPE



The final product will be a web-based or android-based service which will classify the input image provided by the user with the help of Convolutional Neural Network.

## PRODUCT DETAILS

It's a model which will be trained by using collected images from the available sources, converted into a web or android application, and then it will be used to classify the input image to identify the deficiency in the macro nutrients of a paddy crop.

### DATA SOURCES

Data was sourced from kaggle for identification, Agricultural Experts can be consulted for the help. Indian Council of Agricultural Research and other government bodies related to the agriculture can be contact as well (refer External search section for websites).

Link for the data used in this report:

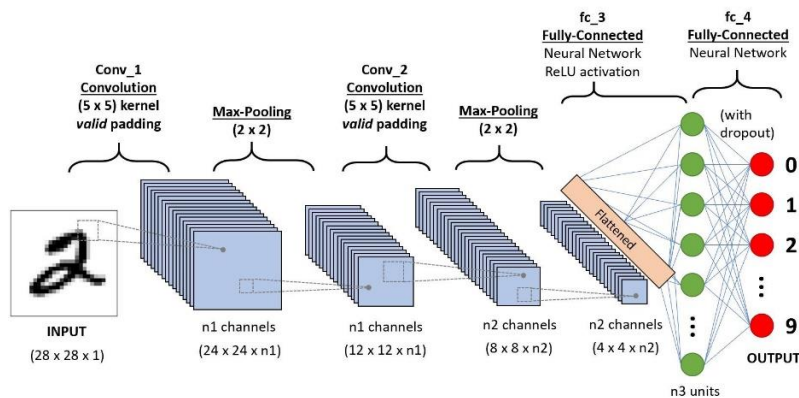
<https://www.kaggle.com/datasets/guy007/nutrientdeficiencysymptomsinrice>

### ALGORITHMS

The algorithm that will be used at the core of the proposed system is **Convolutional Neural Network**, generally abbreviated as CNN.

Key points of CNN:

- **Convolutional Layer:** These layers are made up of a set of filters ( also called as Kernels) that are applied to an input image. The output of the convolutional layer is called Feature Map, which is a representation of the input image with the filters applied.
- **Pooling layer:** This type of layer is responsible for lowering the computational load required to process the data by reducing the size(dimensions) of the convoluted layer.
- **Fully-Connected Layer:** FC layers are used towards the End of CNN to take the features learned by the previous layers and use them to make predictions.



## FRAMEWORKS

The following python frameworks will play a crucial role in creating the desired System.

- Pandas: Pandas is a feature-rich library mainly used for handling, manipulating and transforming data
- Scikit-learn: It is a gold standard library for machine learning which comes with plenty of algorithms for regression, classification, clustering and also for feature engineering task.
- Keras: Keras is a deep learning framework built on top of Tensorflow. It facilitates easy creation of Artificial Neural Networks.
- Matplotlib and Seaborn: Both of these libraries are used for visualization purpose and are totally free to install and use just like the above ones.

## TEAM REQUIRED TO DEVELOP

- 1 Data Scientist
- 1 Software Developer/ Android Developer
- 1 Agricultural Expert (BSc, MSc, PHD)

## CONCLUSION

Artificial Intelligence in agriculture not only helps farmers at their farming but also shifts to precise cultivation for higher crop yield and better quality while using fewer resources.

Companies involved in improving the machine learning or Artificial Intelligence based products or services in agriculture will get technological advancement in the future helping in dealing with the food production issues for the growing population.

The Country like India which have topped in base of population (140Cr) should eventually look for the advancement in the Agriculture so as to full fill the need population with the help of AI and machine Learning. The problems like increase in price of Grains, Vegetables, Fruits, etc. can be controlled with proper monitoring and increasing the yields with the help of AI and Machine Learning which can be proved as **Modern Agricultural Solution for Modern Agricultural Problem.**

## REFERENCES

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