A close-up photograph of young rice plants growing in dark brown soil. The plants have vibrant green, lanceolate leaves with prominent veins. The background is slightly blurred, showing more of the dense crop.

Rice Crop Leaf Image Analysis

Nitrogen Deficiency Detection

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A close-up photograph of a person's hands. The person is wearing a blue and white checkered shirt. Their right hand is given a thumbs up, while their left hand is partially visible at the bottom, also in a checkered pattern. The background is a blurred green field.

O1

Introduction

Why does our project
matter?



**30 FARMERS DIE BY
SUICIDE EACH DAY**

Suicides up almost 30% since 2019

The latest report of the National Crime Records Bureau (NCRB) in India, published earlier this week, said 5,563 agricultural laborers committed suicide last year and the number of people killing themselves in the industry increased by 9% from 2020, and up 29% from 2019.



The state of Punjab where we visit, is known as the breadbasket of India. While it accounts for approximately 3% of India's arable land, it grows almost 20% of the country's wheat and 12% of the country's rice. It is also known as "ground zero" for India's Green Revolution. What happens in Punjab is a warning sign for the rest of the country. Over the last five years, suicides in the rural Indian State of Punjab increased by over 12 times. - CNN

DEATH BY SUICIDE WERE HIGHEST AMONST SMALL AND MARGINAL FARMERS

- NCRB

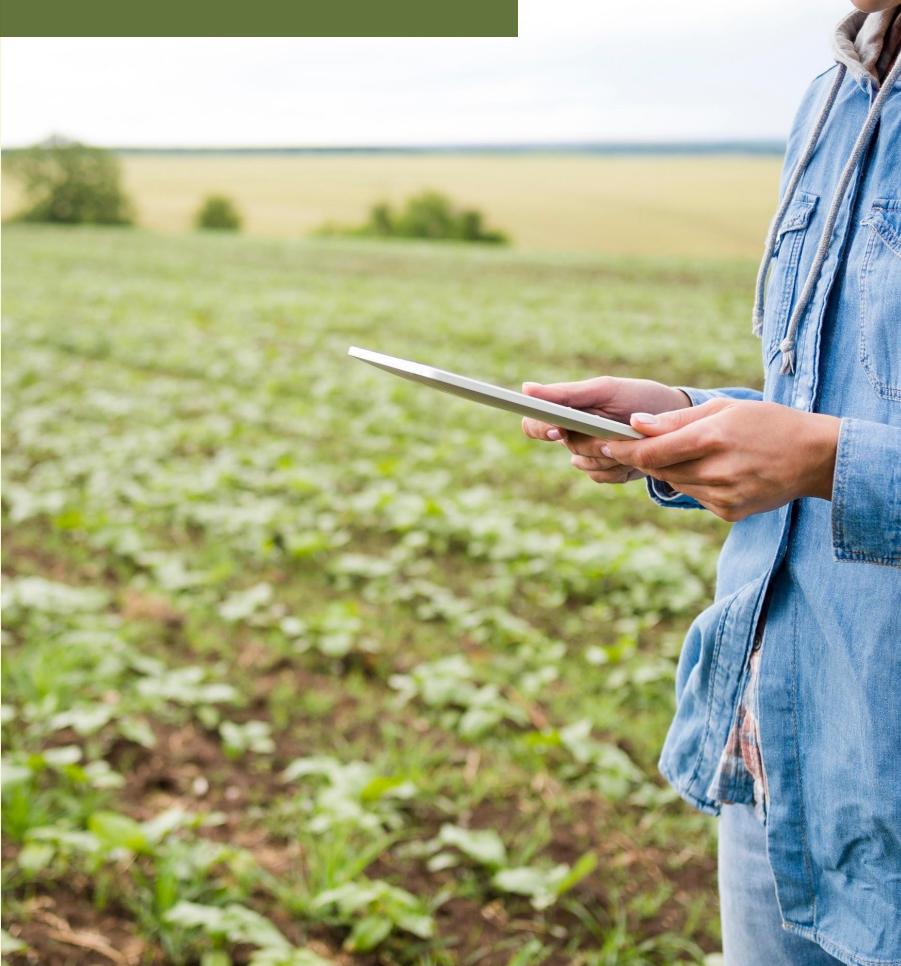
Reason for suicide ranked

1. Overwhelming Debt
2. Crop failure
3. Environmental degradation
4. Illness

Why does it matter?

- ❖ Essential nutrient for growth & development
- ❖ Lack of NO₂
 - Stunted growth
 - Yellow leaves
 - Reduced tillering
 - **Decreased Yield**
 - Quality of Rice
 - Protein content
 - Grain size
 - Market value
- ❖ Common issue for rice crops
 - Rice is heavy feeder of NO₂
- ❖ Improper use of fertilizers
 - Environmental pollution
 - Decreased soil health
 - Reduced crop yields





Our Goal

Ultimately, help small-time farmers
that do not have resources to
operate with high-tech systems to
ensure that rice crops receive
adequate nitrogen for
PRODUCTIVITY & QUALITY
through a low cost method

02. Background & Approach

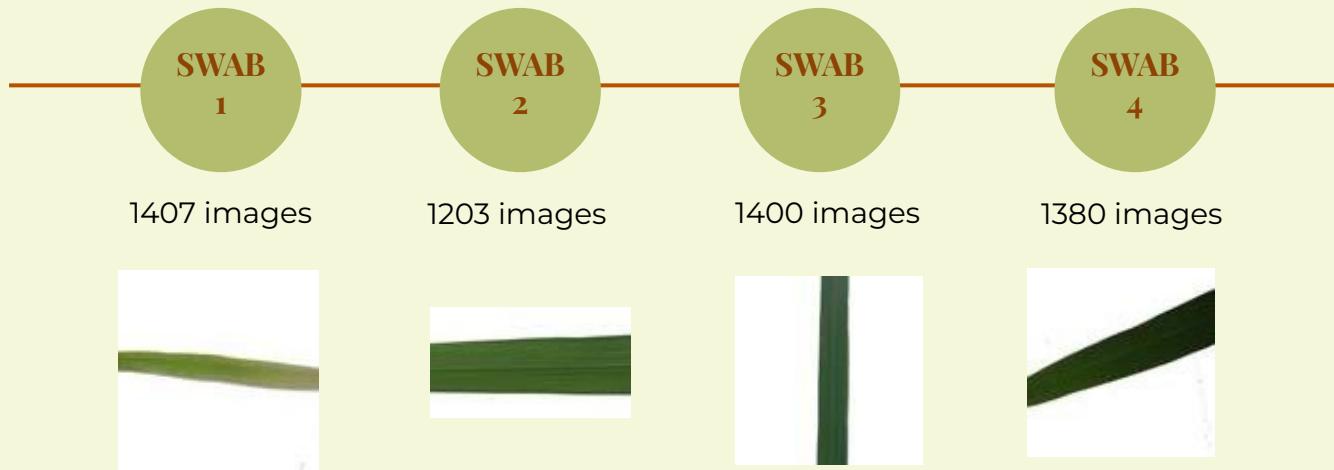
About LCC & Our Data



About Our Dataset

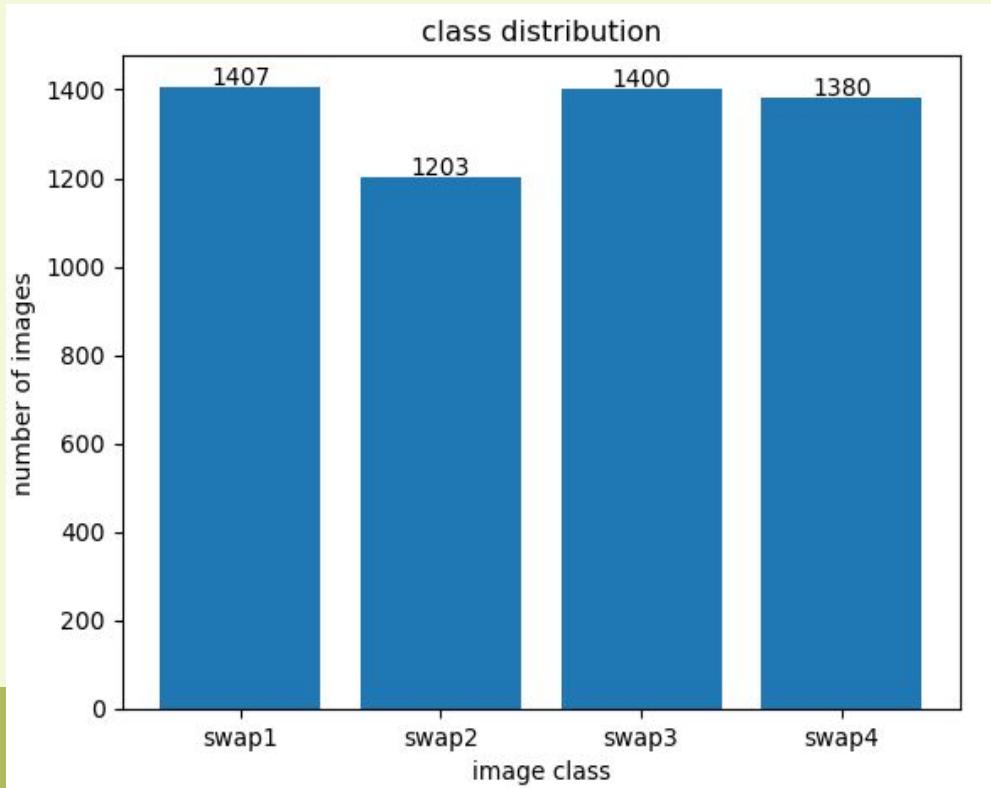


Categorized based on LCC



LCC - Leaf Color Chart

Distribution of Image Data

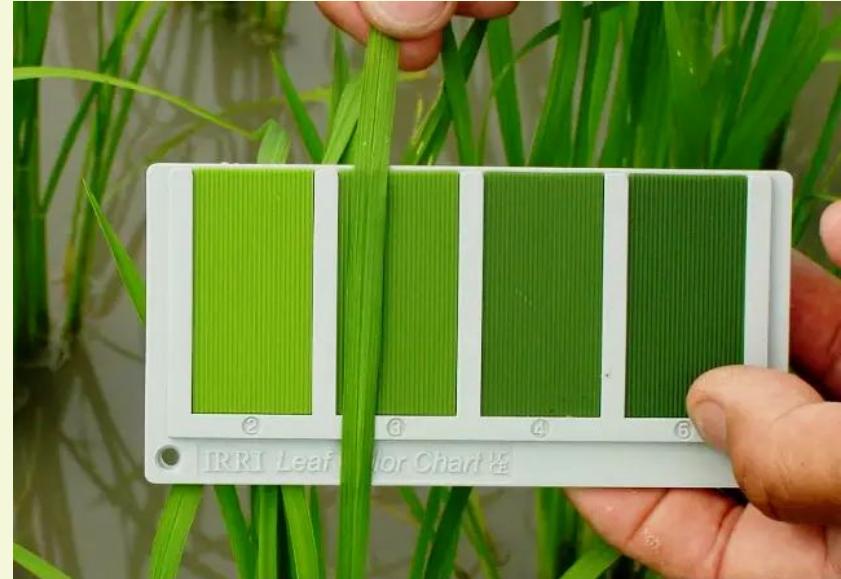


Classes are pretty evenly distributed!

But what is the LCC and SWAB??

About the LCC

- ❖ Visual tool to determine level of nitrogen deficiency by evaluating the greenness of leaves
- ❖ Easy to use, inexpensive diagnostic tool
- ❖ Real-time N management
 - Apply fertilizer whenever leaves become more yellowish-green than threshold
 - Measure leaf color under shade or away from direct sunlight



LCC Real-time N Management

SWAB1

Apply N-Fertilizer IMMEDIATELY



SWAB2

Apply N-Fertilizer soon



SWAB3-4

Ideal level - Do Not Apply



Problem vs. solution



Problem - Misjudgement

LCC relies on human perception & judgement

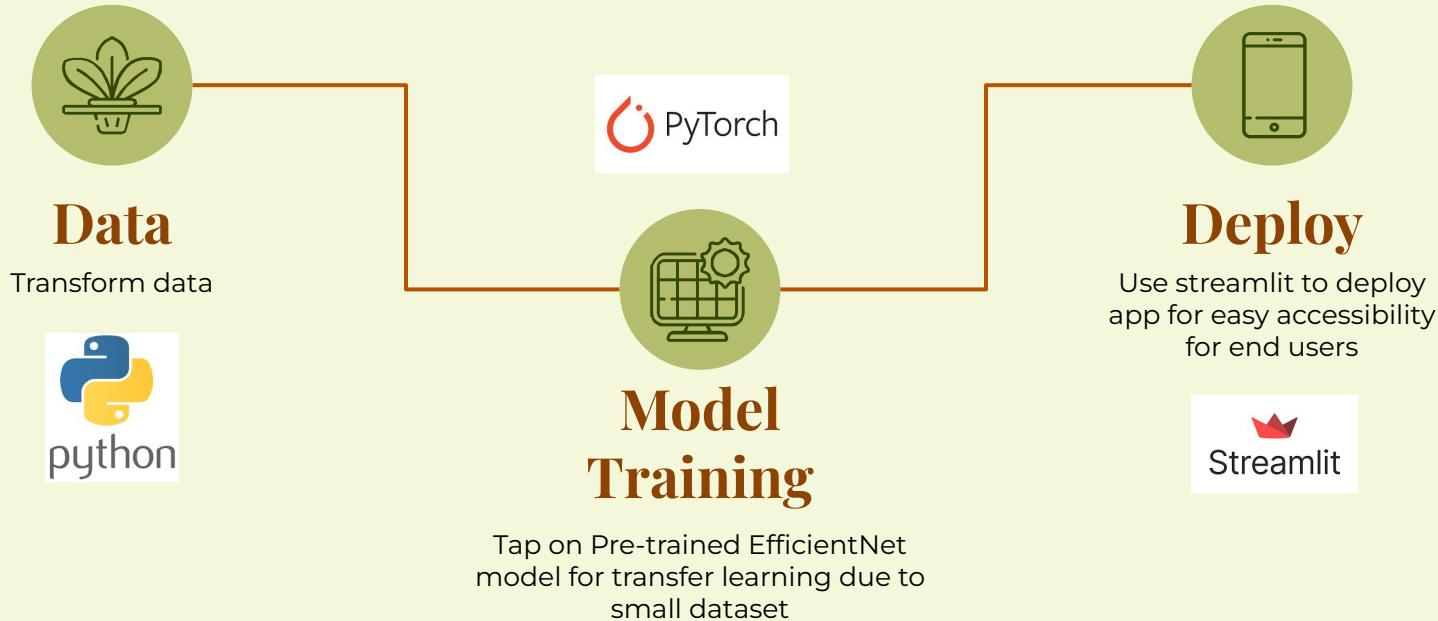
- Variability between different observers
- Requires training and practice to achieve consistent results



Solution

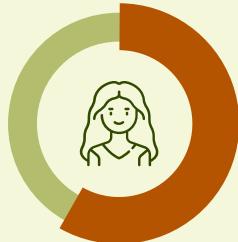
Web application utilising a multi-label image classifier model to remove human error variable

Approach

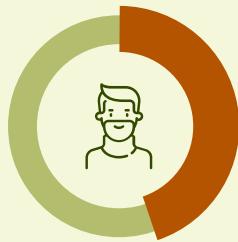


Target

Gender

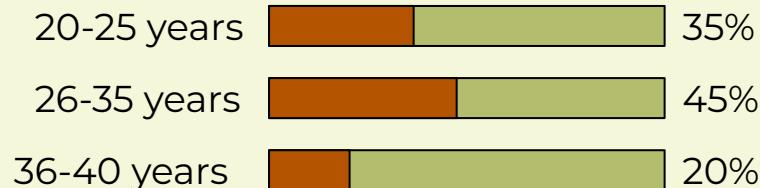


55% **Women**
Neptune is far away from Earth



45% **Men**
Venus is the second planet from the Sun

Age range



Hobbies



Jupiter
Jupiter is a gas giant



Venus
Venus is terribly hot



Mars
Mars is a cold place



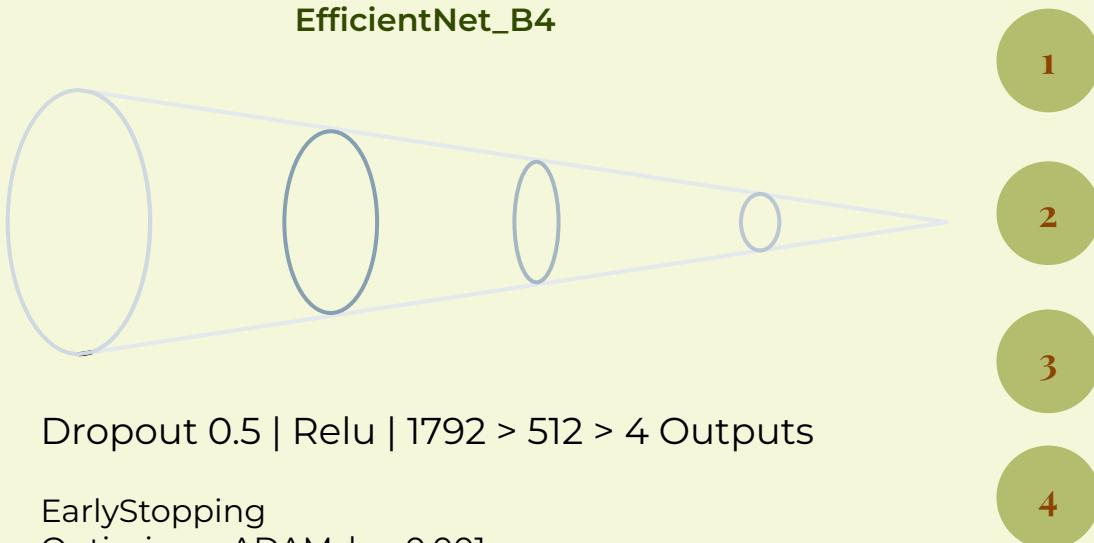
03

Our Model

Architecture & Hyperparameters

Data

4000+ Images (80%)
Transformed to increase
variations for training



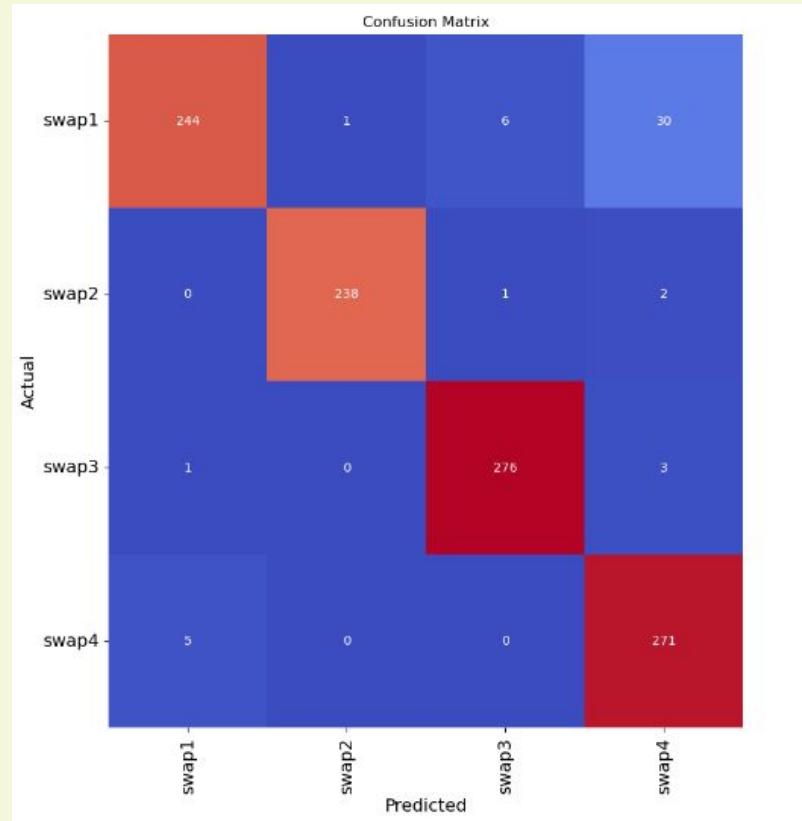
1

2

3

4

Evaluation





The only
source of
knowledge is
experience





04 Deployment



<https://rice-crop-plant-nitrogen-deficiency-detection.streamlit.app/>

5. Conclusion

Summary

Limitations

Future Work





Thanks!

Nitrogen Deficiency Detection | A data science project for a cause

Benedict Yong