Trees classification and NDVI computation using Deep Learning

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ABSTRACT

Rapid expansion in efforts to stop the deforestation of our planet has led to an increase in the information gathered about the forest so that we can better understand their needs. In this research project I aimed to create a robot for estimate the number of trees inside a forest and the stress levels that are affecting these trees. These stress levels have been heightened with an influx of human activity to previously untouched forest areas. The Robot maps such stress levels on a visual display on so that a heat signature shows the area of concern in an area to help show a correlation that is not able to be pictures but by a human working to collect data through the forest.

Figure 1: Object Detection

OBJECTIVES

1) Classify the species of tree using Object Detection
2) Locate the Region of Interest of the Tree
3) Computer the position of the Tree
4) Computer the coordinates of the tree using the depth and angle of the tree
5) Compute the NDVI of the Tree's canopy
6) Map the Coordinates of the Robot

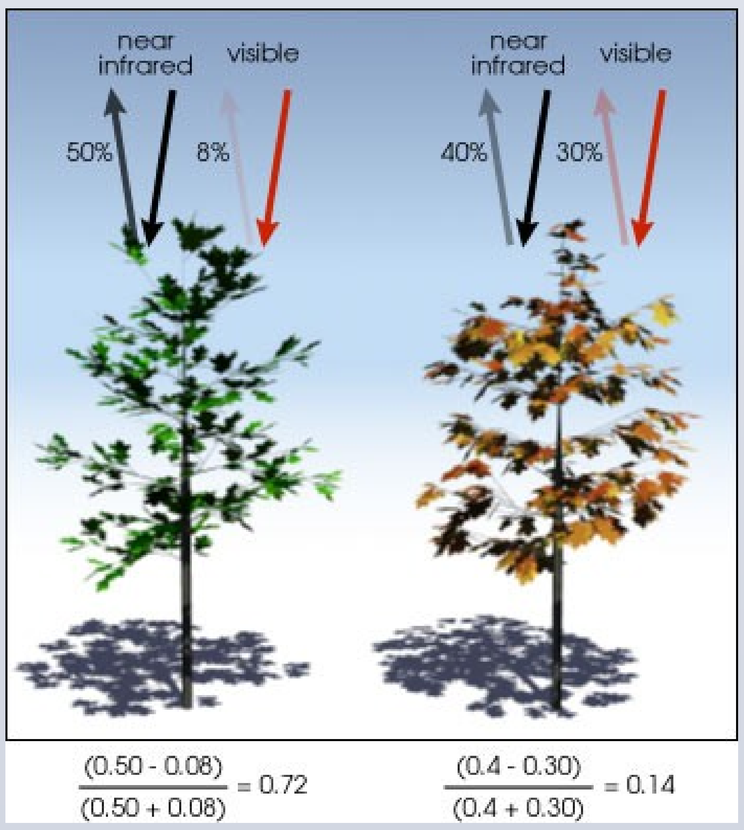

Figure 2: Calculating NDVI [1]

$$NDVI = \frac{NIR - RED}{NIR + RED} (1)$$

Where:
NDVI is the Normalised Difference of Vegetation Index [1]
NIR is the Near Infra Red image
RED is the red channel image extracted from a RGB image

METHODOLOGY

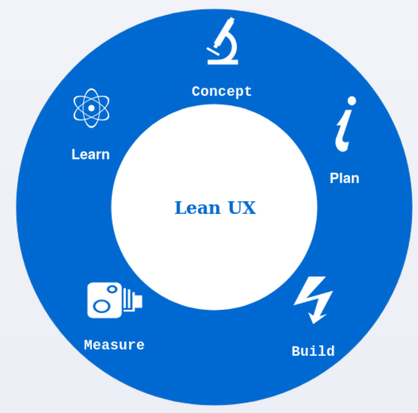

Figure 3 : Lean UX Methodology[2]

i) Concept – What does the project need to succeed
ii) Plan – How is the project going to be conducted
iii) Build – Build basic prototype
iv) Measure – understand the success rate of the AI Model
v) Learn – Learn how to better Implement the AI Model

RESULTS

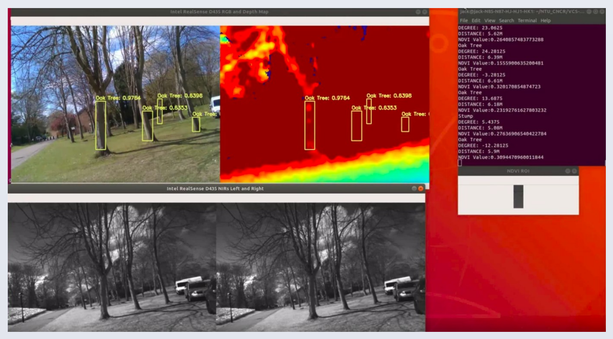

Figure 3 : NDVI Results [3-4]

Table 1 :NDVI Results [5]

Tree Classification	NDVI Value	NDVI Value
Oak Tree	0.26	Shrub/Grassland
Oak Tree	0.15	Stone, Rock or Sand
Oak Tree	0.32	Tropical
Oak Tree	0.23	Shrub/Grassland
Stump	0.26	Shrub/Grassland
Oak Tree	0.30	Shrub/Grassland

CONCLUSIONS AND FUTURE WORK

The results of this project have shown how it is possible to classify trees using the YOLOV3 object detection algorithm on a Xilinx/TULIPP Zynq ReVision platform using the Intel Realsense D435i 3D Camera. Furthermore use the ROI of the detected project objects to compute the NDVI levels. The project showed how different variables can affect the outcome of object detection. Detecting objects under changing environments bring issues that are not apparent when working in a controlled environment.

REFERENCES

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[3] Available online, https://www.youtube.com/watch?v=RxboGda9UGE

[4] Available online, https://www.youtube.com/watch?v=Nj4C7Urb-e8&t=3s

[5] Available online, https://www.youtube.com/watch?v=WqE9EyK46-E

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