Lichen Classification Web Application to Analyze Initial Air Quality With AI

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THE GLOBE PROGRAM
Global Learning and Observations to Benefit the Environment

ABSTRACT

This technology project aims to develop a web application for lichen classification and serve as a tool for preliminary air quality analysis, leveraging the sensitivity of lichens to environmental conditions. The project focuses on enabling the general public to easily identify different lichen species, especially for individuals without prior knowledge in lichenology. To ensure accurate and convenient lichen classification, the developers have implemented an artificial intelligence (AI) system utilizing a Convolutional Neural Network (CNN) trained with ImageDataGenerator from TensorFlow/Keras. This model is capable of classifying lichens into three distinct groups based on user-submitted images via the web application. The development of this web-based platform allows users to access the system seamlessly without the need for additional software installation.This project facilitates lichen identification for enthusiasts, researchers, and those interested in using lichens as bio-indicators of air quality. Additionally, it serves as a foundation for the development of tools that can be applied in environmental conservation and ecological studies in the future.Most lichens thrive in moderate temperatures (20-35°C), with extreme heat or cold potentially inhibiting their development. Some species can withstand harsh conditions.

INTRODUCTION

Identifying different lichen species is challenging for the general public due to their similar physical characteristics. To address this issue, the project team has integrated Artificial Intelligence (AI) technology to facilitate lichen classification and provide insights into air quality. The AI model, developed using TensorFlow/Keras' ImageDataGenerator, is trained on a Convolutional Neural Network (CNN) to accurately distinguish between different lichen species. Recognizing the difficulties in manual classification and the lack of awareness regarding the impact of air pollution on lichen populations, the project team has developed a web application that utilizes AI to automate lichen classification and monitor air quality.

DEVELOPMENT TOOLS

Visual Studio Code

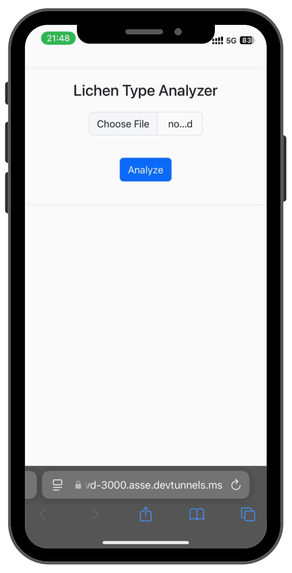
HTML CSS

Google colab

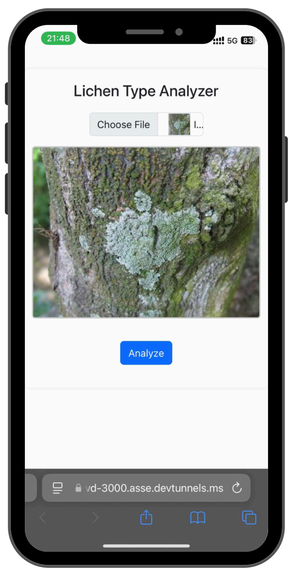
TensorFlow

THE PRINCIPALS OF OPERATION AND FUNCTIONS

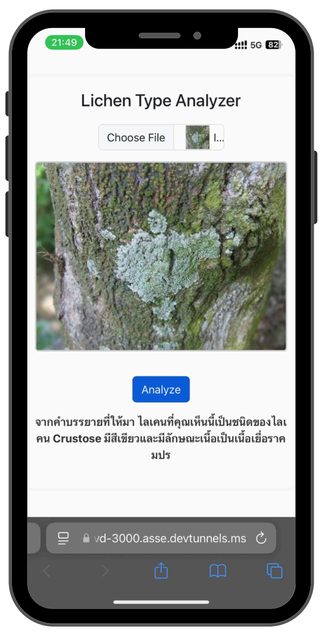
(WEB APPLICATION)



Home page of web application.



Upload lichen image



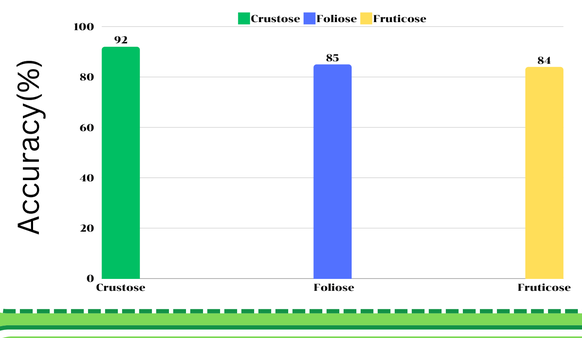
Result

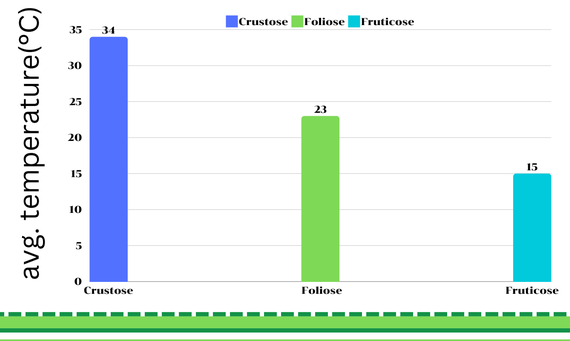
OBJECTIVE

To develop and evaluate the effectiveness of AI applications for lichen classification.

RESULTS

During testing, the AI model achieved an accuracy of 87% in classifying lichen species, with Crustose lichens being correctly identified 92% of the time, Foliose 85%, and Fruticose 84%. The model occasionally misclassified lichen species due to variations in texture, lighting, and background.From the temperature survey in the school area where different types of lichens were found, it was observed that Crustose lichen exists at a temperature of 34.5°C that lichens can grow and thrive in temperatures ranging from 15–35°C from the study in Lichen Explorer's Guide.





CONCLUSION

This web application classifies lichen species with 87% accuracy, providing preliminary air quality assessments based on their presence. Crustose lichens thrive in polluted areas, Foliose in moderately polluted regions, and Fruticose in cleaner environments. While the results are promising, challenges such as misclassification and environmental variability need to be addressed. Future improvements should focus on enhancing accuracy Temperature also plays a crucial role in lichen growth. Most lichens thrive in moderate temperatures (20-35°C)

DISCUSSION

The developed web application uses AI to classify lichen species (Crustose, Foliose, Fruticose) and analyze air quality based on their presence. The AI model shows promise but isn't 100% accurate due to the variability of lichen species. Lichens are sensitive to pollutants like sulfur and nitrogen dioxide, making them useful bioindicators for air quality. The app provides a preliminary air quality assessment, with Crustose lichens indicating areas with higher pollution, Foliose in moderate pollution, and Fruticose in areas with good air quality. However, other environmental factors like temperature and humidity should also be considered for more precise assessments. The web platform is accessible, user-friendly, and provides an entry point for the public to learn about lichen identification and air quality. To improve, the app could offer more educational resources and integrate real-time air quality data for a more comprehensive analysis. The project has the potential for environmental monitoring, with future improvements focusing on accuracy, user experience, and expanded ecological data integration.

BIBLIOGRAPHY

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