Paper title: **Implementing Sentinel-2 Data and Machine Learning to Detect Plant Stress in Olive Groves**
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Motivation:

The motivation behind this study lies in addressing the challenges faced by the Mediterranean olive cultivation industry, including diseases, pests, and environmental stressors. The need to efficiently identify and categorize stress in Halkidiki olive fields is underscored, emphasizing the impact of such stressors on crop productivity. The study is driven by the recognition of Greece's significant contribution to Mediterranean olive production and the desire to mitigate the effects of plant stress quickly. Traditional stress detection methods are deemed inefficient, leading to the adoption of Sentinel-2 satellite data and machine learning as a more effective approach.

Contribution:

The primary contribution of the study is the utilization of Sentinel-2 satellite data and machine learning to develop a large-scale olive orchard stress assessment tool. This innovative approach aims to identify and categorize stress in olive fields, addressing the absence of a comprehensive tool for this purpose. The study contributes valuable insights into the application of machine learning algorithms, particularly Support Vector Machines and Random Forest, for binary and multiclass classification in the context of olive orchard stress assessment. The paper also highlights the goals of the research, including finding the best classifier, optimal stress thresholds, and determining the sources of stress. The broader contribution lies in showcasing how this methodology can enhance precision crop protection decision-making, promoting sustainable olive cultivation in Greece.

Methodology:

The methodology involves the integration of Sentinel-2 satellite data and machine learning algorithms to identify and classify olive orchard stress. The detailed and available Sentinel-2 data, known for its effectiveness in satellite-based remote sensing, is used to monitor large-scale data and identify stress factors. Vegetation indices

derived from this data are employed to simplify stress-induced crop damage identification and gain insights into diseases like Xylella fastidiosa. Machine learning algorithms, specifically Support Vector Machines and Random Forest, are utilized for binary and multiclass classification, leveraging their proficiency demonstrated in previous research on seed and land coverage classification. The methodology aims to find the best classifier, determine optimal stress thresholds, and identify sources of stress, contributing to the development of a comprehensive stress assessment tool.

Conclusion:

The conclusion of the study emphasizes the potential of the proposed methodology in improving precision crop protection decision-making for olive cultivation in Greece. It recaps the goals achieved, such as identifying stress factors and selecting optimal classifiers and thresholds. The study underscores the broader implications of the methodology in contributing to sustainable olive cultivation practices and highlights the significance of using Sentinel-2 data and machine learning in large-scale stress assessment.

Limitations:

The study acknowledges certain limitations, notably the absence of an existing large-scale olive orchard stress assessment tool prior to this research. While the proposed methodology shows promise, the specific challenges and nuances of olive orchards may pose limitations to the generalizability of the findings. The study also recognizes the need for further research to explore additional machine learning algorithms and refine the methodology. Additionally, the interpretability and complexity of the machine learning models are acknowledged as potential limitations. Overall, the study encourages future research to address these limitations and further advance the understanding and application of satellite data and machine learning in olive orchard stress assessment.