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AARS

Advancing Agricultural Analysis by Remote Sensing

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Lidia M. Ortega is an Associate Professor in Computer Science at the University of Jaén, Spain (ORCID: 0000-0002-7320-7382)

Her research spans Computer Graphics, Computational Geometry, 3D GIS, and Remote Sensing. Over the past decade, her multidisciplinary work has focused on applications in urban environments, Archeology, Geomatics, and Precision Agriculture. She leads projects on 3D/4D tools for digital twins of rural environments, specifically involving the capture and processing of spectral data from various sensors for crop prediction using Machine Learning techniques.

Advantages of Remote Sensing in Agriculture

- Automated remote sensing techniques enable easy and extensive data capture across vast agricultural terrains.
- Obtain of highly diverse information from vegetation health by integrating different sensors like multispectral, hyperspectral, thermal, or LiDAR.
- Diverse sensors can be attached onto drones or Unmanned Aerial Vehicles (UAVs), providing unprecedented flexibility and efficiency in data collection.
- This information requires advanced analytical techniques to extract actionable insights crucial for informed decision-making in precision agriculture.

Applications of Remote Sensing in Agriculture

- Enhanced crop health monitoring and early identification of stress indicators due to nutrient deficiencies, water scarcity, pests, or diseases.
- Early detection allows for timely intervention, preventing widespread damage and optimizing crop yields.
- Early Yield Prediction can be used to create accurate yield maps to predict harvest outcomes more precisely and adjust management practices
- By collecting and analyzing remote sensing with Machine and Deep learning techniques, farmers can make informed decisions to carry out the most productive and environmentally friendly actions.

Advances presented in AARS, Geoprocessing’25 (I)

Data from HSI for Distinguishing Olive Varieties for Precision Agriculture

- Demonstration of the effectiveness of drone-acquired Hyperspectral Imaging (HSI) for precise distinction of olive varieties like Arbequina and Picual, based on subtle spectral differences in leaf reflectance
- A non-invasive, non-destructive, and high-resolution method for varietal mapping, which is crucial for optimizing orchard management and oil quality control in precision agriculture

Advances presented in AARS, Geoprocessing’25 (II)

Optimizing Olive Variety Recognition through Deep Learning and HSI

- Achieved highly accurate automated classification of Picual olive variety by integrating UAV-based Hyperspectral Imaging (HSI) with Deep Learning using Convolutional Neural Networks (CNNs).
- Significantly outperformed traditional machine learning methods by automatically extracting relevant spectral-spatial features

Advances presented in AARS, Geoprocessing’25 (III)

Optimal location of solar panels for agrivoltaic systems in olive groves."

- Proposed a geospatial framework combining GIS and the Analytic Hierarchy Process (AHP) to identify optimal locations dual land use for both agricultural production and solar energy generation.
- Study of the percentage of the area suitable for agrivoltaic systems, with solar radiation and terrain slope being the most influential factors

Advances presented in AARS, Geoprocessing’25 (IV)

Extra Virgin Olive Oil Price Prediction

- Machine Learning (ML) model to accurately predict Extra Virgin Olive Oil (EVOO) prices, leveraging a wide range of multi-source variables.
- Identified the most effective ML algorithms for capturing complex, non-linear market relationships, thereby aiding in market stabilization, distribution optimization, and agricultural budgeting

Advances presented in AARS, Geoprocessing’25 (IV)

Identification of individual olive trees independently of the spatial distribution

- Generalization of traditional computer vision techniques for initial vegetation segmentation and deep learning models for broad vegetation identification.
- A 3D geometric post-processing filter to accurately isolate individual olive tree canopies by discarding ground-level vegetation based on height thresholds.

Advances presented in AARS, Geoprocessing’25 (VI)

Predictive System of Crop Yield in Vineyards

- AI-based geospatial system for early crop yield prediction in vineyards, integrating multispectral satellite images (MODIS, ERA5) and climatic variables
- Achieve outstanding accuracy in harvest prediction by validating and adjusting the predictive models using high-resolution drone-acquired data.

AARS, Geoprocessing'25

Remote Sensing
UAVs
Machine Learning
Deep Learning
olive grove
Prediction
Precision Agriculture
Vineyard