

Antonio Martínez Ibarra

antonio.martinez@um.es

Ph.D student in Computer Science,
University of Murcia



AI for Smart Environments
and Dimensionality Reduction



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Marine
Sciences

Smart
Agriculture

Energy
Efficiency

Time Series
Classification

Future Work

Referencias

- 1 Marine Sciences
- 2 Smart Agriculture
- 3 Energy Efficiency
- 4 Time Series Classification
- 5 Future Work

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Water level forecast



Area of study

- Water flow from stream to Mar Menor
- Multiple data sources during its course

Water level forecast

Marine Sciences

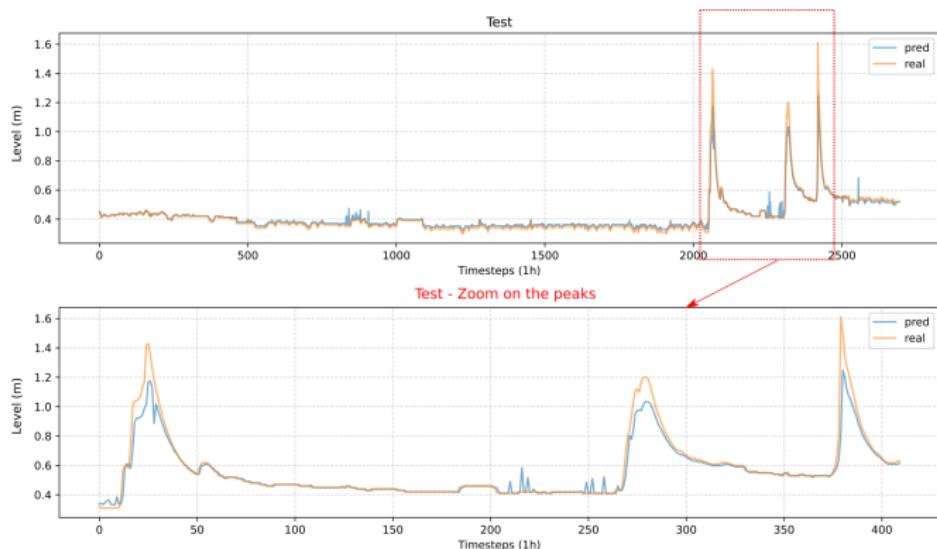
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1 hour forecast

- Time Series forecast
- Deep learning models (focus on LSTM)

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OPTRAM

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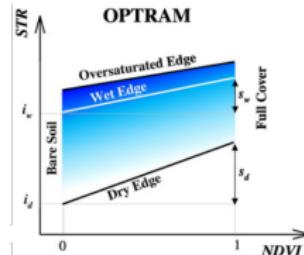
Smart Agriculture

Energy Efficiency

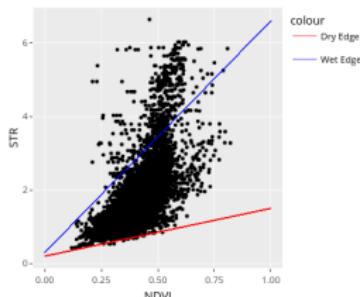
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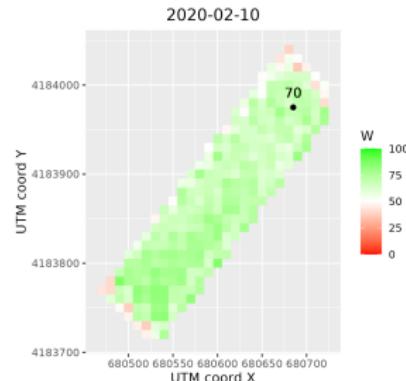
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STR-NDVI space [1]



STR-NDVI in real scenario



Output result

- i_d, i_w, s_d, s_w automatically computed
- Model returns base64 image

RGB-NDVI

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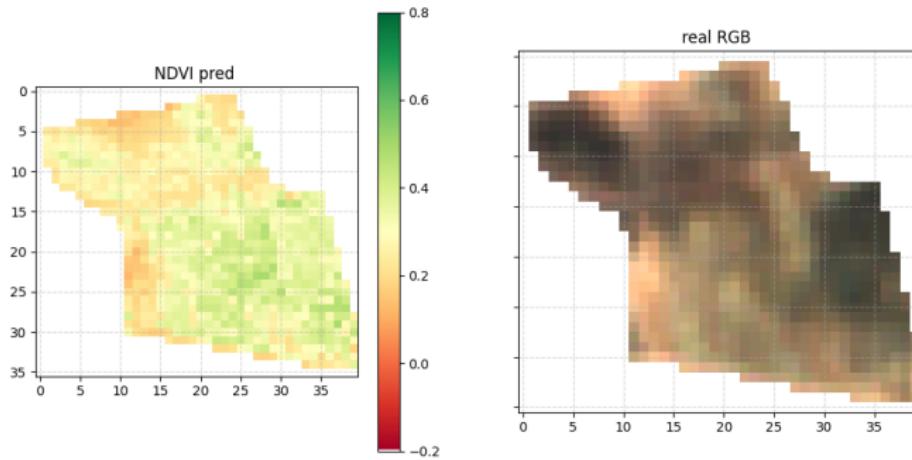
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Predicted image and satellite image

- NDVI: overall health status
- Cross validation, model selection and hyperparameter optimization
- Best one: Random Forest Regressor

Autolabelling

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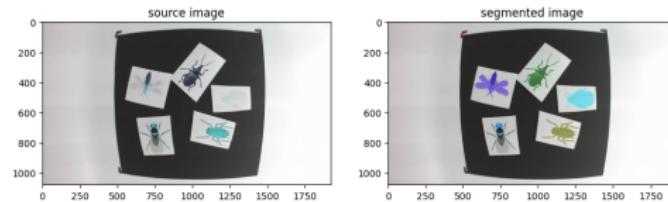
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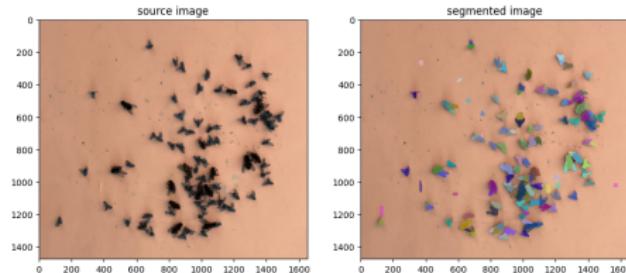
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Detection in staged scenario



Detection in real scenario

- Segment Anything Model [2]

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Temperature and consumption forecasts

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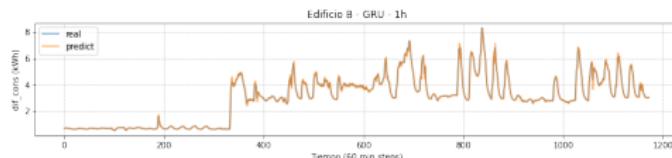
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- Consumption
- Temperature
- HVAC data
- Meteorological data

Use case building [3, 4]

- Data Descriptor [5]



Consumption forecast for block B

Temperature and consumption forecasts

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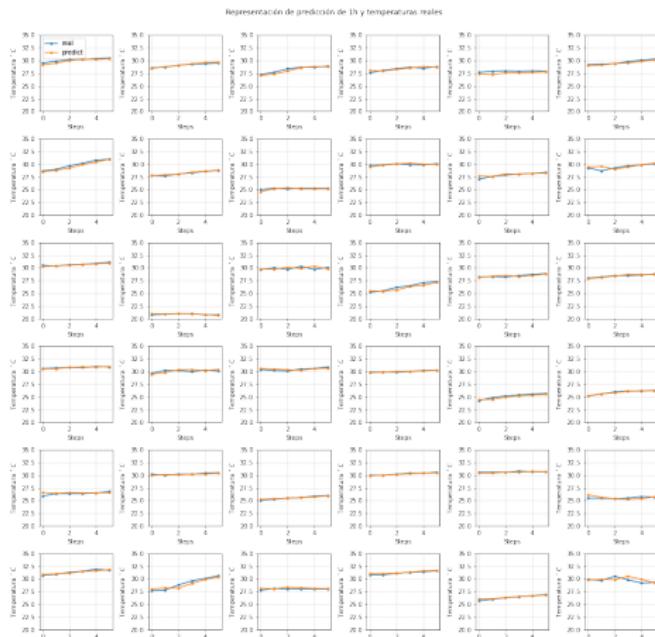
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Temperature forecast for each room

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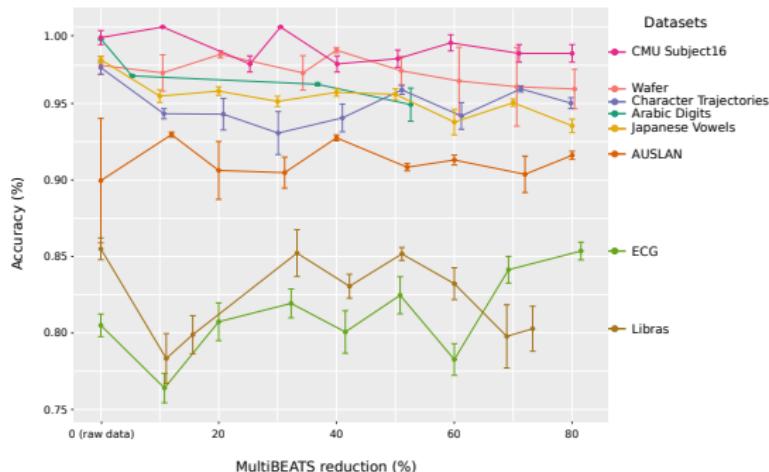
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Evolution of accuracy compared to MultiBEATS reduction percentages [6]

- Dimensionality reduction [7]
- Maintain or improve raw accuracy

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GPUs monitoring

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- Model inference
- Inference time and memory usage
- Real images
- Test different architectures (EfficientNet, DenseNet, VGG, etc)
- Concurrency
- Optimization model

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- [1] Morteza Sadeghi et al. "The optical trapezoid model: A novel approach to remote sensing of soil moisture applied to Sentinel-2 and Landsat-8 observations". En: *Remote sensing of environment* 198 (2017), págs. 52-68.
- [2] Alexander Kirillov et al. "Segment anything". En: *arXiv preprint arXiv:2304.02643* (2023).
- [3] *Adapt-&-Play Holistic cOst-Effective and user-frieNdly Innovations with high replicability to upgrade smartness of eXisting buildings with legacy equipment*. 2021. URL: <https://cordis.europa.eu/project/id/893079/es>.
- [4] Antonio Skarmeta. *First feedback from the Proof-of-Concept deployment and Introduction to the other pilots*. 2020. URL: <https://ec.europa.eu/research/participants/documents/downloadPublic?documentIds=080166e5df32915d&appId=PPGMS>.
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- [6] Aurora González-Vidal, Antonio Martinez-Ibarra y Antonio F Skarmeta. "MultiBEATS: Blocks of eigenvalues algorithm for multivariate time series dimensionality reduction". En: *Information Fusion* (2023), pág. 102159.
- [7] Aurora Gonzalez-Vidal, Payam Barnaghi y Antonio F Skarmeta. "Beats: Blocks of eigenvalues algorithm for time series segmentation". En: *IEEE Transactions on Knowledge and Data Engineering* 30.11 (2018), págs. 2051-2064.

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