Extraction of variations in agricultural practices over rice fields using unsupervised learning

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Extraction of variations in agricultural practices over rice fields using unsupervised learning

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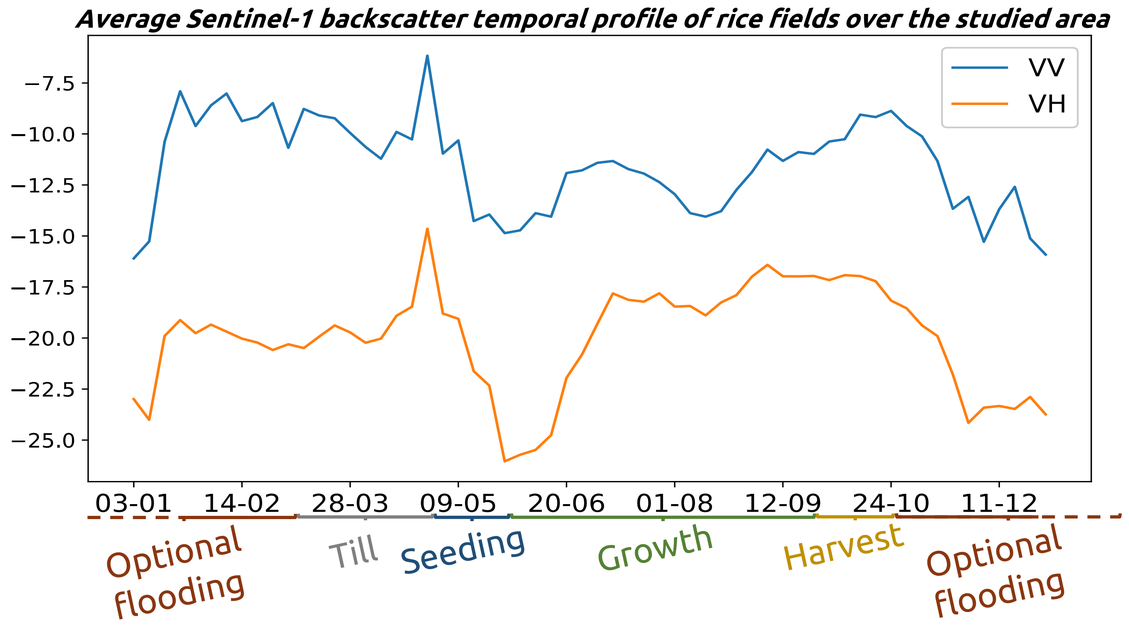
INTRODUCTION

Existing variations of agricultural practices within a single crop type:
- Various sowing, harvesting dates [1].
- Optional flooding of rice fields, for bird resting areas [2], seeding period...

Convolutional Autoencoders [3] can model and **extract variations within a single crop type** and **group them**, using different semantic criteria, **without supervision**.

Average Sentinel-1 backscatter temporal profile of rice fields over the studied area

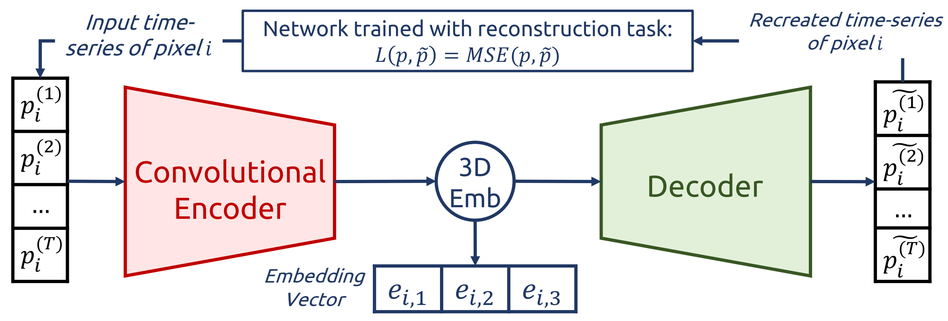


USED DATA

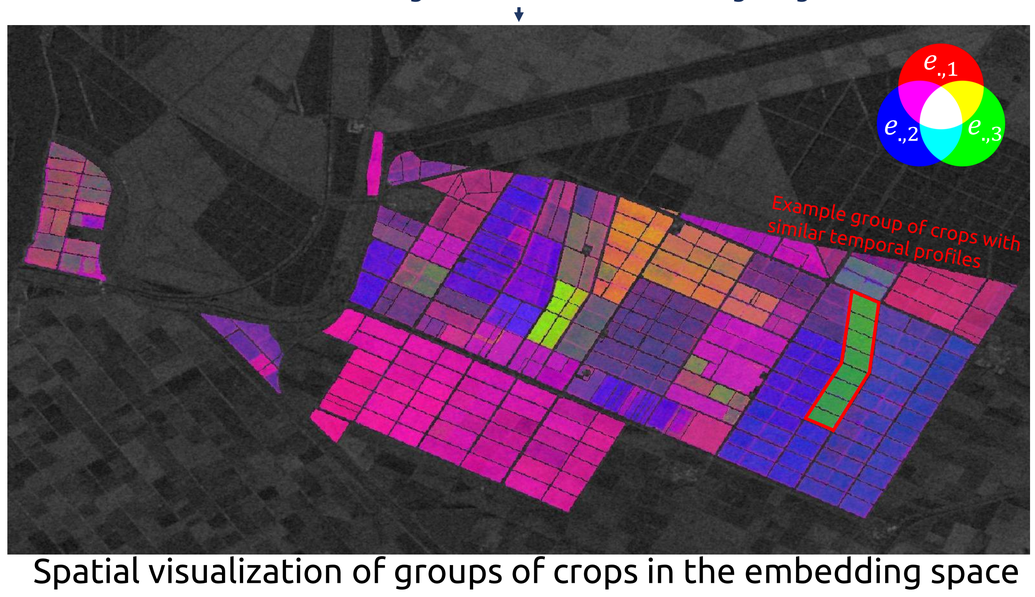
- Location of rice crops: Sector BXII, near Sevilla, Spain
- Details: 3500 ha of crops, growing in 2017.
- Sentinel-1 Data: 61 acquisitions (Jan 2017 to Dec 2017), dual-pol (VV, VH), preprocessing in [4]

Rice fields, in a Guadlquivir Marshes landscape, Andalucia, Spain (Source: [5])

AUTOENCODERS AND APPLICATION



3D Embedding vectors ➔ RGB Embedding image



Spatial visualization of groups of crops in the embedding space

Optional Flooding Period | Approximate Seeding Period | End of the year flooding Period

CONCLUSION

The application of an autoencoder to SAR time series of rice crops allows to:

- Generate a 3D **embedding image** that **highlights groups** of crops.
- **Visualize** these **groups** of crops by mapping the embedding space to the **RGB** color space.
- Find out **which period** of a field contributes to **making the groups** of crops using the Grad-CAM methodology.

RESULTS AND VISUALISATION

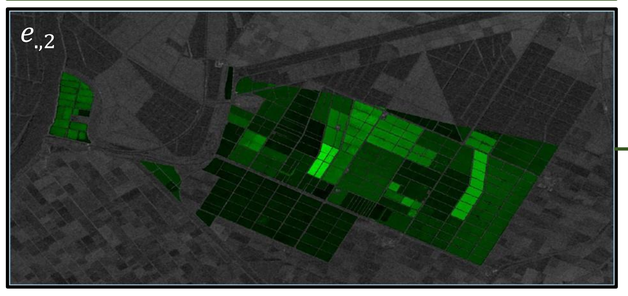
Red channel: 1st embedding dimension

***Similarities** between **crops in shades of red** imply **similarities** in **harvest strategies in key periods** (i.e. Till, Seeding, Harvest, End of the year flooding)*

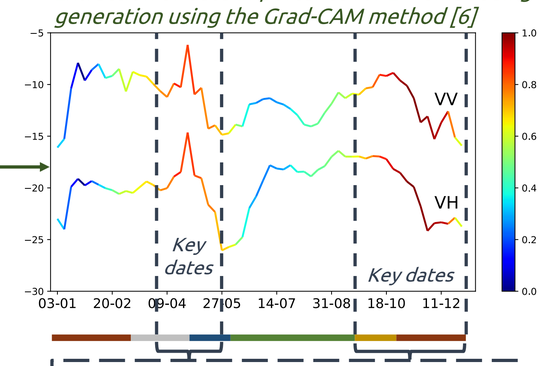
Extraction of date importance for 1st embedding generation using the Grad-CAM method [6]

Periods of interest for 1st embedding:
- All, but start of the year *optional flooding*

Green channel: 2nd embedding dimension

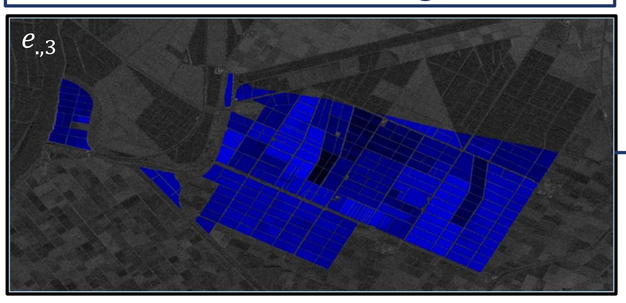


Extraction of date importance for 2nd embedding generation using the Grad-CAM method [6]

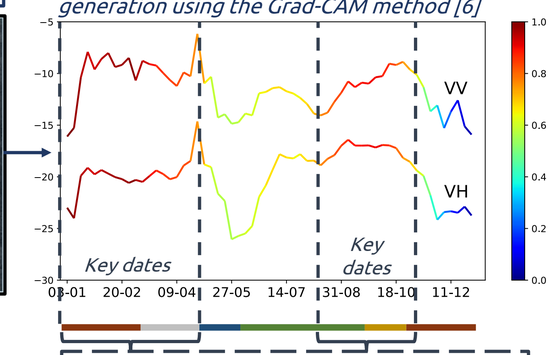


Periods of interest for 2nd embedding:
- End of *Field preparation*
- *Seeding*
- *Harvest*
- End of the year *optional flooding*

Blue channel: 3rd embedding dimension



Extraction of date importance for 3rd embedding generation using the Grad-CAM method [6]



Periods of interest for 3rd embedding:
- Start of the year *optional flooding*
- *Growth*

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