

Demonstração Hands-On



Classificação de Culturas Agrícolas

- 1. Criar Embeddings com Modelo Fundacional Geoespacial **Tessera**
- 2. Treinar um classificador com os embeddings
- 3. Utilizar modelo treinado para mapear/prever culturas em Portugal

Tessera (GFM)

Sentinel-1



2 bandas x 70 imagens/ano = 140d



+

Sentinel-2



10 bandas x 70 imagens/ano = 700d



=



12 bandas x 70 imagens/ano = 840d



TESSERA

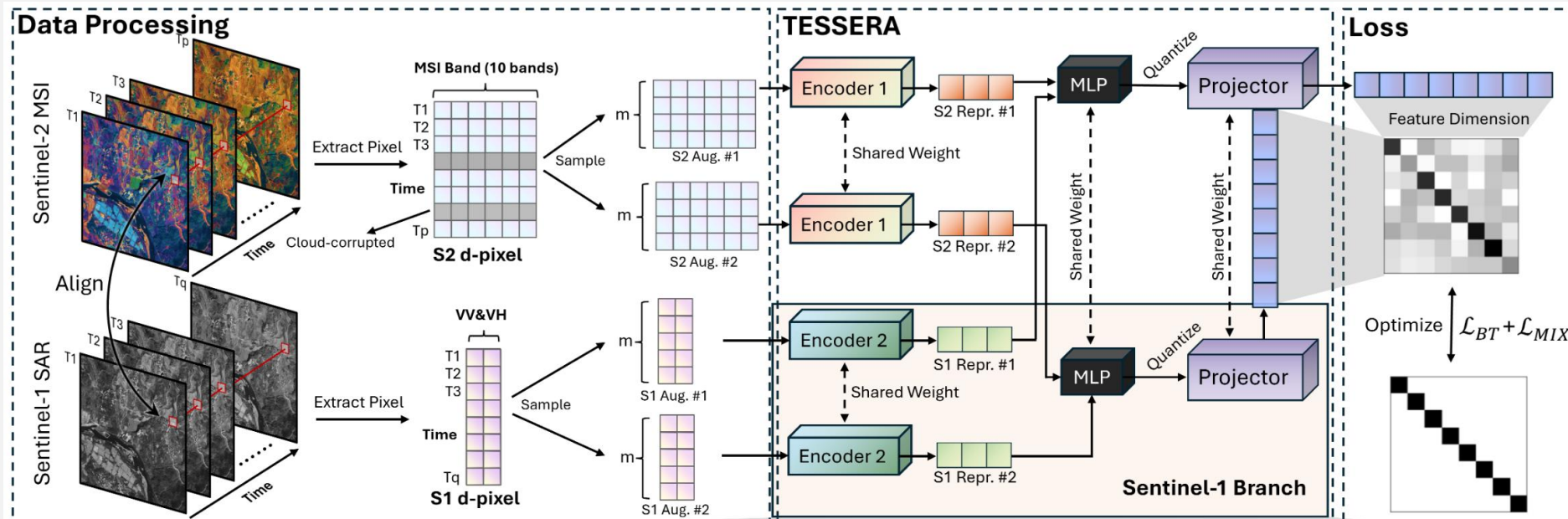


128d



Tessera (GFM)

- Encodificação a nível do pixel: foco na dimensão espectro-temporal
- Modelo Barlow-Twins: compara views temporais aleatórias de um mesmo pixel



Classificação de Culturas

- Dados de treino
 - IFAP Parcelário
 - COS
- Modelo
 - Classification Head (FCN)



Links Úteis

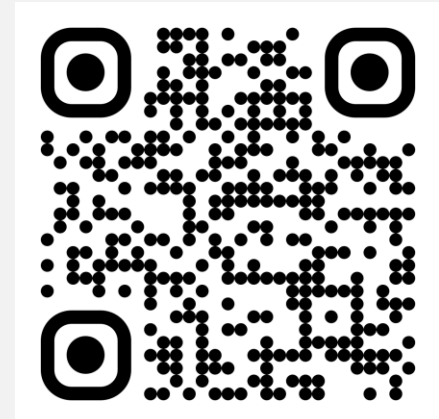
GitLab Repo

<https://gitlab.a.acnca.pt/cnca/aif-pt/baif-agr-workshop>



Página do Evento

<https://indico.acnca.pt/event/10>



1. Abrir Shell no Open OnDemand

Deucalion Files Jobs Clusters Interactive Apps My Interactive Sessions Help Logged in as daniel.moraes Log Out

Home Directory
/projects/F2026AIVLAB00021BSCAIF

deucalion.acnca.pt

CNCA Centro Nacional de Computação Avançada | DEUCALION

OnDemand provides an integrated, single access point for all of your HPC resources.

Message of the Day

Changelog

- 22/05/2026: You can now move swiftly to your project folder by using the `cdp` command.
- 27/03/2026: Project PI's can now set individual user limits in each allocation (total number of hours). These settings can be managed under the Project Usage tab.

<https://ood.deucalion.macc.fccn.pt>

powered by OPEN OnDemand

OnDemand version: 4.0.11

1. Abri Shell no Open OnDemand

Deucalion Files Jobs Clusters Interactive Apps My Interactive Sessions Help Logged in as daniel.moraes Log Out

Open in Terminal Refresh New File New Directory Upload Download Copy/Move Delete

Home Directory /projects/F2026AIVLAB00021BSCAIF Change directory Copy path

Show Owner/Mode Show Dotfiles Filter: Showing 121 of 122 rows - 0 rows selected

| Type | Name | Size | Modified at |
|--------|---------------|------|-----------------------|
| Folder | agaudencio | - | 6/19/2026 1:16:22 PM |
| Folder | agr_demo | - | 6/17/2026 10:33:05 PM |
| Folder | aifactory.001 | - | 1/22/2026 4:14:34 PM |
| Folder | aifactory.002 | - | 1/22/2026 4:21:03 PM |
| Folder | aifactory.005 | - | 1/22/2026 4:13:39 PM |
| Folder | aifactory.012 | - | 4/23/2026 4:10:44 PM |
| Folder | aifactory.013 | - | 1/22/2026 4:24:44 PM |
| Folder | aifactory.014 | - | 1/22/2026 4:19:53 PM |
| Folder | aifactory.018 | - | 1/22/2026 4:21:17 PM |
| Folder | aifactory.020 | - | 1/22/2026 4:11:44 PM |

1. Abri Shell no Open OnDemand

```
Host: login-ext Initial directory: /projects/F2026AIVLAB00021BSCAIF

Greetings daniel.moraes

Welcome to the Portuguese EuroHPC supercomputer, *please* read documentation before use:
https://docs.macc.fccn.pt/

The following scripts are now available for user reference:

1. Home Quota Check:          quotahome
2. Lustre (projects) Quota Check: quotaprojects
3. Slurm Billing Information:  billing

Run these scripts directly to get up-to-date information on
your storage usage and job-related billing.

[daniel.moraes@ln02 F2026AIVLAB00021BSCAIF]$
```

2. Clone Workshop Repository

```
bash clone_agr.sh
```

```
[daniel.moraes@ln02 F2026AIVLAB00021BSCAIF]$ bash clone_agr.sh
Cloning into 'daniel.moraes/baif-agr-workshop'...
remote: Enumerating objects: 119, done.
remote: Counting objects: 100% (48/48), done.
remote: Compressing objects: 100% (47/47), done.
remote: Total 119 (delta 23), reused 0 (delta 0), pack-reused 71 (from 1)
Receiving objects: 100% (119/119), 540.01 KiB | 22.50 MiB/s, done.
Resolving deltas: 100% (24/24), done.
[daniel.moraes@ln02 F2026AIVLAB00021BSCAIF]$
```

2. Clone Workshop Repository

- `cd $USER`

Muda de diretório para a pasta do utilizador

- `ls`

Lista os ficheiros e pastas existentes no diretório atual

- `cd baif-agr-workshop`

Muda de diretório para a pasta do workshop

- `ls`

2. Clone Workshop Repository

```
[daniel.moraes@ln02 F2026AIVLAB00021BSCAIF]$ cd $USER
[daniel.moraes@ln02 daniel.moraes]$ ls
ai-assist  baif-agr-workshop  baif-llm-workshop  ml-example
[daniel.moraes@ln02 daniel.moraes]$ cd baif-agr-workshop/
[daniel.moraes@ln02 baif-agr-workshop]$ ls
assets          gpu.sh          model_checkpoints  README.md        run_train.sh      tessera          train.py
data_loader.py  interactive_map.ipynb  model.py           run_test.sh     submit_infer.sh   test.py         utils.py
[daniel.moraes@ln02 baif-agr-workshop]$
```

3. Abrir Jupyter Notebook

*Não feche o terminal

The screenshot shows the Deucalion web interface. The top navigation bar includes 'Deucalion', 'Files', 'Jobs', 'Clusters', 'Interactive Apps', and 'My Interactive Sessions'. A user is logged in as 'daniel.moraes'. A dropdown menu is open under 'Interactive Apps', listing various applications. A red arrow points to 'Jupyter Notebook' in the 'Servers' category. The background shows a file browser interface with a table of files.

| Name | Size | Modified at |
|---------------|------|-----------------------|
| sgaudencio | - | 6/19/2026 1:16:22 PM |
| mgr_demo | - | 6/17/2026 10:33:05 PM |
| aiFactory.001 | - | 1/22/2026 4:14:34 PM |
| aiFactory.002 | - | 1/22/2026 4:21:03 PM |
| aiFactory.005 | - | 1/22/2026 4:13:39 PM |
| aiFactory.012 | - | 4/23/2026 4:10:44 PM |
| aiFactory.013 | - | 1/22/2026 4:24:44 PM |
| aiFactory.014 | - | 1/22/2026 4:19:53 PM |
| aiFactory.018 | - | 1/22/2026 4:21:17 PM |
| aiFactory.020 | - | 1/22/2026 4:11:44 PM |

3. Abrir Jupyter Notebook

Configurações

Nº CPU cores: 32

Nº Horas: 2

Partition: normal-x86

Account: f2026aivlab00021bscaifx

Jup. Container Image:

/projects/F2026AIVLAB00021BSCAIF/agr_demo/containers/jupyter_leafmap.sif

Reservation: aif_x86

The screenshot shows a web interface for configuring a Jupyter Notebook. At the top, there are navigation tabs: Clusters, Interactive Apps, and My Interactive Sessions. Below this is a breadcrumb trail: Home / My Interactive Sessions / Jupyter Notebook. On the left, there is a sidebar with 'Saved Settings' (empty) and 'Interactive Apps' (listing various categories like AI, Desktops, Editors, GUIs, Servers, and Viz). The main area is titled 'Jupyter Notebook' and contains several configuration fields: 'Number of CPU cores' (32), 'Number of hours' (2), 'Partition' (normal-x86), 'Account' (f2026aivlab00021bscaifx), and 'Jupyter Container Image' (the path from the text above). There is a 'Select Path' button below the container image field. At the bottom, there is a 'Reservation' field (aif_x86), a 'Save settings' checkbox, and a 'Launch' button. A red arrow points to the 'Launch' button.



3. Abrir Jupyter Notebook

Clusters ▾ Interactive Apps ▾ My Interactive Sessions Help ▾ Logged in as daniel.moraes

Home / My Interactive Sessions

Saved Settings

You have no saved settings.

Interactive Apps

AI

- Llama.cpp

Desktops

- Desktop

Editors

- VS Code

GUIs

- VAPOR
- VMD

Servers

- Jupyter Notebook
- Jupyter Notebook Pytorch
- Jupyter Notebook Pytorch (GPU)
- RStudio Server
- mlflow

Viz

- TensorBoard

Jupyter Notebook (1678558) 1 node | 128 cores | Running

Host: cnx161.deucalion.macc.fccn.pt Cancel

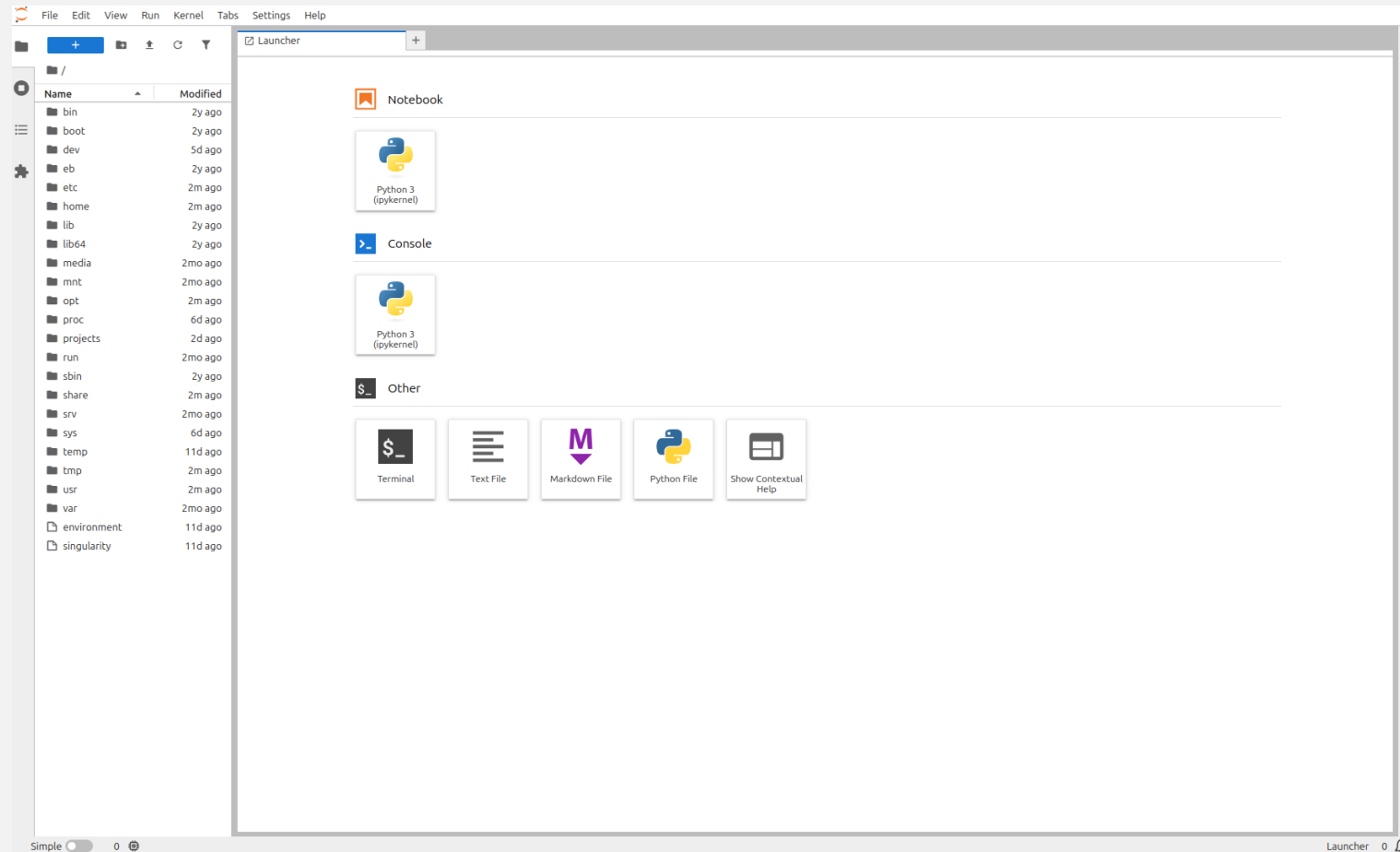
Created at: 2026-06-21 17:57:36 WEST

Time Remaining: 1 hour and 59 minutes

Session ID: d80ba072-fccd-43ea-9a19-c006e7c26945

[Connect to Jupyter](#)

3. Abrir Jupyter Notebook



3. Abrir Jupyter Notebook

The sequence of screenshots illustrates the navigation steps to open a Jupyter Notebook:


- Step 1:** Home directory view. The `projects` folder is highlighted with a red box.
- Step 2:** `/ projects /` directory view. The folder `F2026AIVLAB00021BSCAIF` is highlighted with a red box.
- Step 3:** `/ projects / F2026AIVLAB00021BSCAIF /` directory view. The folder `aifactory.028` is highlighted with a red box. A yellow text box with the text **Procurar o seu utilizador!** is overlaid on this screenshot.
- Step 4:** `/ ... / F2026AIVLAB00021BSCAIF / daniel.moraes /` directory view. The folder `baif-agr-workshop` is highlighted with a red box.
- Step 5:** `/ ... / daniel.moraes / baif-agr-workshop /` directory view. The file `interactive_map.i...` is highlighted with a red box.

3. Abrir Jupyter Notebook

Siga as instruções do notebook

The screenshot shows a Jupyter Notebook interface with a file explorer on the left and a code editor on the right. The file explorer shows a directory structure with files like `assets`, `model_checkpoints`, `tessera`, `data_loader.py`, `gpu.sh`, `interactive_mapl...`, `model.py`, `README.md`, `run_test.sh`, `run_train.sh`, `submit_infer.sh`, `test.py`, `train.py`, and `utils.py`. The code editor contains the following code:

```
Interactive Notebook

Press Shift + Enter to run cells
Alternatively, click the  button to run the selected cell

[ ]: import os
os.environ['LOCALTILESERVER_CLIENT_PREFIX'] = f"*/node/{os.environ.get('host')}/{os.environ.get('port')}/proxy/{port}"
import leafmap

Inspect Sentinel-2 Time Series

[ ]: # Load Interactive Map
m = leafmap.Map(center=[37.988, -7.918], zoom=12)

images = "/projects/F2026AIVLAB00021BSCAIF/agr_demo/data/sat_data/multiband_mosaics"

m.add_time_slider(
    images,
    time_interval=0.75,
    positions="bottomright",
    band=[3, 2, 1],
    vmin=0,
    vmax=2000,
)

m

[ ]: #Calculate total elements and corresponding storage needs (study area: 10 km x 10 km)
num_pixels = 1e6 #1000 x 1000
num_bands = 10 #bands or channels
num_imgs_ts = 71 #number of images in the time series (1 year)

total_elements = num_pixels * num_bands * num_imgs_ts

bits_per_elem = 16 #UInt16
bytes_per_bit = 0.125

total_gb = (total_elements * bits_per_elem * bytes_per_bit) / (1024**3)

print(f"Total elements in study area = {int(total_elements):,}")
print(f"Space in Disk (uncompressed) = {total_gb:.2f} GB")

[ ]: #Calculate total elements and corresponding storage needs for Portugal
num_pixels_PT = 890_000_000 #approx 89000 km2 -> 890M pixels
total_elements_PT = num_pixels_PT * num_bands * num_imgs_ts
```

4. Correr Job de Inferência

*De volta para o terminal. Mantenha a aba do Jupyter Notebook aberta

- `sbatch submit_infer.sh`
Envia o job de inferência para a fila do Slurm
- `squeue --me`
Verifica o estado do job na fila
- `tail -f slurm-infer.out`
Verifica os outputs/logs do job
**Faça Ctrl + C no teclado para sair do comando tail*

4. Correr Job de Inferência

```
[daniel.moraes@ln02 baif-agr-workshop]$ sbatch submit_infer.sh
Submitted batch job 1678722
[daniel.moraes@ln02 baif-agr-workshop]$ squeue --me
      JOBID PARTITION     NAME     USER ST       TIME  NODES NODELIST(REASON)
     1678722 normal-a1    infer daniel.m  R        0:16      1 gnx522
     1678558 normal-x8  sys-dash daniel.m  R       32:01      1 cnx161
[daniel.moraes@ln02 baif-agr-workshop]$ tail -f slurm-infer.out
Running Inference...
█
```

Aguarde a conclusão do Job (aprox. 8 min)

5. Visualizar Embeddings Gerados

Retornar ao Jupyter Notebook e seguir as instruções indicadas no próprio notebook.

Mantenha o terminal aberto.

6. Correr Treino e Prediction

*De volta para o terminal. Mantenha a aba do Jupyter Notebook aberta

- `bash gpu.sh`

Executa script que chama o comando `salloc` para criar sessão interativa em nó de GPU

- `bash run_train.sh`

Executa script que dá início ao treino do modelo de classificação de culturas

Aguardar a conclusão do treino do modelo (aprox. 5 min)

6. Correr Treino e Prediction

```
[daniel.moraes@ln02 baif-agr-workshop]$ bash gpu.sh
salloc: Pending job allocation 1678815
salloc: job 1678815 queued and waiting for resources
salloc: job 1678815 has been allocated resources
salloc: Granted job allocation 1678815
salloc: Waiting for resource configuration
salloc: Nodes gn522 are ready for job
[daniel.moraes@gn522 baif-agr-workshop]$ bash run_train.sh
Creating train/test datasets
Created train/test datasets
Loading model. Device: cuda
Model loaded
Starting training
Epoch [1/15], Average Loss: 0.8140, Average Loss Test: 0.5781, Time/epoch: 0.36min
Epoch [2/15], Average Loss: 0.6390, Average Loss Test: 0.5445, Time/epoch: 0.3min
█
```

6. Correr Treino e Prediction

*De volta para o terminal. Mantenha a aba do Jupyter Notebook aberta

- `bash run_test.sh`

Executa script que usa o modelo treinado para prever as culturas em PT

- Aguardar a conclusão da prediction (aprox. 5 min)

- `exit`

Encerra a sessão interativa no nó de GPU

6. Correr Treino e Prediction

```
[daniel.moraes@gnx522 baif-agr-workshop]$ bash run_test.sh
Loading model. Device: cuda
Model loaded
Running predictions: Batch 0/143
Running predictions: Batch 1/143
Running predictions: Batch 2/143
Running predictions: Batch 3/143
Running predictions: Batch 4/143
Running predictions: Batch 5/143
Running predictions: Batch 6/143
Running predictions: Batch 7/143
Running predictions: Batch 8/143
Running predictions: Batch 9/143
Running predictions: Batch 10/143
```

7. Visualizar Mapa de Culturas

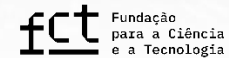
Retornar ao Jupyter Notebook e seguir as instruções indicadas no próprio notebook.

Fim Obrigado

daniel.moraes@acnca.pt



BSC AI Factory Partners



Affiliated entities



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