
# U-Net to predict segmentation in raster images

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# Outline

- **Amazon Rainforest and deforestation**
- **Methodology**
- **Results**
- **Conclusions**

# // Amazon rainforest

Deforestation in Rondônia state [5].

- Amazon rainforest deforestation[5].
- Biodiversity loss [5].
- Deforestation increasement [2][3][5][6][7].
- Raster Images available by tools created by INPE [6][7].

# // Study Region and its Specifications

- **Jamari National Forest.**
- **State Rondônia.**
- **Images with 657x1196.**
- **X-band.**
- **June and October**

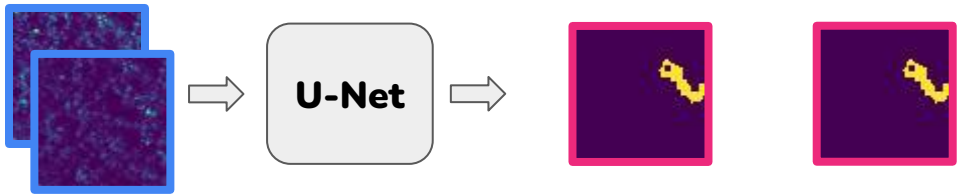
**Table 1.** Characteristics of the COSMO-SkyMed scenes used in this study.

| Parameter | Specification |
|---|---|
| Platform | COSMO-SkyMed |
| Launch | June 2007 |
| Swath | 620 km |
| Wavelength | X-band |
| Polarization | HH |
| Number of satellites | 4 |
| Year | 2018 |
| Acquisition mode | Stripmap HIMAGE |
| Size | 40 km × 40 km |
| Incidence angle | ~55° |
| Spatial resolution | 3 m × 3 m |

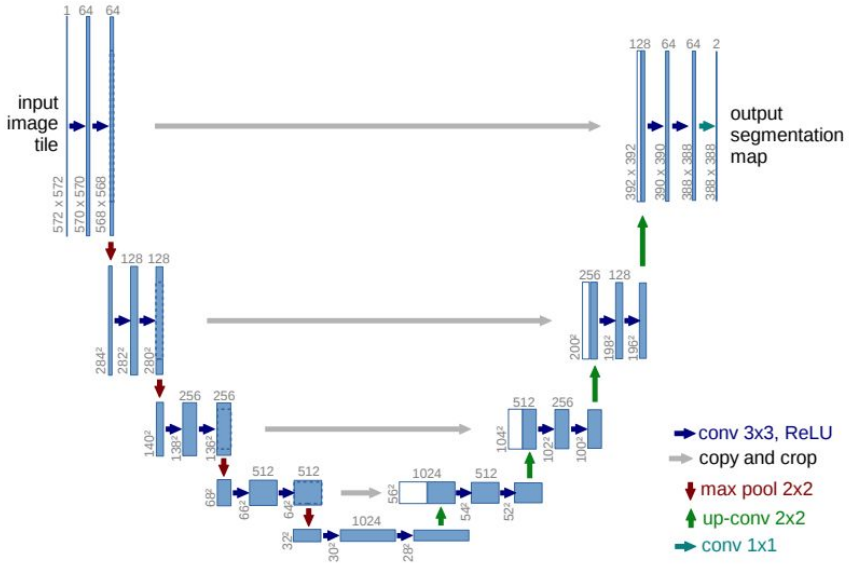
**[8]**

# // Methodology

- **U-Net [1].**
- **Deforestation Segmentation using U-Net [2].**
- **Patches with 64x64x1**




**2 images** **Predicted** **Expected**




**[1]**

# // Methodology

## Grid Search (Hyper Parameters Optimization)

**Tools:**

- Optuna (Instances Parallelism).
- Tensorboard(Compile all the instances).
- Tensorflow Keras (Modeling).

**Hyperparameters Evaluation:**

- Filters number (32,64,128).

**Data augmentation:**

- Default operations.
- Autoencoders.

**How to select the best model ?**

- Execution Time.
- Validation Error.
- Train Error.

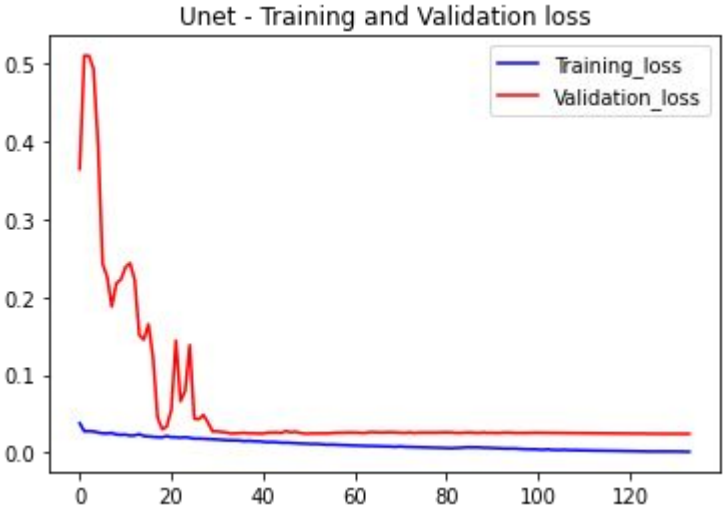
**Hardware:**

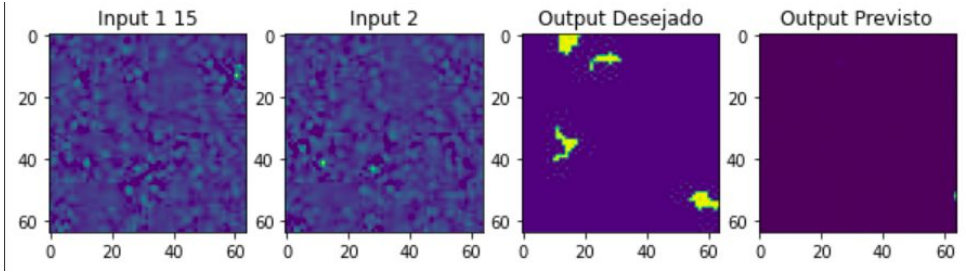
CPU: Intel(R) Xeon(R) Gold 5118 CPU @ 2.30GHz
RAM: 755GB
GPU: 4xNVIDIA Tesla V100 16GB

# // Results

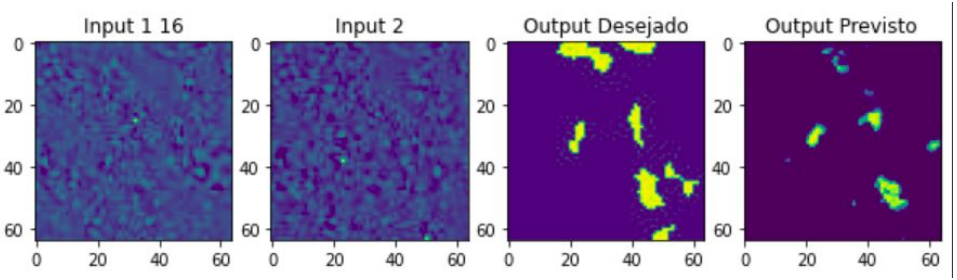
**Final Model:**

- **Input shape: 64x64x2 (Two images)**
- **Output shape: 64x64x1**
- **Filters: 128**




**Worst case scenario**




**Best case scenario**

# // Conclusions

## Segmentation

- **U-Net do a great work.**
- **Locating the deflorestation in most cases.**

## Machine Learning Techniques

- **Autoencoders use was not possible because of the high number of gradient vanish or explosion.**
- **The initial objective was to compare the data augmentation brought by autoencoder with the default flip and rotation.**

## Data Augmentation

- **Only used the default data augmentation (rotation and flip).**

# Thank You

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# // References


[1] U-net

[2] U-Net deforestation segmentation

[3] Desmatamento na Amazônia tem a maior taxa em 15 anos

[4] Alto desmatamento

[5] IPAM

[6] Terrabrasilis

[7] PRODES

[8] A Comparative Assessment of Machine-Learning Techniques for Forest Degradation Caused by Selective Logging in an Amazon Region Using Multitemporal X-Band SAR Images


**Documentation: Tensorflow / Optuna / Tensorboard**