



MINISTÉRIO DA CIÊNCIA E TECNOLOGIA
INSTITUTO NACIONAL DE PESQUISAS ESPACIAIS



SITS Demonstration in SEPAL

Karine R. Ferreira, Rolf Simões, Felipe Souza and Gilberto R. Queiroz

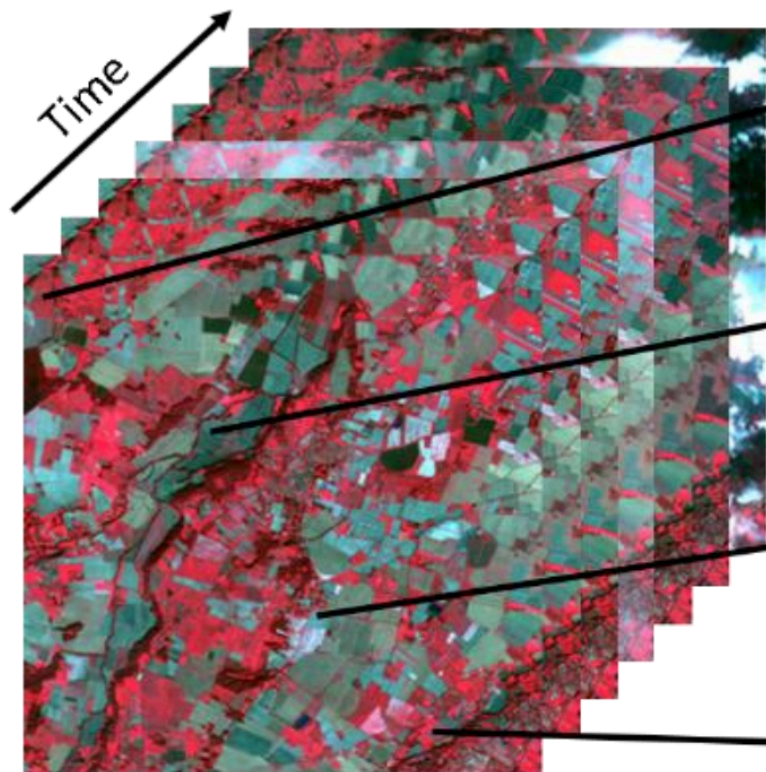
National Institute for Space Research, Brazil – INPE

GEO-GFOI
Virtual Workshop
16-17 June

The banner features a large, stylized 'G' shape composed of three overlapping triangles. The top-left triangle is light green, the top-right is dark green, and the bottom is a mix of green and brown. The text is positioned to the left of the 'G' shape.



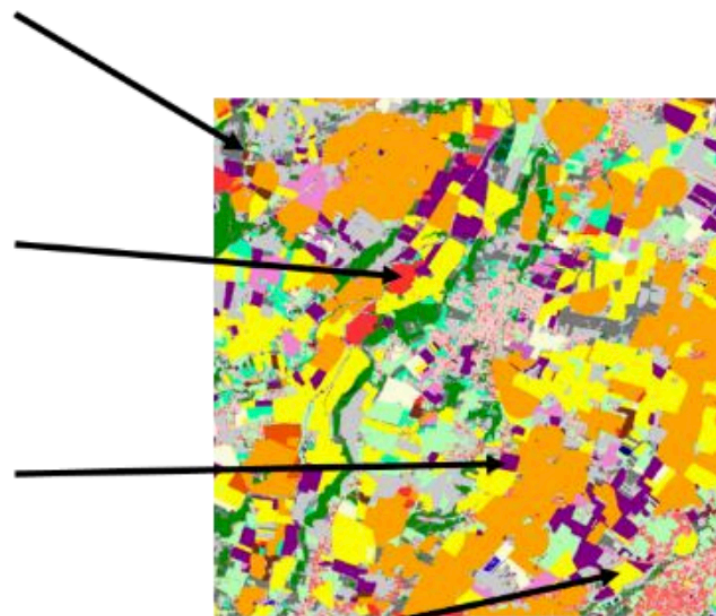
Land classification with satellite image time series



Satellite Image Series



Time Series

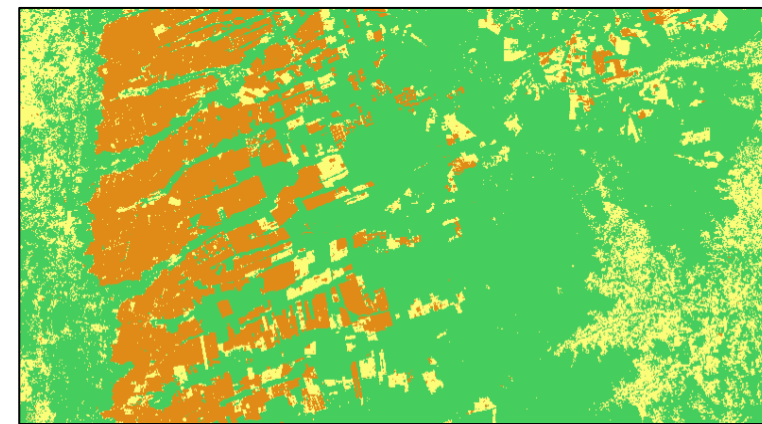
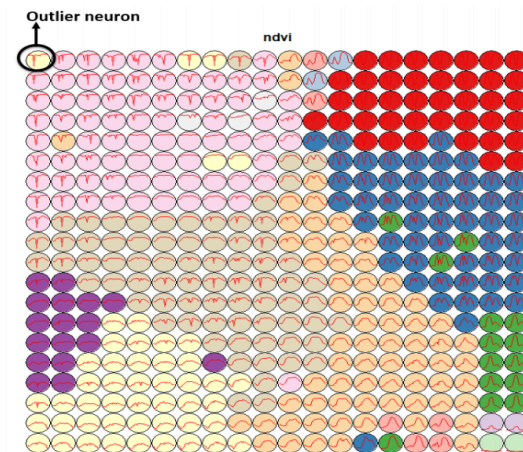
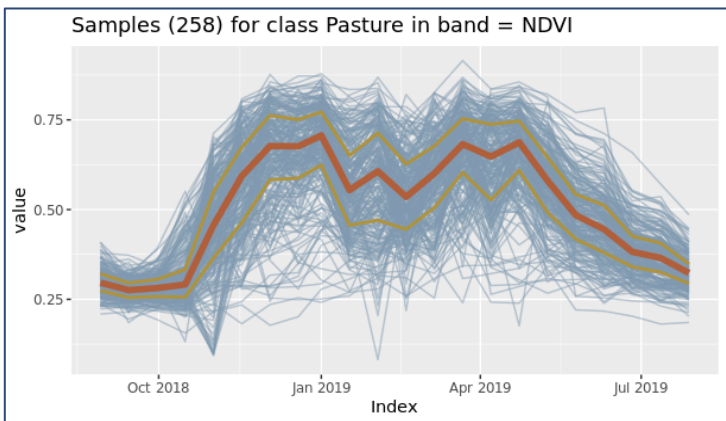


Land Cover Map (Classes)

Color	Class
Orange	corn
Light Orange	corn for silage
Yellow	non-irrigated corn
Light Yellow	wheat
Dark Yellow	sunflower
Light Green	sorghum
Green	sorghum II
Light Green	barley
Light Green	pea
Light Green	rape
Light Green	broad-leaved tree
Light Green	conifer
Light Green	poplar tree
Light Green	eucalyptus
Light Green	water
Light Green	lake
Light Green	gravel pit
Light Green	meadow
Light Green	temporary meadow
Light Green	fallow land
Light Green	wild land
Light Green	high density housing surface
Light Green	specific urban surface
Light Green	low density housing surface
Light Green	mineral surface



Complete land classification workflow



LULC samples

Quality Analysis

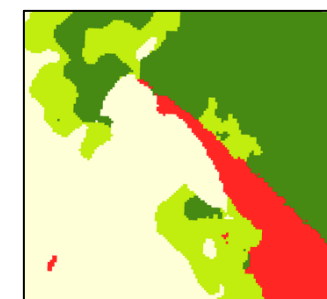
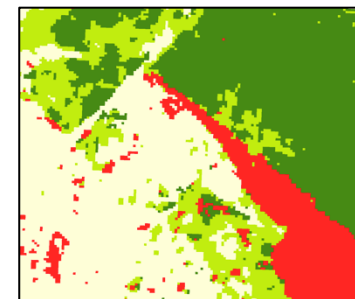
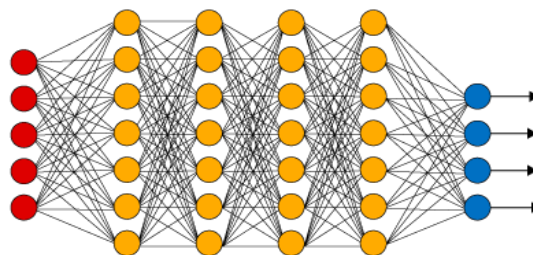
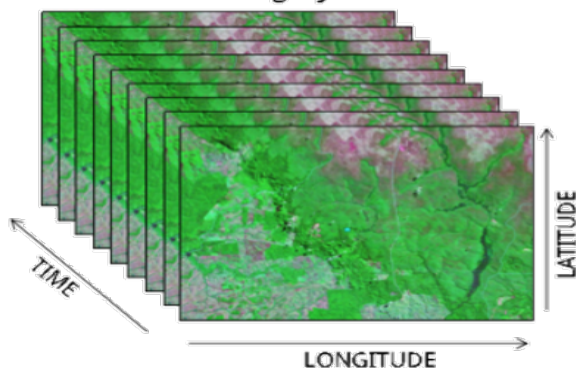
LULC maps

EO data cubes

ML models

Classification and smoothing

Satellite Imagery

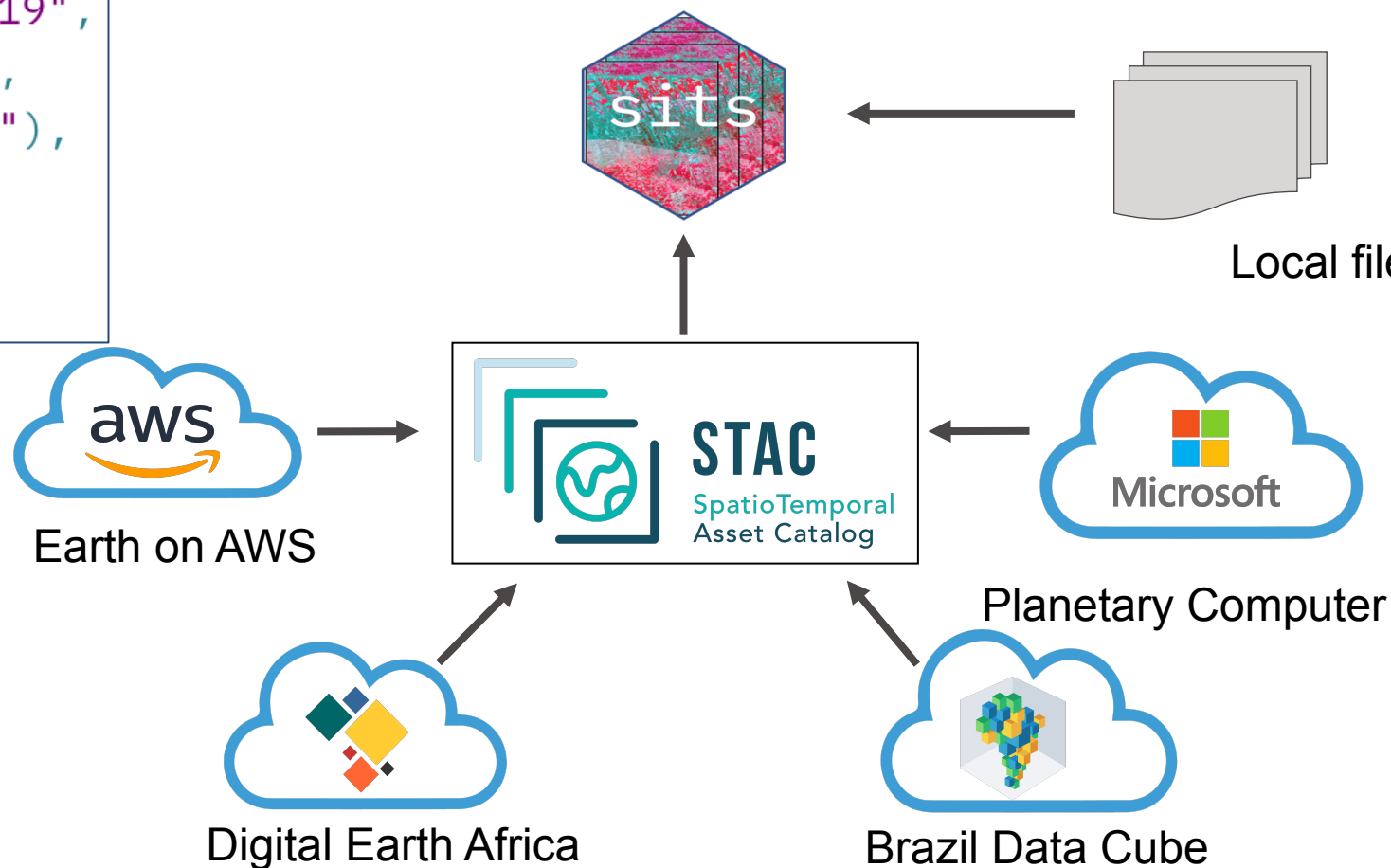




Data cubes from different providers



```
s2_cube ← sits_cube(  
  source      = "AWS",  
  name        = "Rondonia_2018_2019",  
  collection  = "sentinel-s2-l2a",  
  tiles       = c("20LKP", "20LLP"),  
  start_date  = "2018-08-01",  
  end_date    = "2019-07-31"  
)
```





Machine learning and deep learning methods



```
cnn_model ← sits_train(  
  data = samples_amazonia,  
  ml_method = sits_TempCNN()  
)
```

```
res_model ← sits_train(  
  data = samples_amazonia,  
  ml_method = sits_ResNet()  
)
```



remote sensing

Article

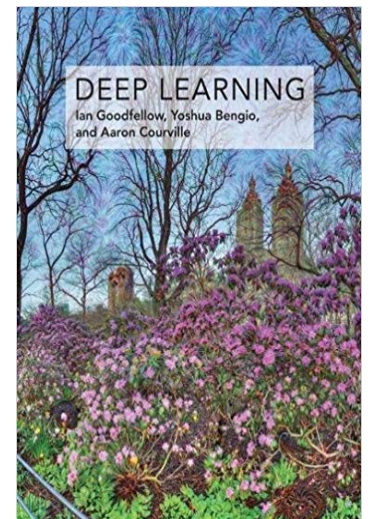
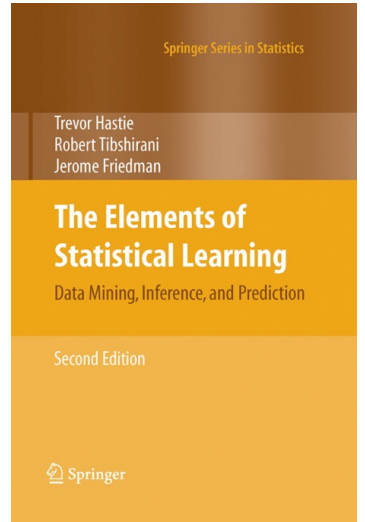
Temporal Convolutional Neural Network for the Classification of Satellite Image Time Series

Charlotte Pelletier *¹, Geoffrey I. Webb¹ and François Petitjean¹

Data Mining and Knowledge Discovery (2019) 33:917–963
<https://doi.org/10.1007/s10618-019-00619-1>

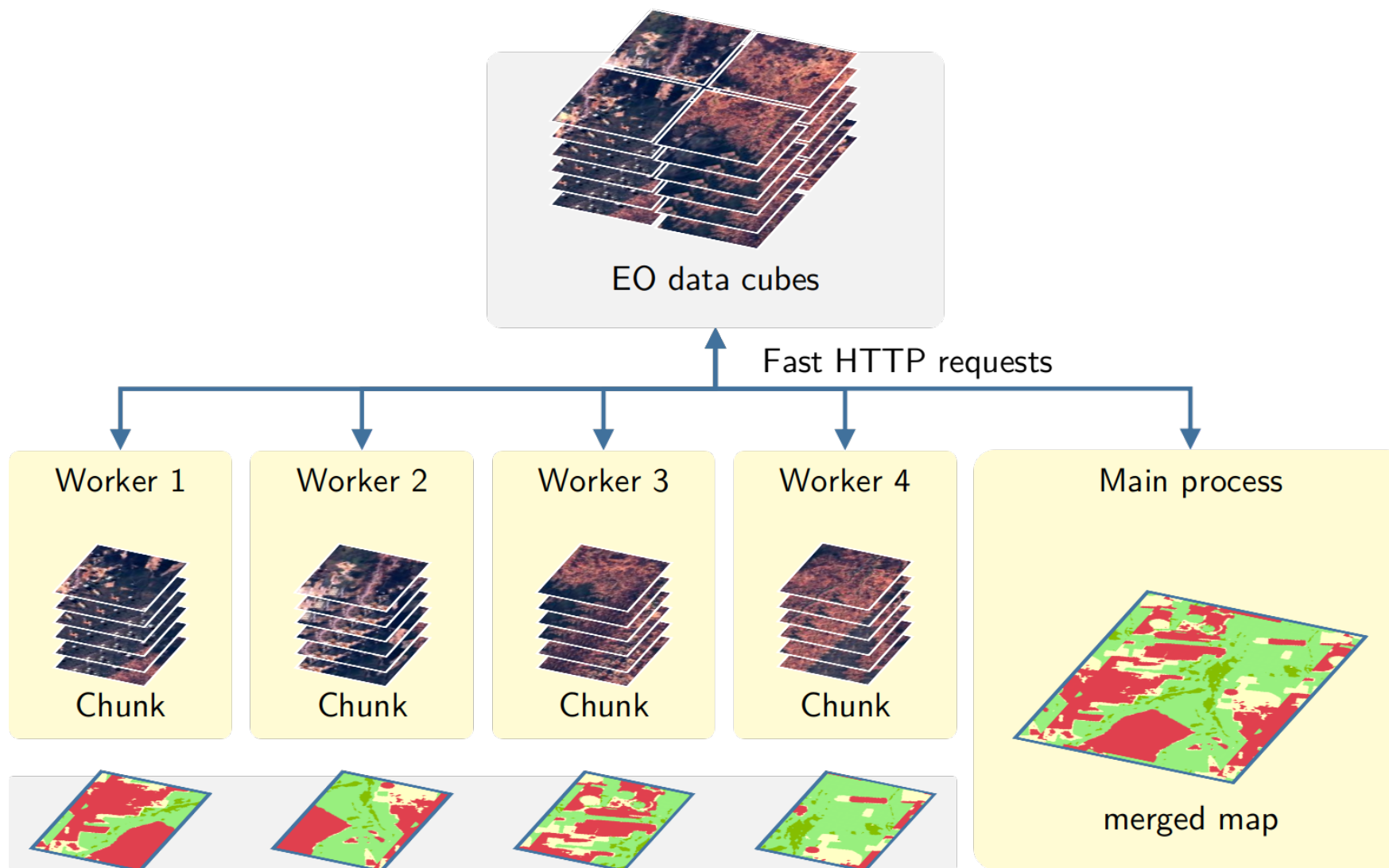
Deep learning for time series classification: a review

Hassan Ismail Fawaz¹ · Germain Forestier^{1,2} · Jonathan Weber¹ ·
Lhassane Idoumghar¹ · Pierre-Alain Muller¹





Transparent and efficient parallel processing





Accuracy assessment supports GFOI best practices



Remote Sensing of Environment 148 (2014) 42–57

Contents lists available at [ScienceDirect](#)

Remote Sensing of Environment

journal homepage: www.elsevier.com/locate/rse



ELSEVIER



Review

Good practices for estimating area and assessing accuracy of land change

Pontus Olofsson ^{a,*}, Giles M. Foody ^b, Martin Herold ^c, Stephen V. Stehman ^d,
Curtis E. Woodcock ^a, Michael A. Wulder ^e

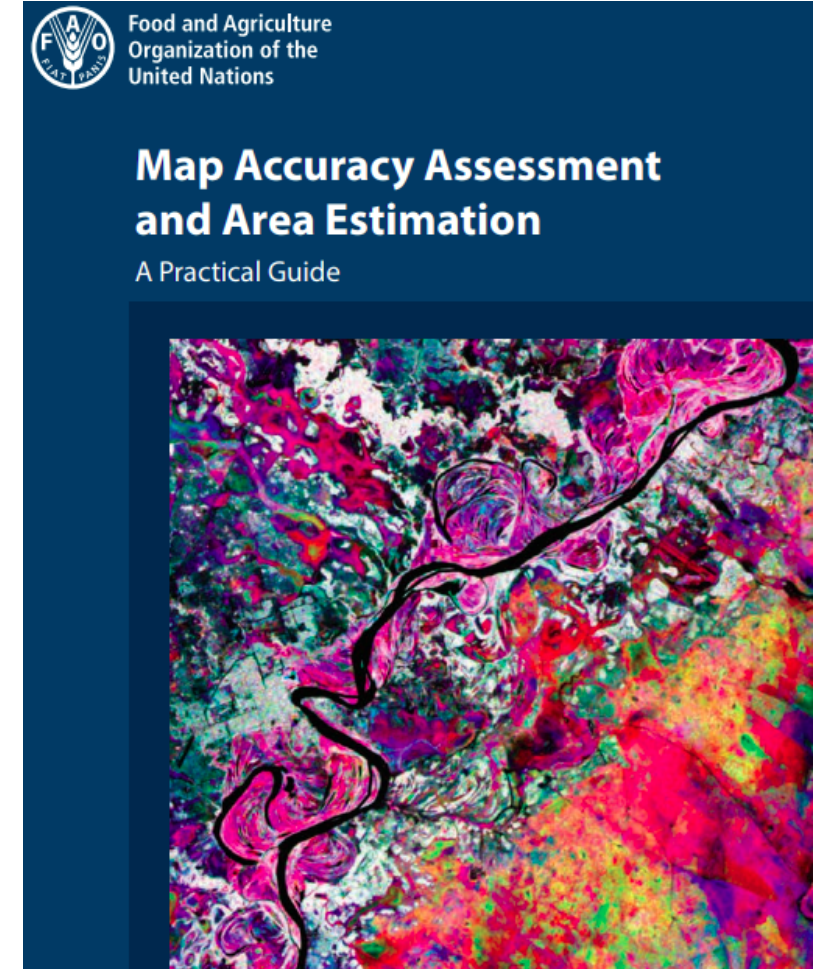
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^b School of Geography, University of Nottingham, University Park, Nottingham NG7 2RD, UK

^c Laboratory of Geo-Information Science and Remote Sensing, Wageningen University, Droevendaalsesteeg 3, 6708 Wageningen, The Netherlands

^d Department of Forest and Natural Resources Management, State University of New York, 1 Forestry Drive, Syracuse, NY 13210, USA

^e Canadian Forest Service (Pacific Forestry Centre), Natural Resources Canada, Victoria, BC 12 V8Z 1M5, Canada





LULC classification

Cerrado biome (200 million ha)

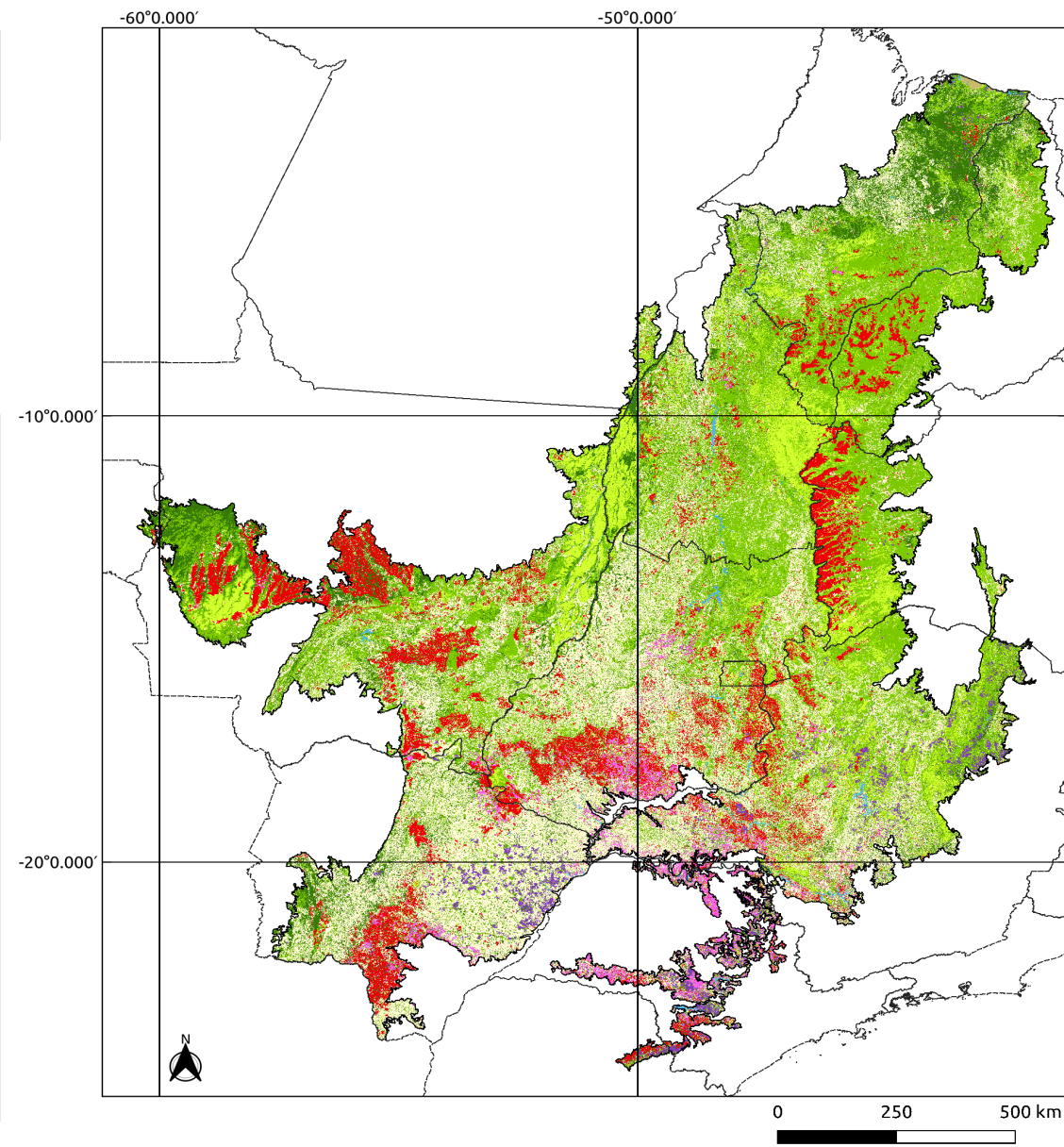
LULC map for year 2018

48,850 samples (TempCNN model)

Landsat-8 16-day time series

8 TB processed in 24 hours

10 LULC classes (86% accuracy)





Measuring deforestation using time series



BDC Cube Sentinel 2 2018/07/12



BDC Cube Sentinel 2 2019/07/28



90%
accuracy!

Random Forest



ResNet



TempCNN



Live Demonstration



<https://github.com/e-sensing/sits>