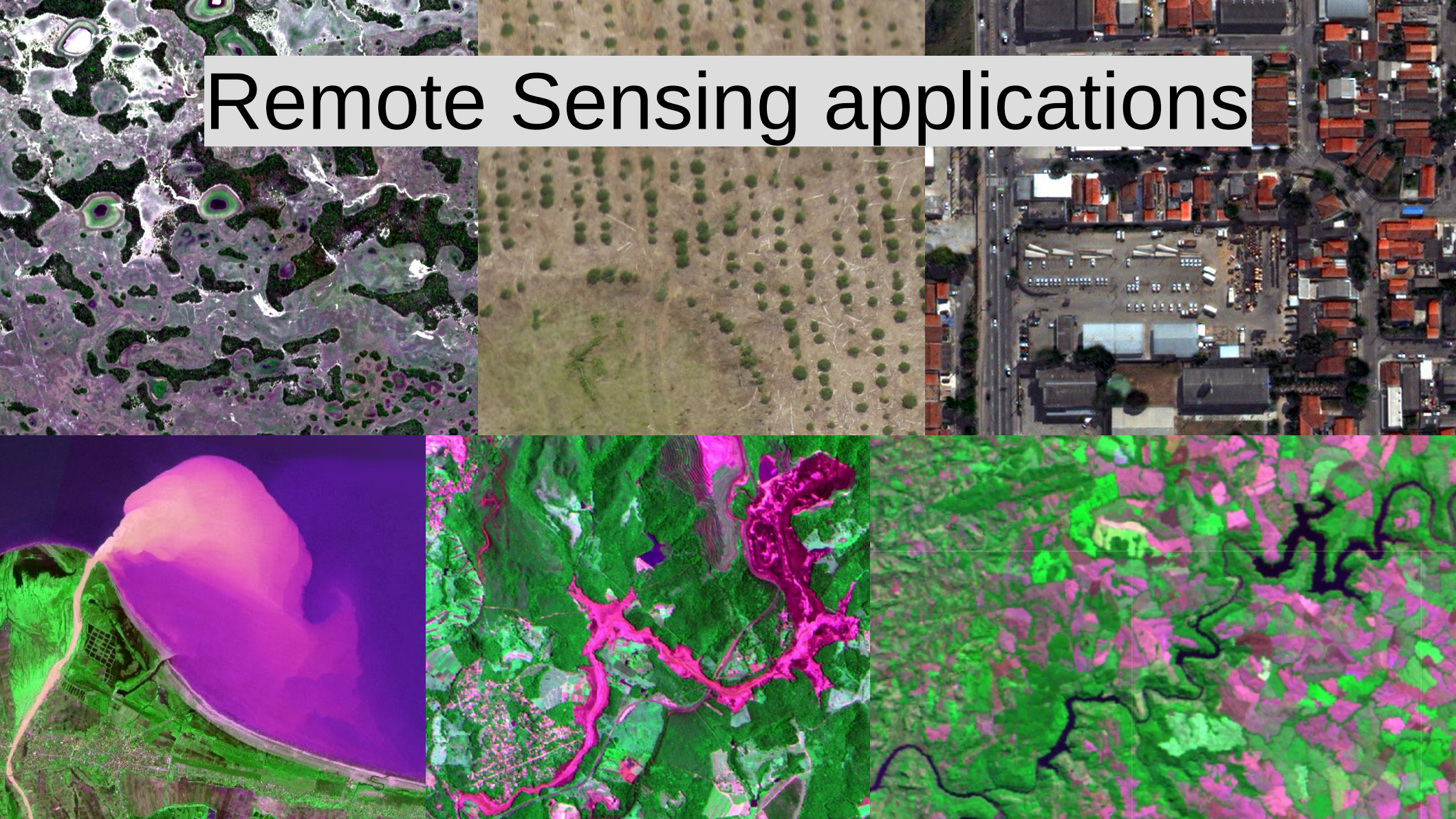
Image Processing, Analysis and Classification for Remote Sensing

Thales Sehn Körting
http://youtube.com/tkorting


Remote Sensing applications

How to write algorithms to deal with images?

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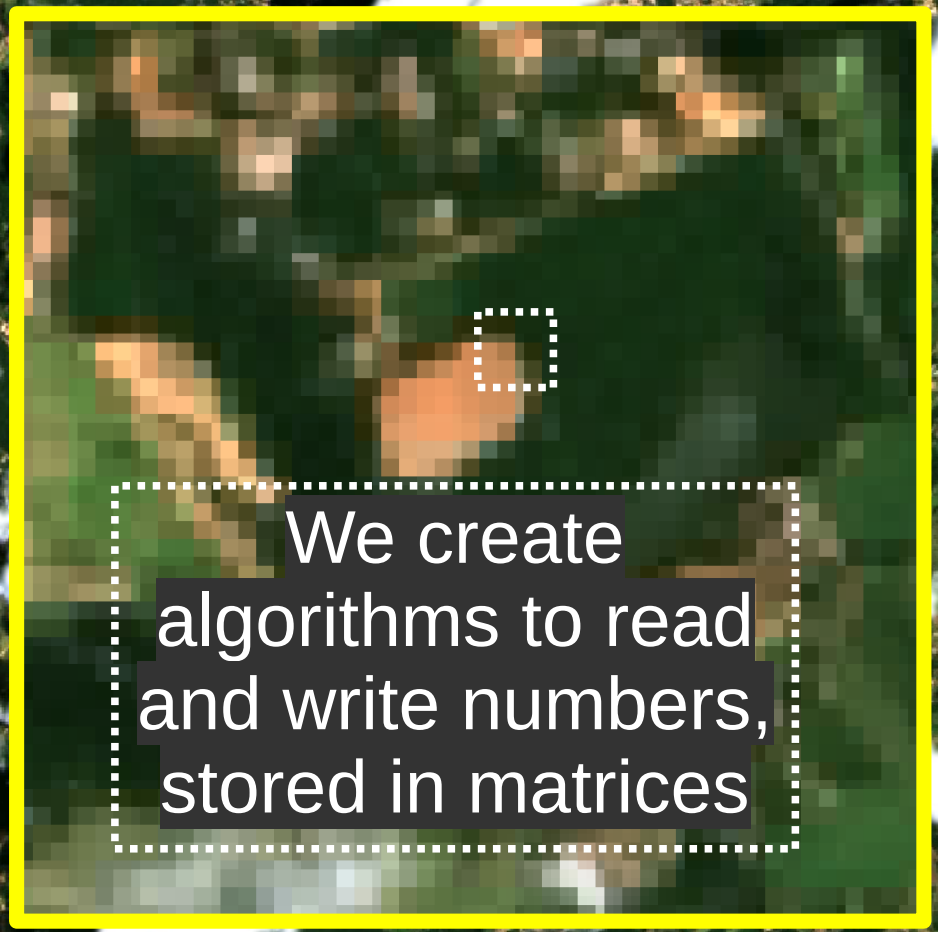
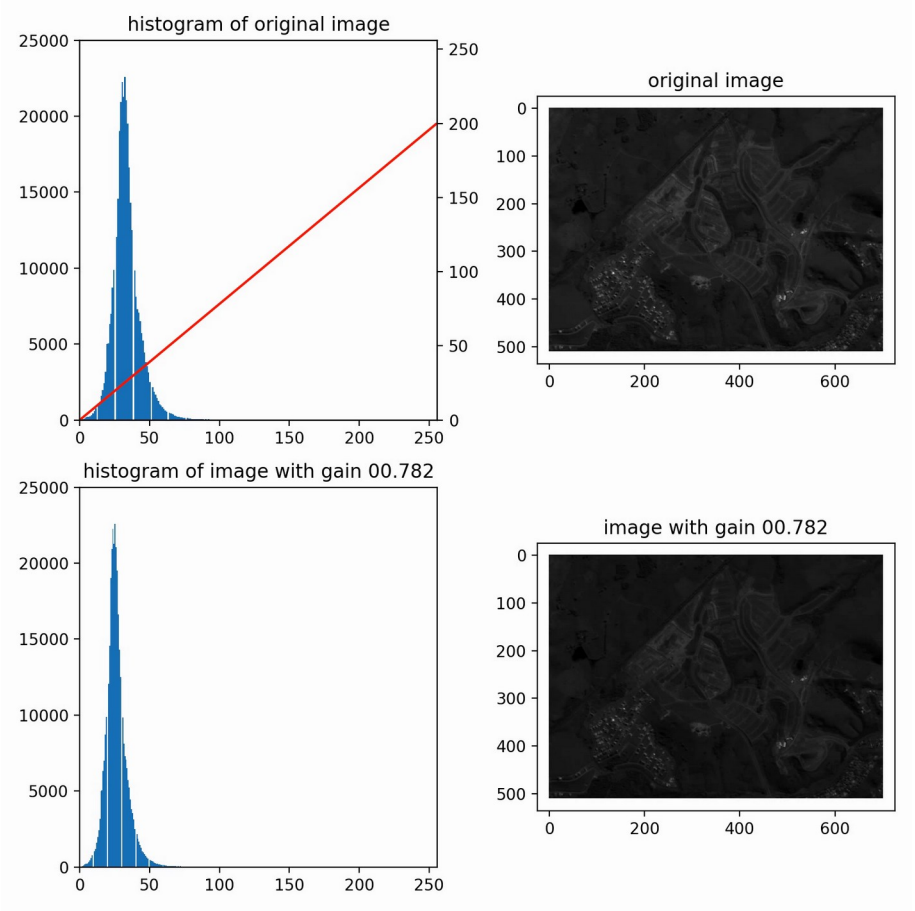


We create algorithms to read and write numbers, stored in matrices

```
[[ 54  49  49  48  48  48  48  48  51  51]
 [ 45  46  46  43  43  45  45  45  44  44]
 [ 45  46  46  43  43  45  45  45  44  44]
 [ 61  90  90  82  82  48  42  42  47  47]
 [138 139 139 122 122  78  47  47  46  46]
 [138 139 139 122 122  78  47  47  46  46]
 [144 144 144 140 1
 [144 144 144 140 1
 [146 144 144 142 1
 [146 144 144 142 1
```

```
[[ 20  23  23  22  22  20  20  20  21  21]
 [ 40  41  41  37  37  21  21  21  18  18]
 [ 40  41  41  37  37  21  21  21  18  18]
 [ 60  96  96  86  86  24  19  19  21  21]
 [210 199 199 173 173  74  38  38  22  22]
 [210 199 199 173 173  74  38  38  22  22]
 [220 206 206 200 200 129  65  65  24  24]
 [220 206 206 200 200 129  65  65  24  24]
 [220 211 211 207 207 167  84  84  25  25]
 [220 211 211 207 207 167  84  84  25  25]]
```

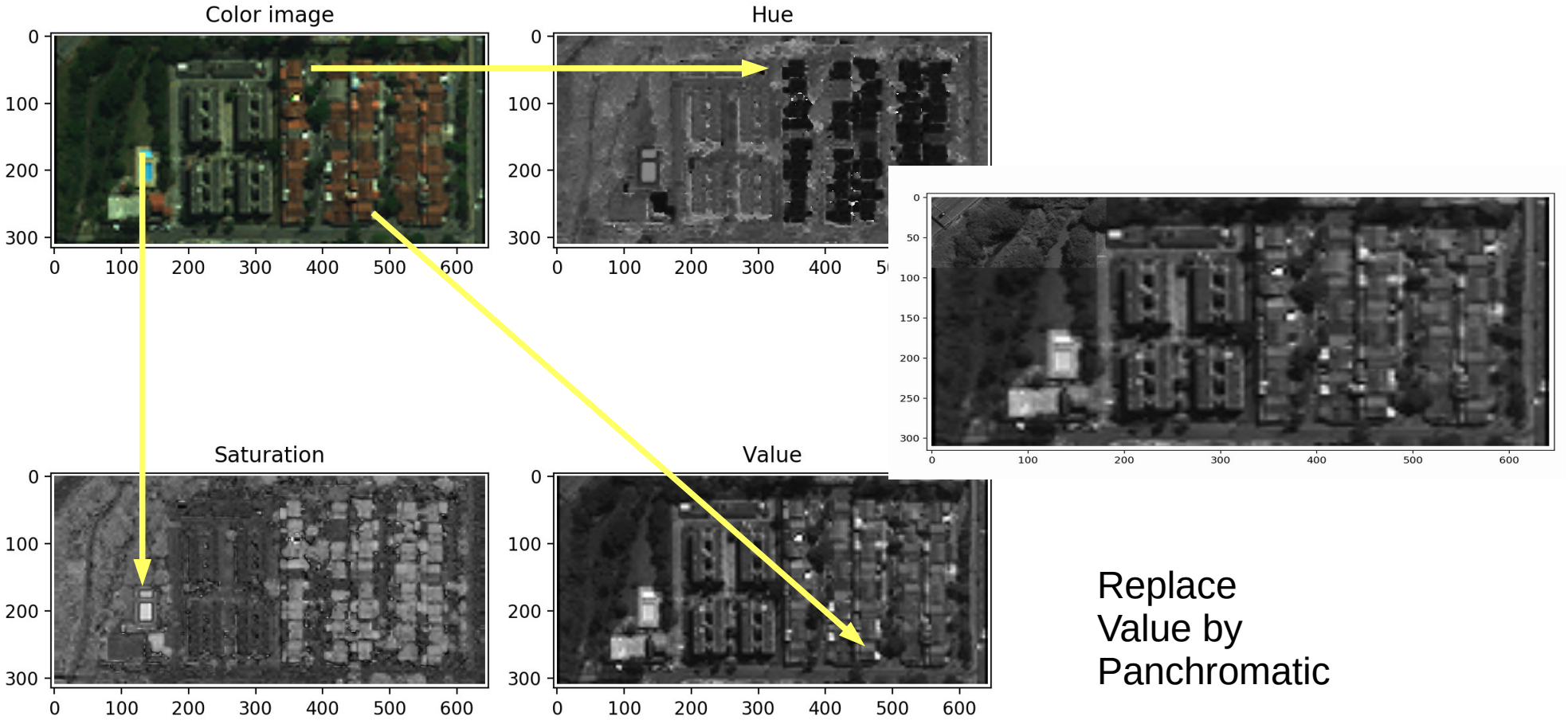
```
[[ 22  20  20  19
 [  9  11  11   7
 [  9  11  11   7
 [ 25  54  54  46
 [ 86  90  90  74
 [ 86  90  90  74  74  41  10  10  22  22]
 [ 92  94  94  90  90  86  33  33  25  25]
 [ 92  94  94  90  90  86  33  33  25  25]
 [ 93  93  93  91  91 108  43  43  22  22]
 [ 93  93  93  91  91 108  43  43  22  22]]
```



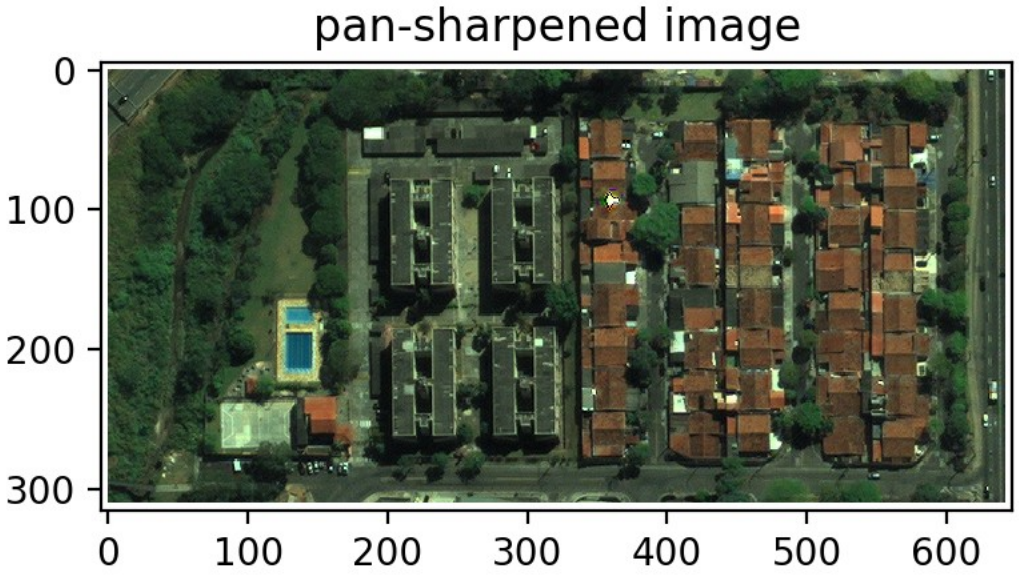
Techniques to improve visualization

example: multiply all values to a constant

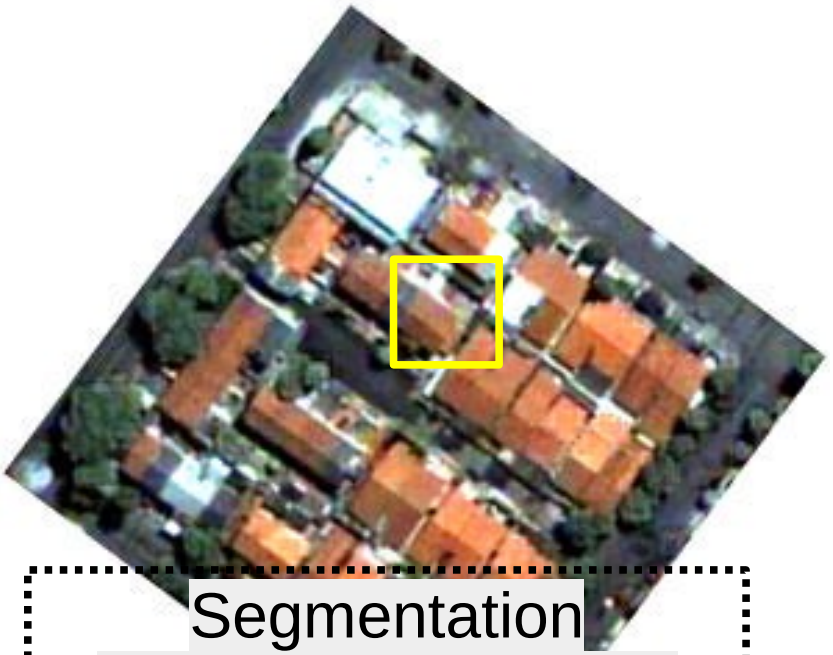
Preprocessing in Remote Sensing



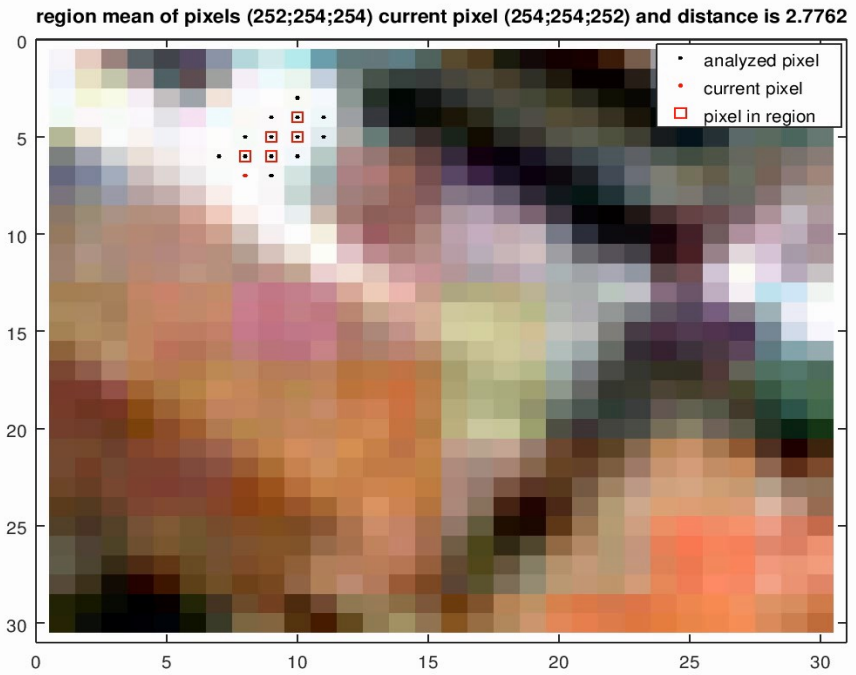
Preprocessing in Remote Sensing



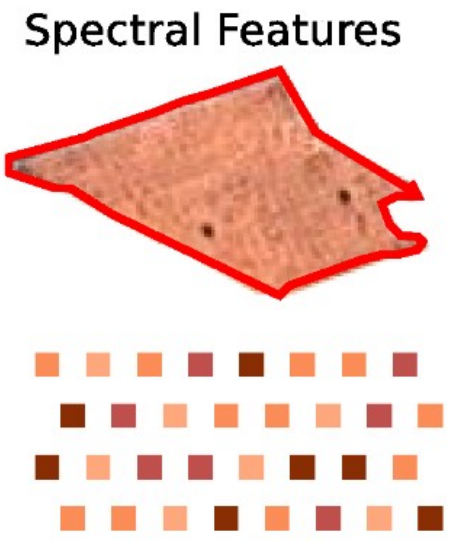
From pixels to objects

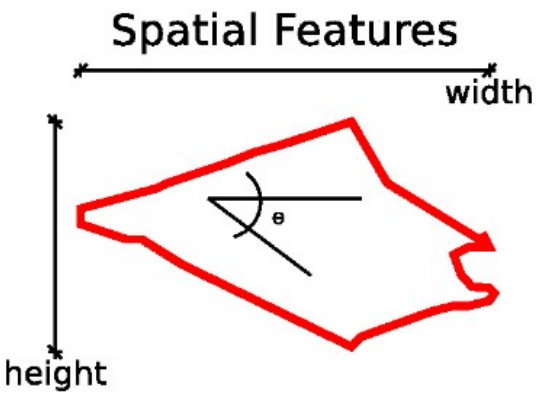


Segmentation separates the image into simple regions with homogeneous behavior

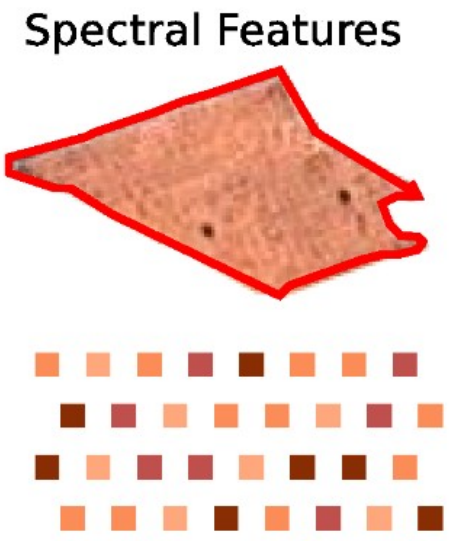


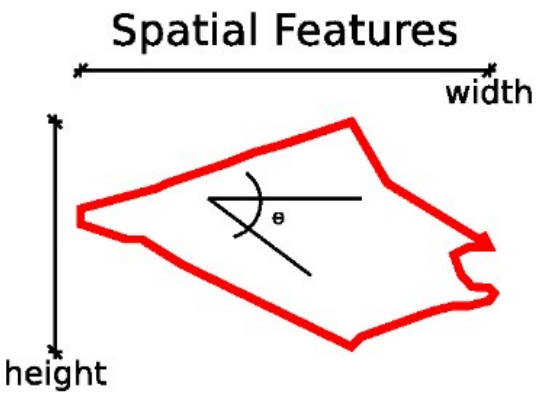
From pixels to objects

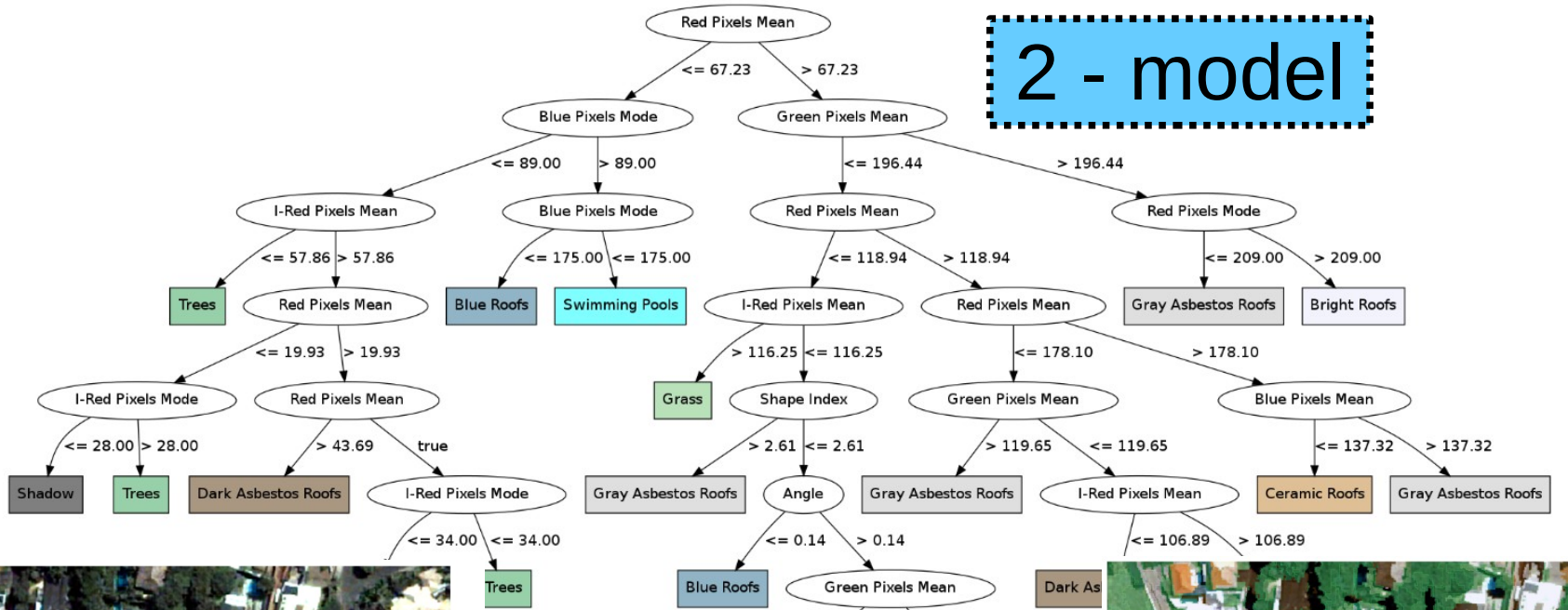




From pixels to objects



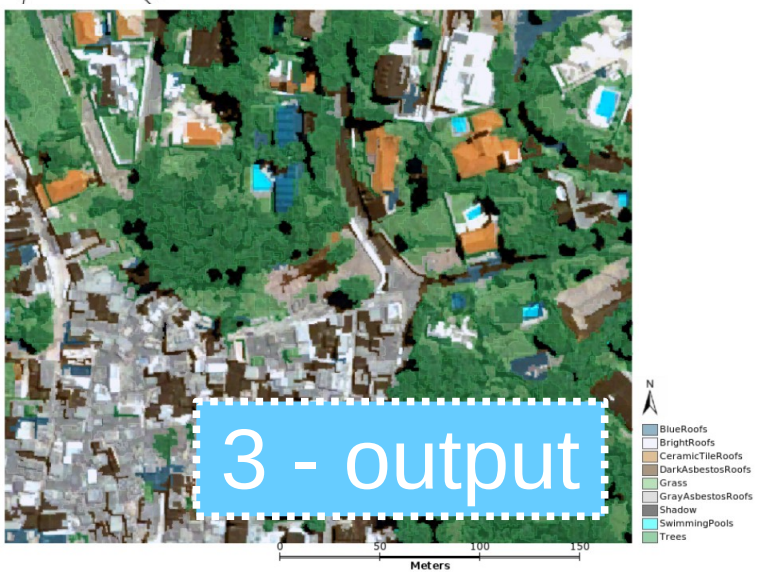




2 - model

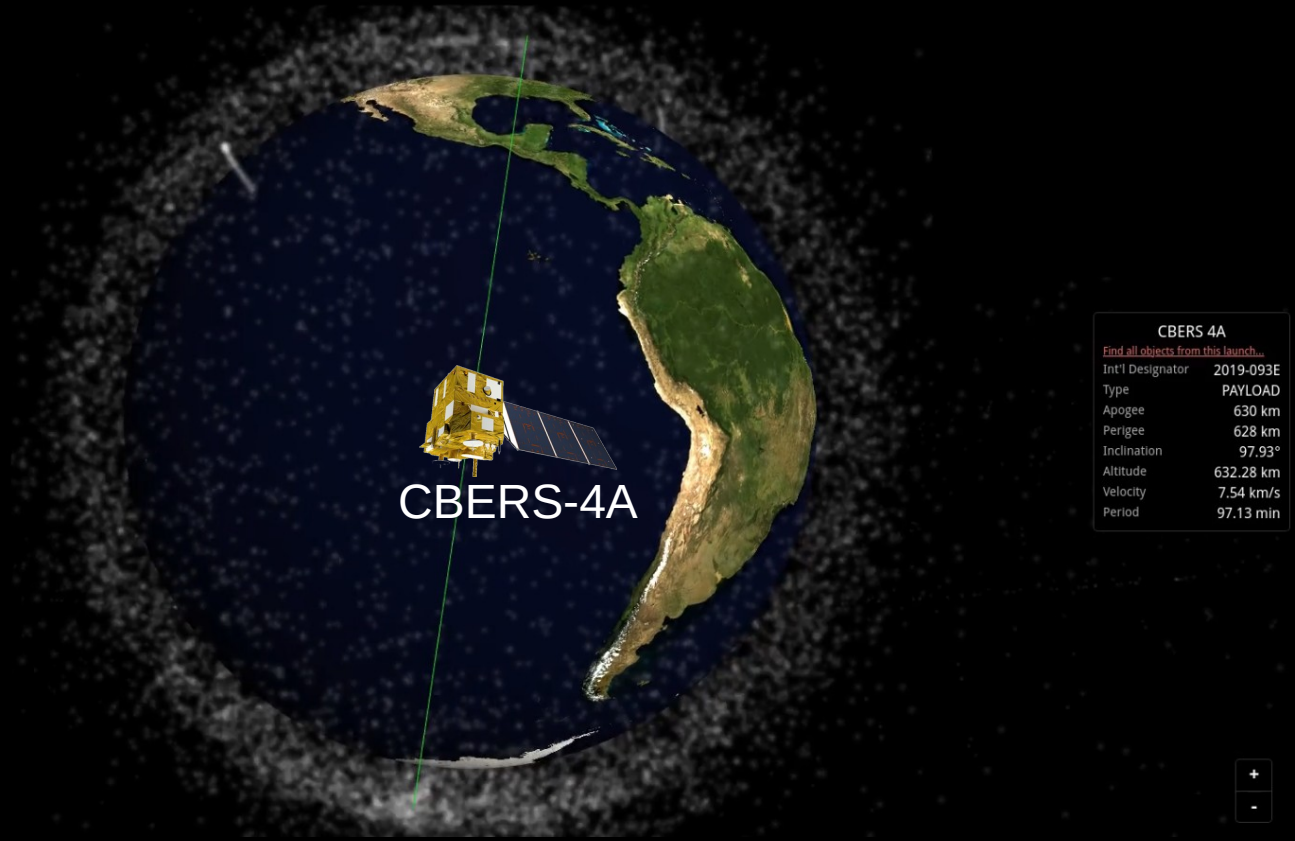
1 - input

The accuracy of the model depends on the analyst



3 - output

State-of-the art: Image Time Series



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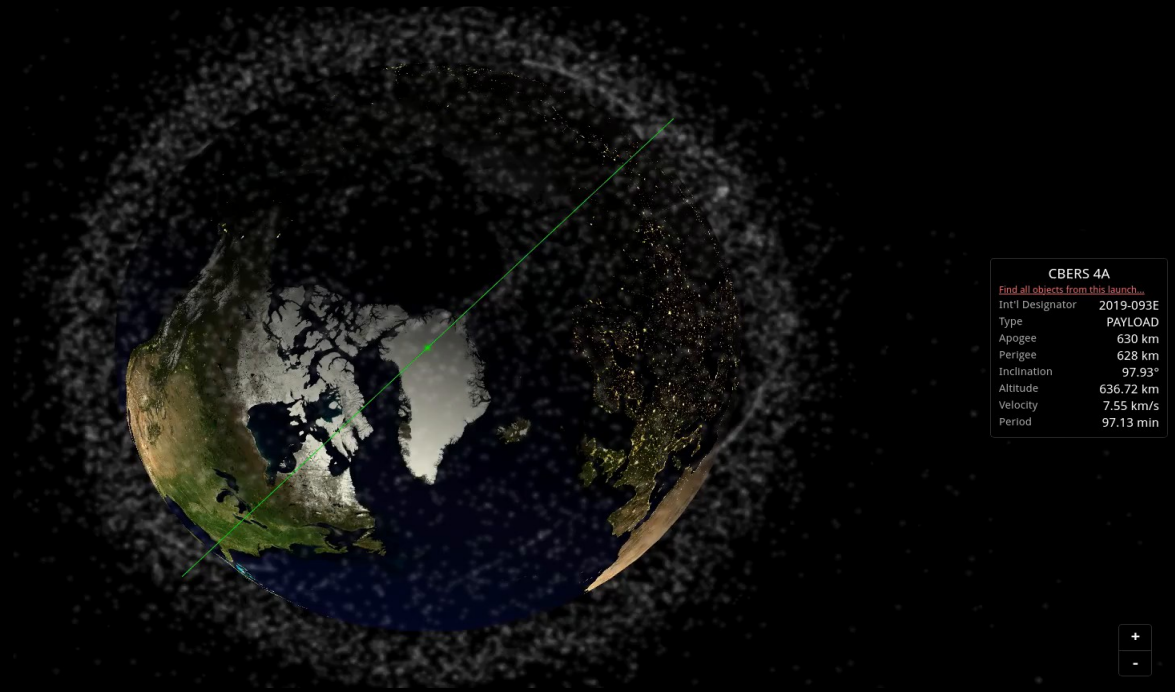
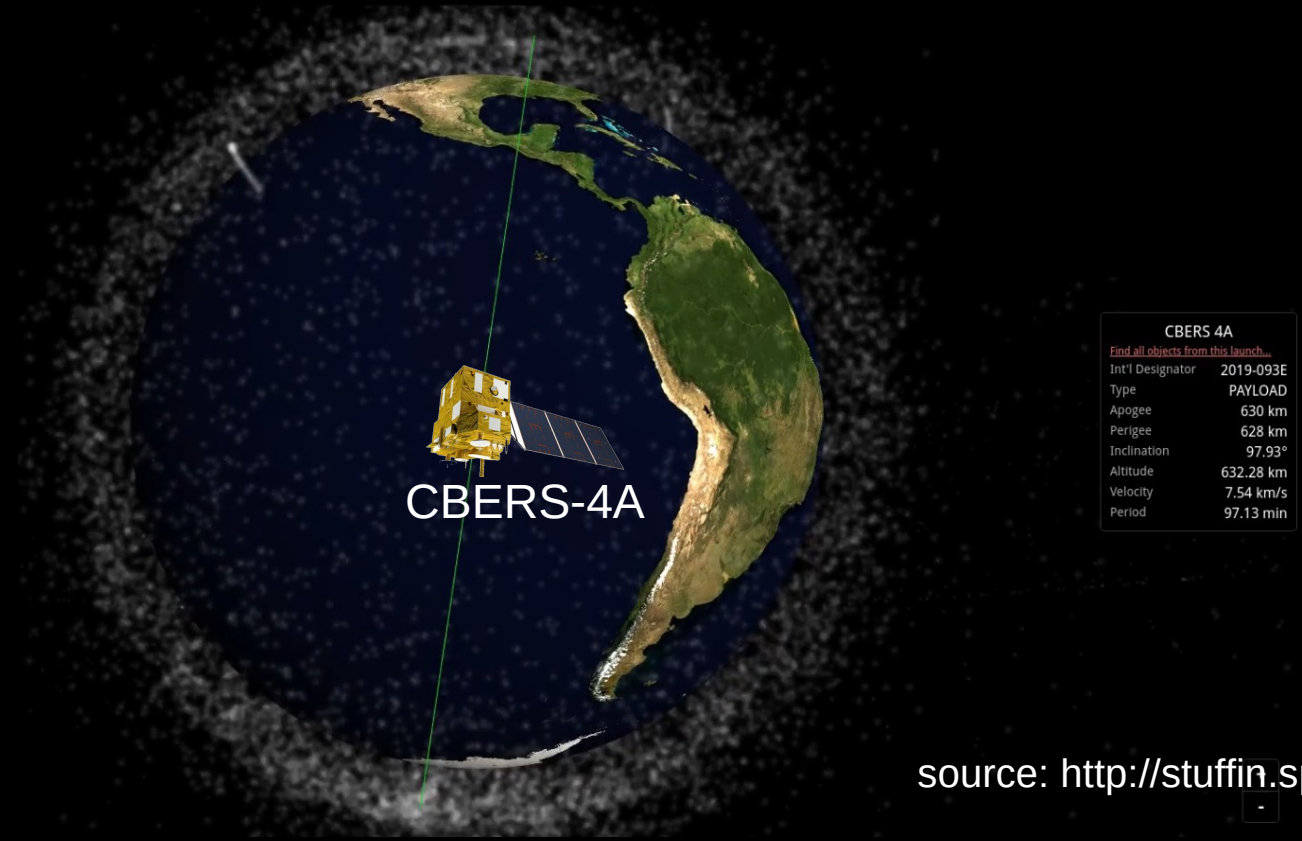


State-of-the art: Image Time Series

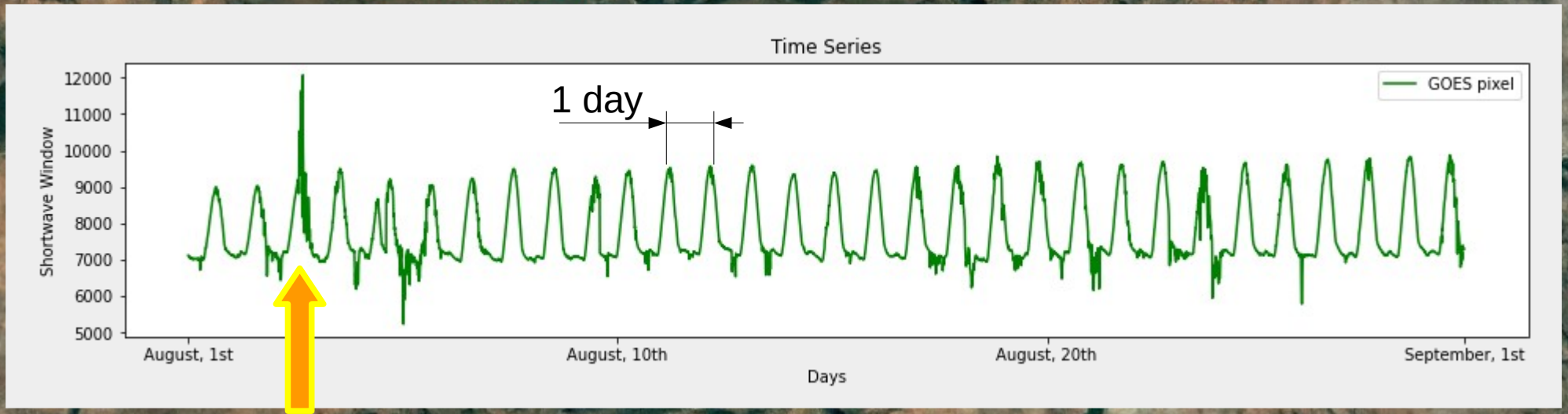
After 26 days (the temporal resolution), CBERS-4A captures a new image of the same place



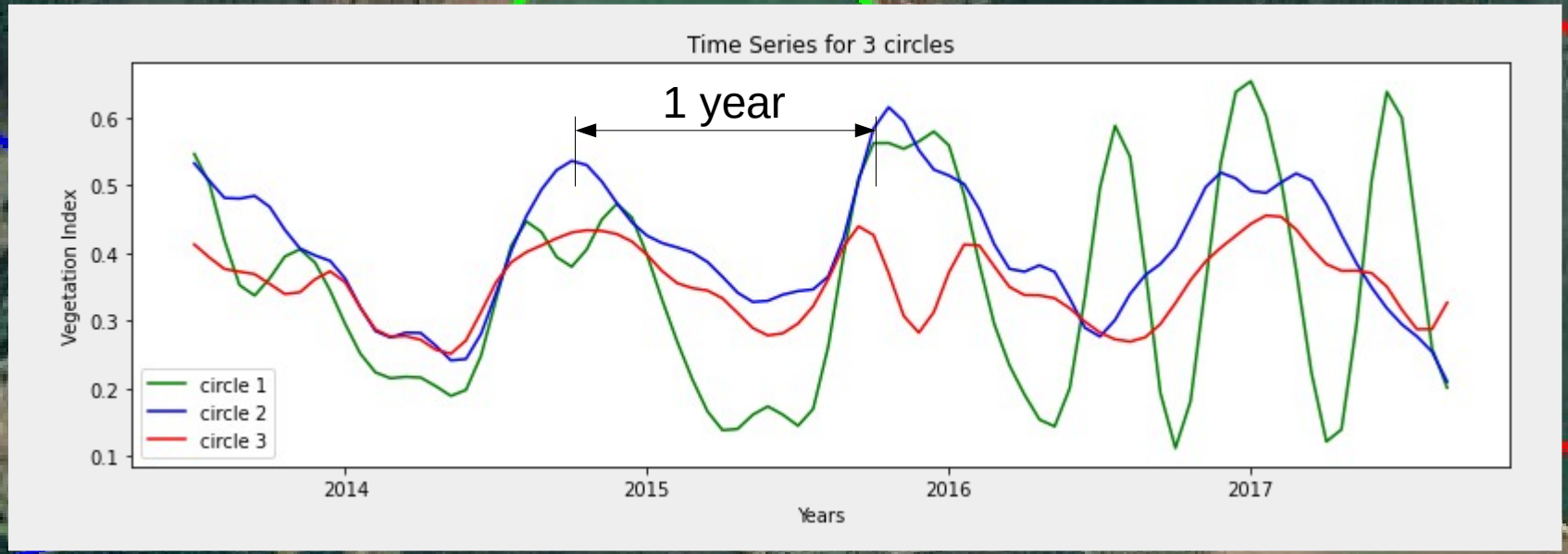
source: http://stuffin.space/

Spatial x Temporal resolution

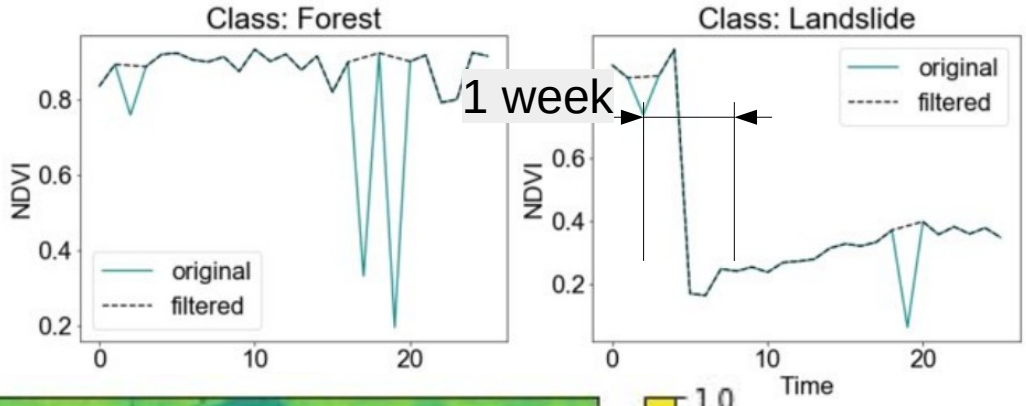
GOES
1 pixel = 1km x 1km
1 observation every 10 minutes

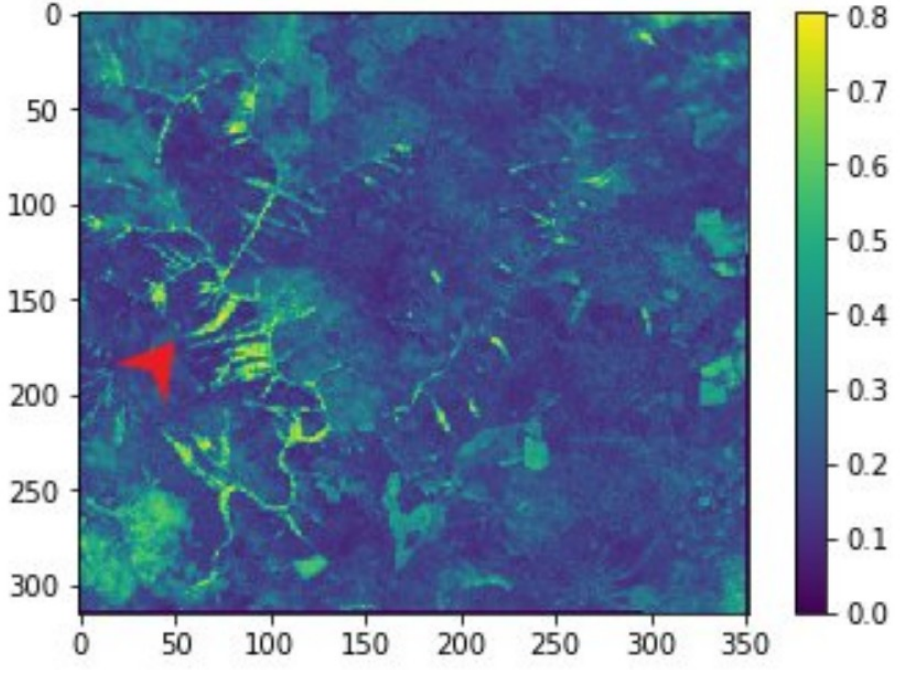


MODIS
1 pixel = 250m x 250m
1 observation every 8 days

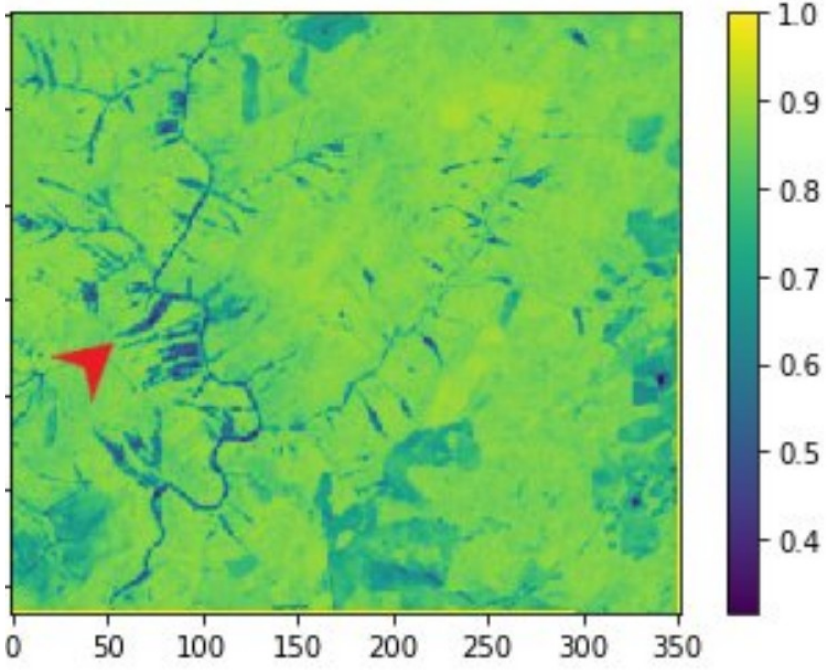


Sentinel
1 pixel = 10m x 10m
1 observation every 5 days



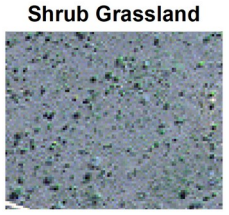


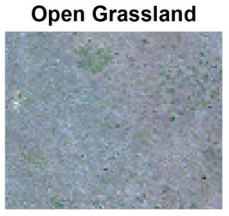
Amplitude

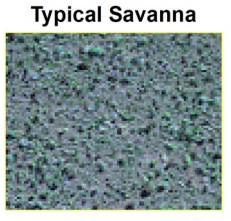


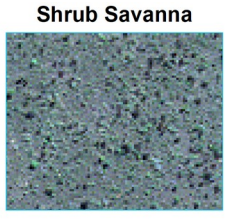
Mean

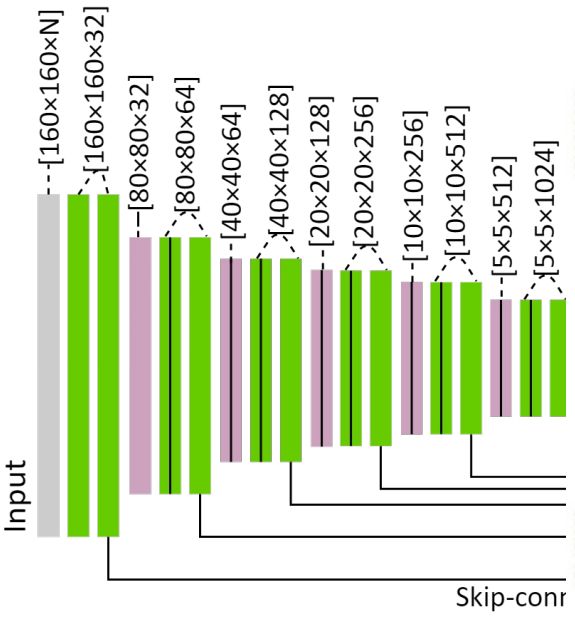
WorldView-2 - 1 pixel = 2m x 2m

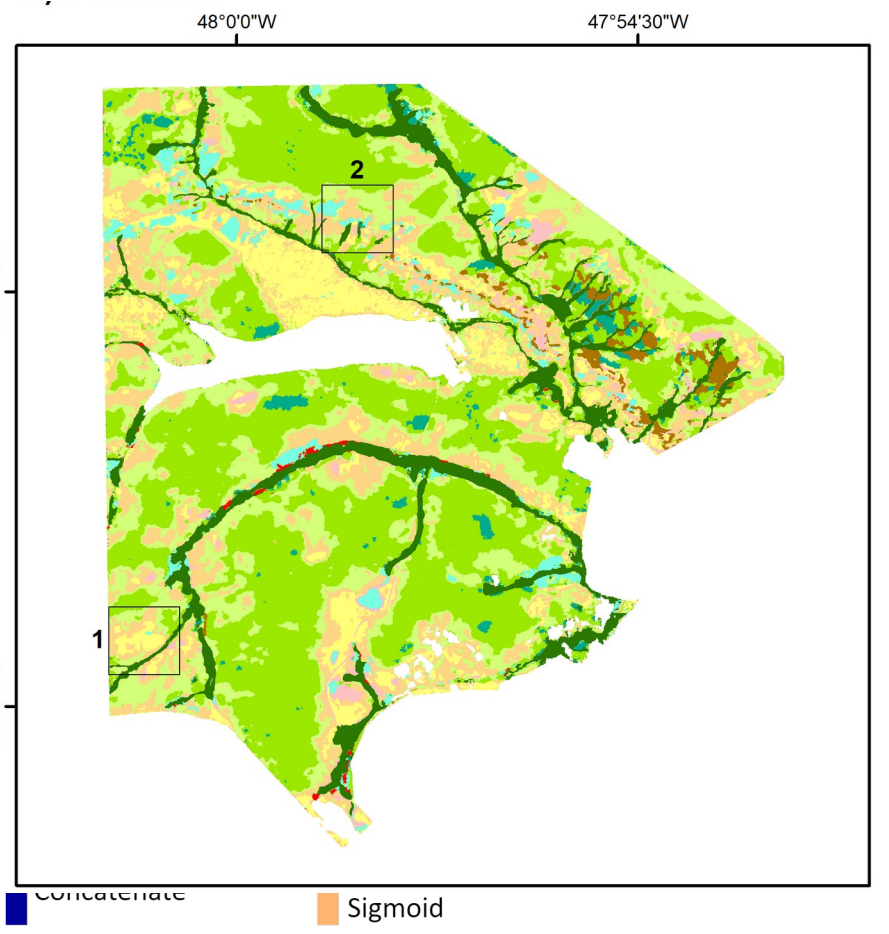


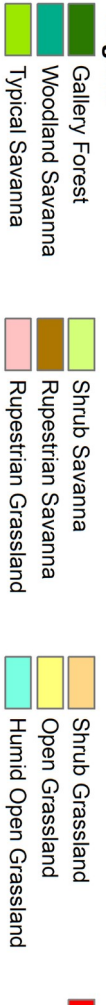












Satellite Image Classification

- Deep Learning → https://prezi.com/n_r8p1ytanyh/
- KNN → https://prezi.com/9h9amupckjjn/
- KNN *in action* → https://prezi.com/bf7r0vaasqim/
- Random Forest → https://prezi.com/nue3i0jqhwdp/
- Random Forest *in action*

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