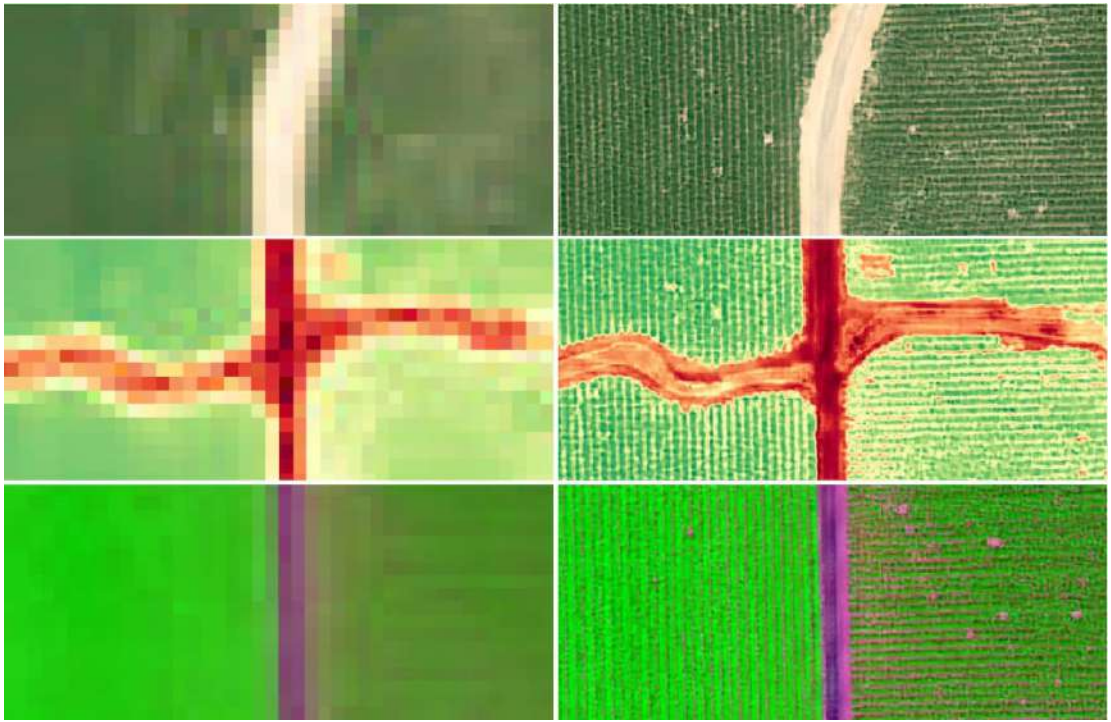
S2DR3: Effective 10-Band 10x Single Image Super-Resolution for Sentinel-2



Yosef Akhtman 29/05/2024 SUREDOS24 ya@gamma.earth


Col Du Grand
Saint-Bernard
Châtillon
Santa Cristina
Viverone

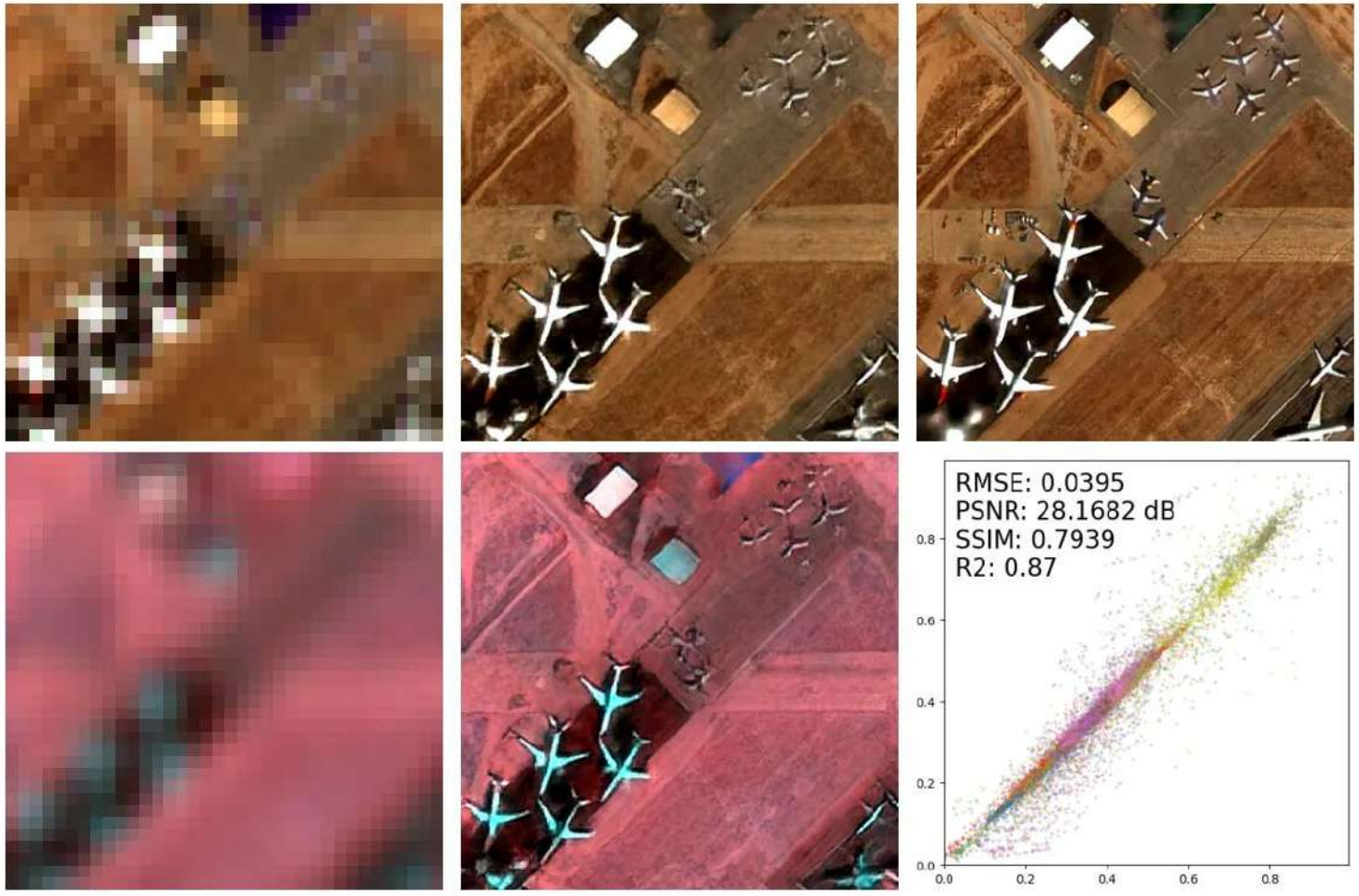

Gd.St-Bernard
2473 m
8114 ft
A.C.S.


Cassio
Lucca
Siena
Acquapendente
Civitas Vatican
Città del Vatica

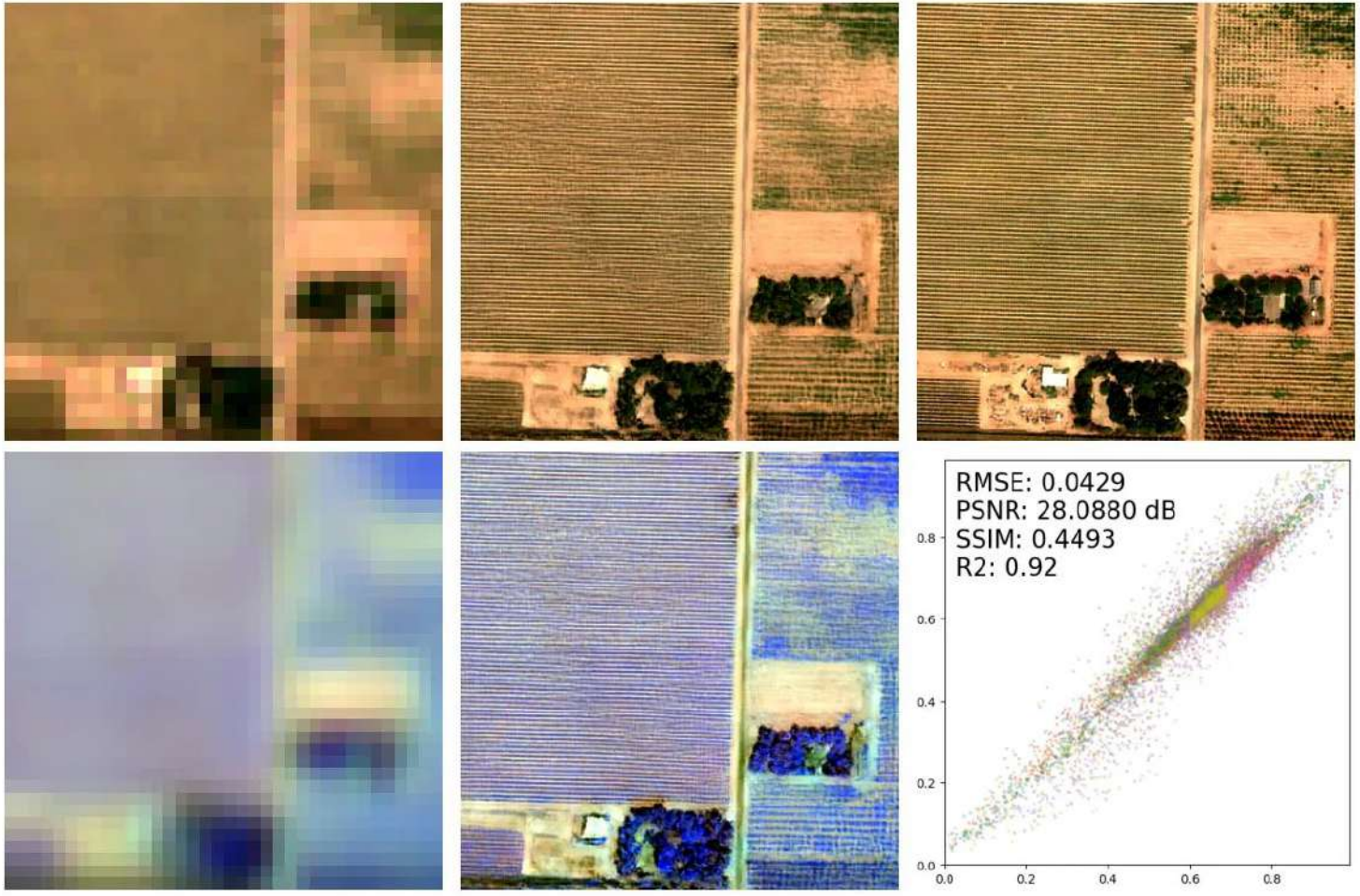

Col Du Grand
Saint-Bernard
Châtillon
Santa Cristina
Viverone
Cas
cca
Siena
Capra
quapendente
Civitas Vatica
Città del Vati

- Does Single-Image Super-Resolution Work?
- Is SISR useful?
- Why does it work? (Or why it doesn’t?)

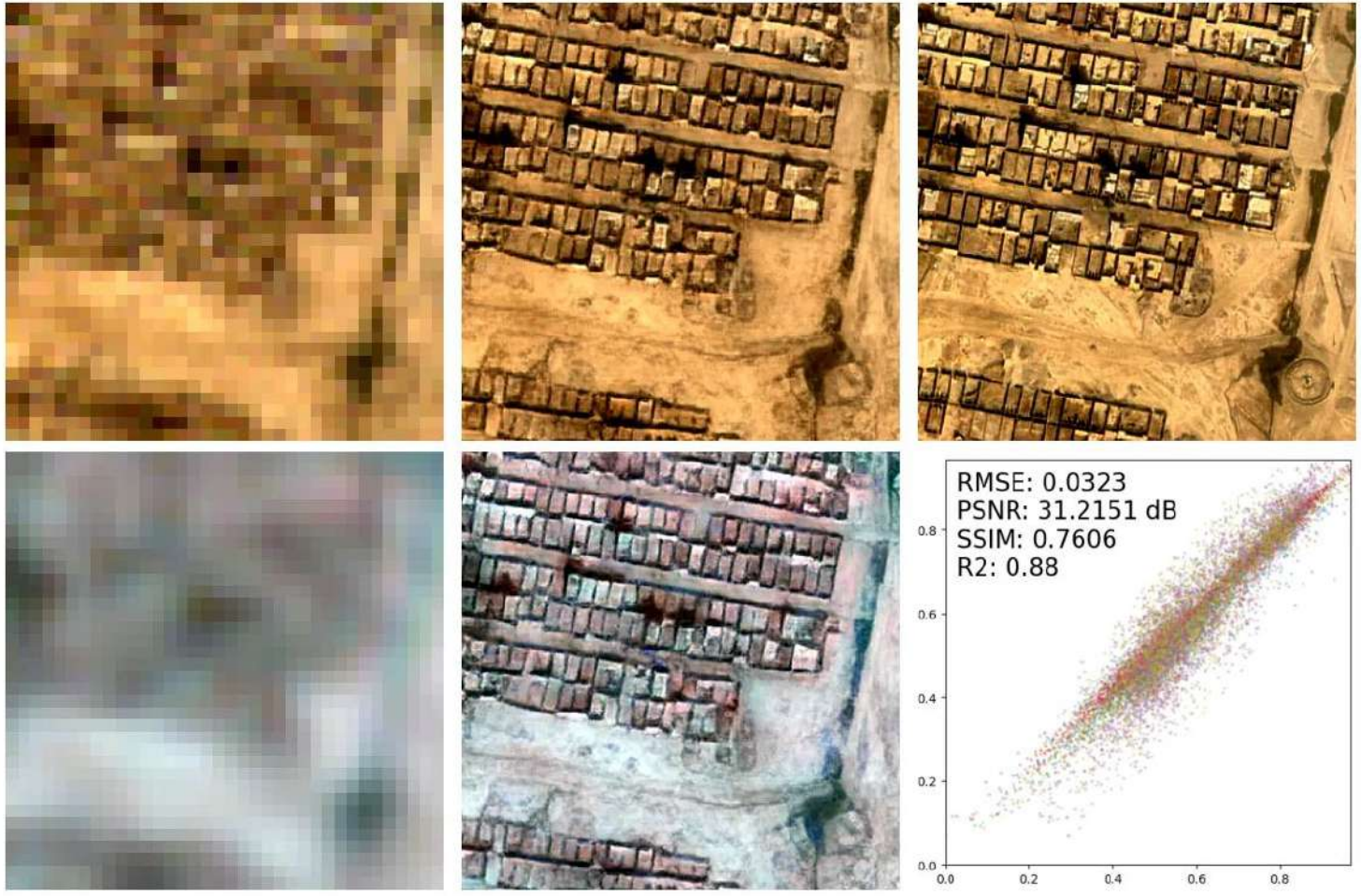
LR SR HR



LR SR HR



LR SR HR



Gamma Earth S2DR3 - Sentinel-2 Deep Resolution 3.0

Effective 10-Band 10x Single Image Super-Resolution for Sentinel-2

The notebook showcases the performance of the S2DR3 module. Detailed description of the module, as well as performance analysis can be found in the following white paper. Please contact info@gamma.earth for extended functionality, commercial use and other enquiries.

S2DR3 module will fetch Sentinel-2 data for the provided location and data and will super-resolve the 10 multispectral bands from the original 10m and 20m resolution to the targe spatial resolution of 1m/px. The output is a 10-band 1m/px multispectral georeferenced TIF image. The output product will be generated in the local filesystem path '/content/output', which will contain 4 products:

- S2L2Ax10_T[MGRS]-[DATE]-[UID]_MS.tif – 10-band multi-spectal image
- S2L2Ax10_T[MGRS]-[DATE]-[UID]_TCI.tif – True colour RGB image
- S2L2Ax10_T[MGRS]-[DATE]-[UID]_NDVI.tif – Pseudo-colour NDVI image
- S2L2Ax10_T[MGRS]-[DATE]-[UID]_IRP.tif – Ifra-red preudo-colour image

The order of the 10 bands in the multi-spectral product is: B02, B03, B04, B05, B06, B07, B08, B8A, B11, B12

Installation

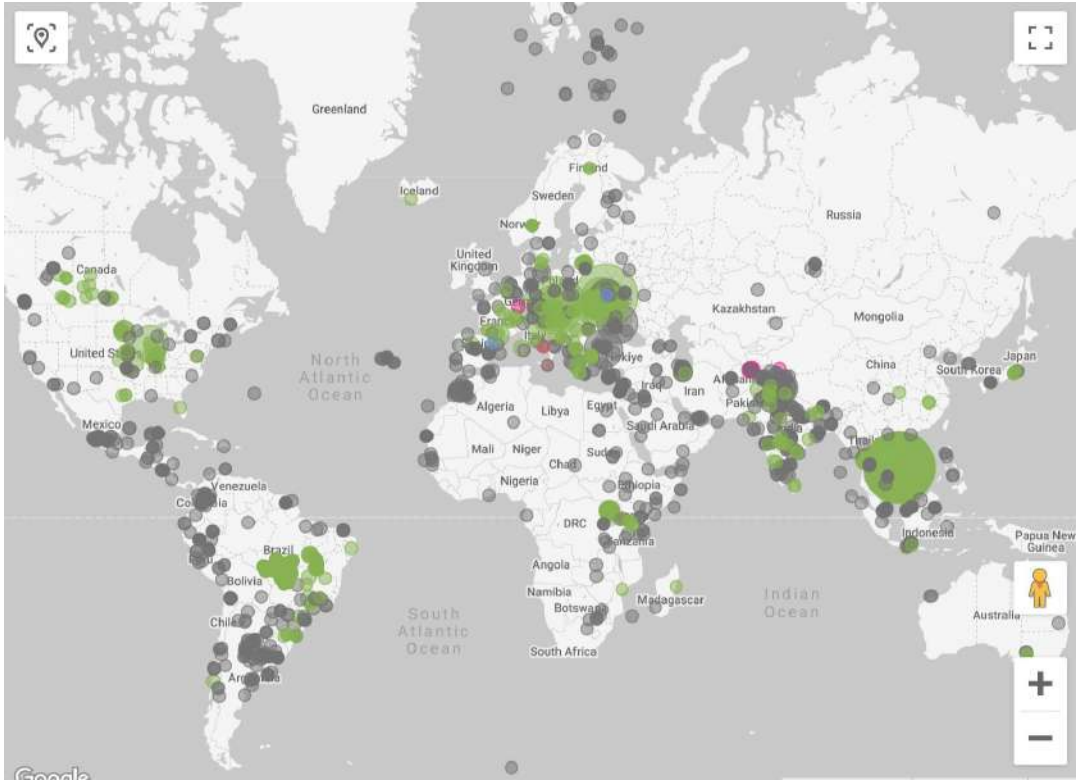
```
# Make sure to select T4 GPU instance from the Runtime/Change-runtime-type menu

!apt install -qq gdal-bin
!pip -q install https://storage.googleapis.com/0x7ff601307fa5/s2dr3-20240430.1-cp310-cp310-linux_x86_64.whl
```

Single-Image Super-Resolution **Does** Work

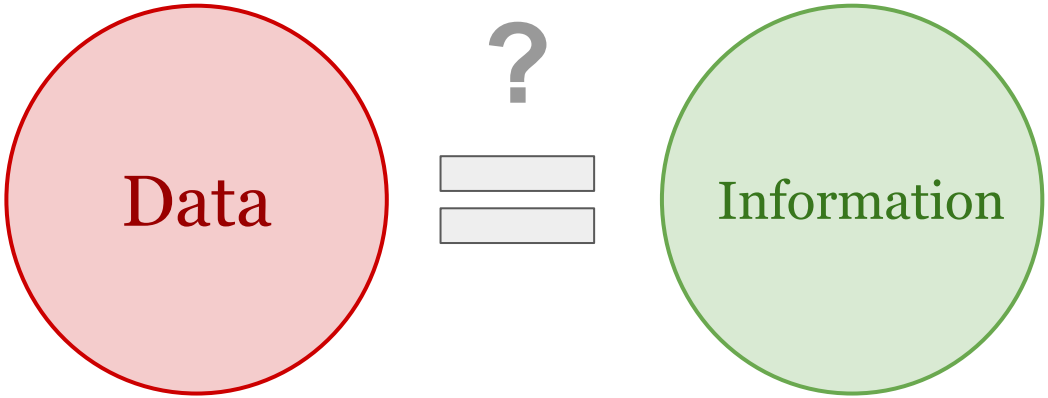
- The spatial resolution of the super-resolved images is increased (the image is **upsampled**)
- The information content of the super-resolved images is increased
- The entropy of the super-resolved images is reduced

SISR **Is** Useful

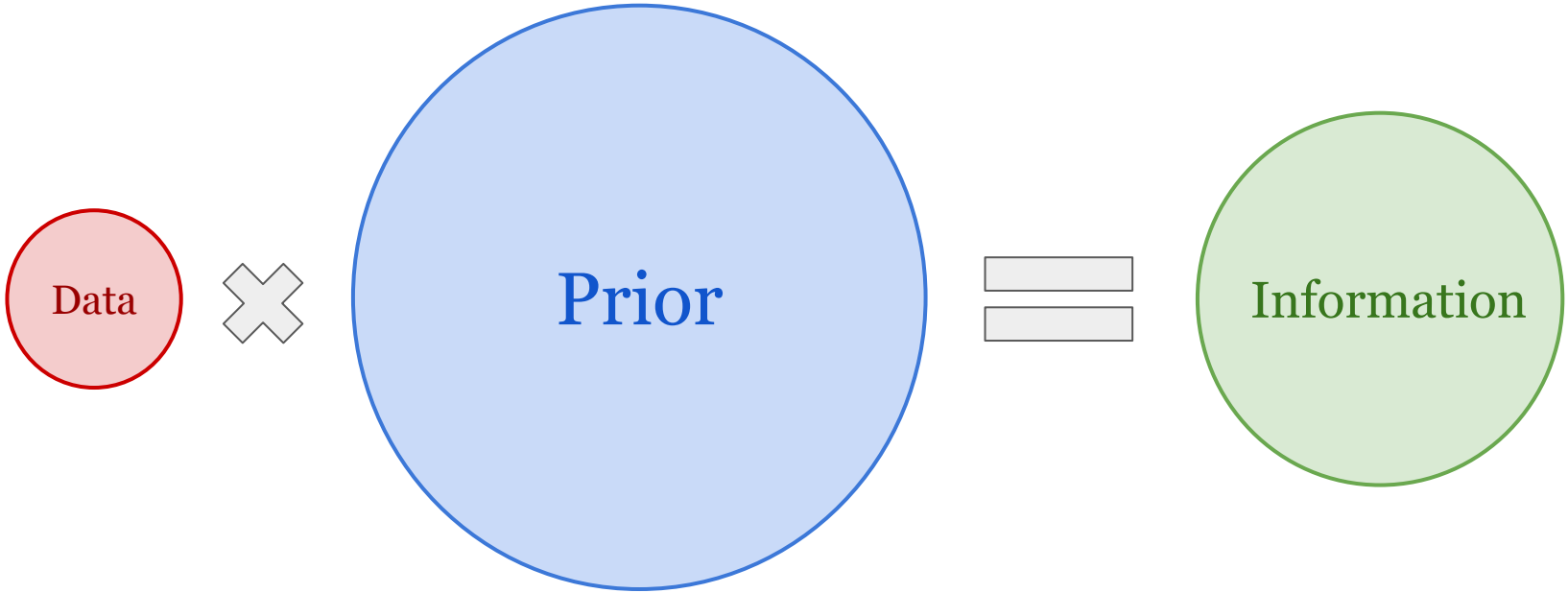
- 150 million sq. km over the last 3 years for commercial clients including
  - Bayer, KWS, Limagrain, CNH, Mahindra, ICL, etc.
- S2DR3 on Google Colab
  - 1 month
  - 150,000 sq. km
  - 10,000 runs



Why SISR works? (Or why it doesn’t?)



Why SISR works? (Or why it doesn't?)



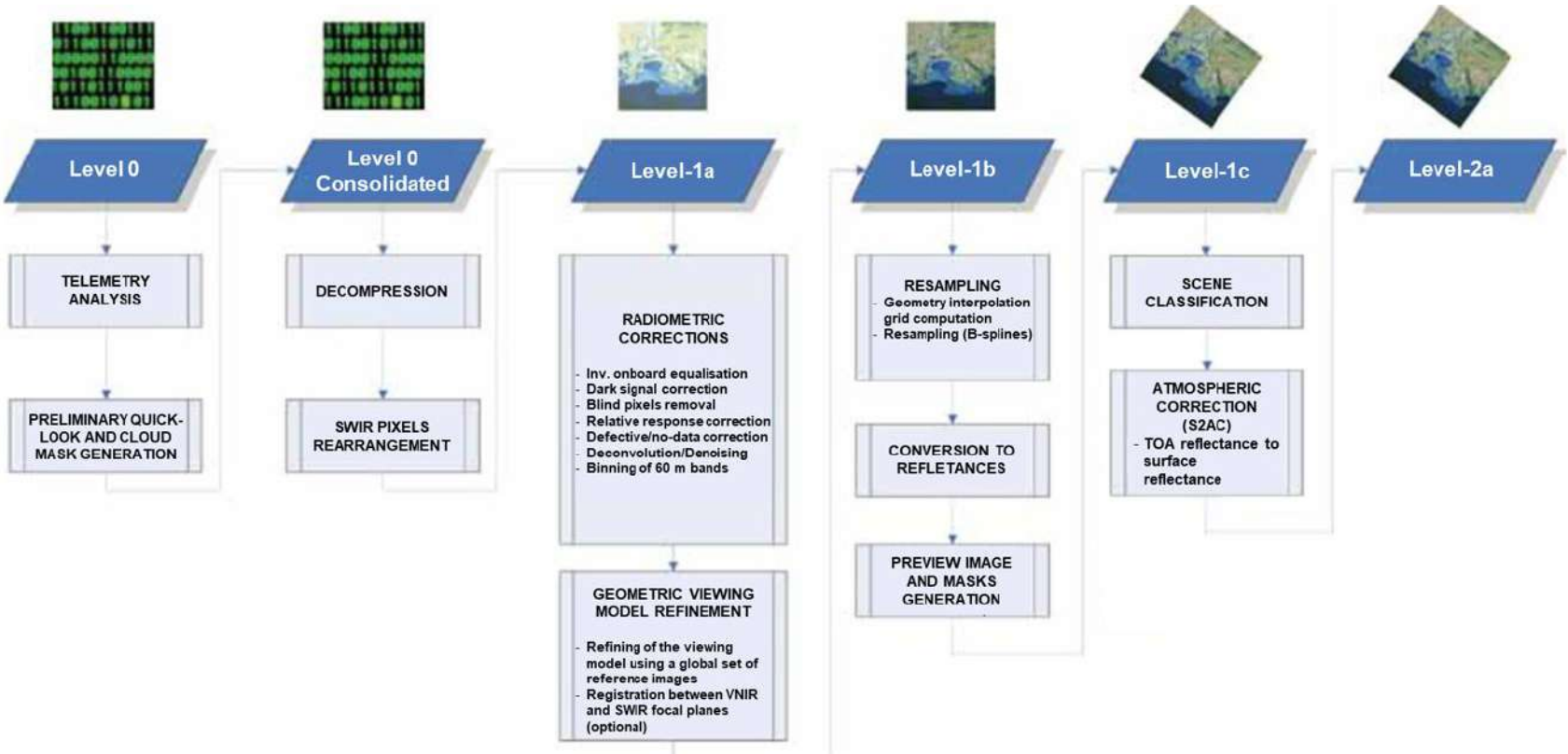
×


S-Bahn
Nach
Gleis
Hinweis
S9 07.28 Stadelhofen Stettbach Dübendorf Uster 44
S3 07.29 Hardbrücke Altstetten Dietikon 41
S6 07.30 Stadelhofen Tiefenbrunnen Uetikon 43
S6 07.31 Hardbrücke Oerlikon Seebach Baden 42
S3 07.33 Stadelhofen Stettbach Wetzikon 43/44
S10 07.35 Selnau Binz Triemli Uetliberg 22
S8 07.37 Wiedikon Enge Wollishofen Pfäffikon SZ 31
S9 07.37 Hardbrücke Oerlikon Glattbrugg Rafz 41/42
S4 07.38 Selnau Adliswil Langnau-G. 21
S5 07.39 Hardbrücke Altstetten Urdorf Zug 41/42
S15 07.40 Stadelhofen Uster Wetzikon Rapperswil 43/44
S7 07.42 Stadelhofen Meilen Uetikon Rapperswil 43/44
S14 07.42 Oerlikon Wallisellen Dübendorf Hinwil 33
S25 07.43 Wädenswil Pfäffikon SZ Glarus Linthal 6
S12 07.44 Hardbrücke Altstetten Schlieren Brugg 41/42
S2 07.44 Oerlikon Flughafen ✈ 34
24 07.44 Wipkingen Flughafen ✈ Thayngen 3
07.45 Stadelhofen Tiefenbrunnen Herrliberg-F. 43/44

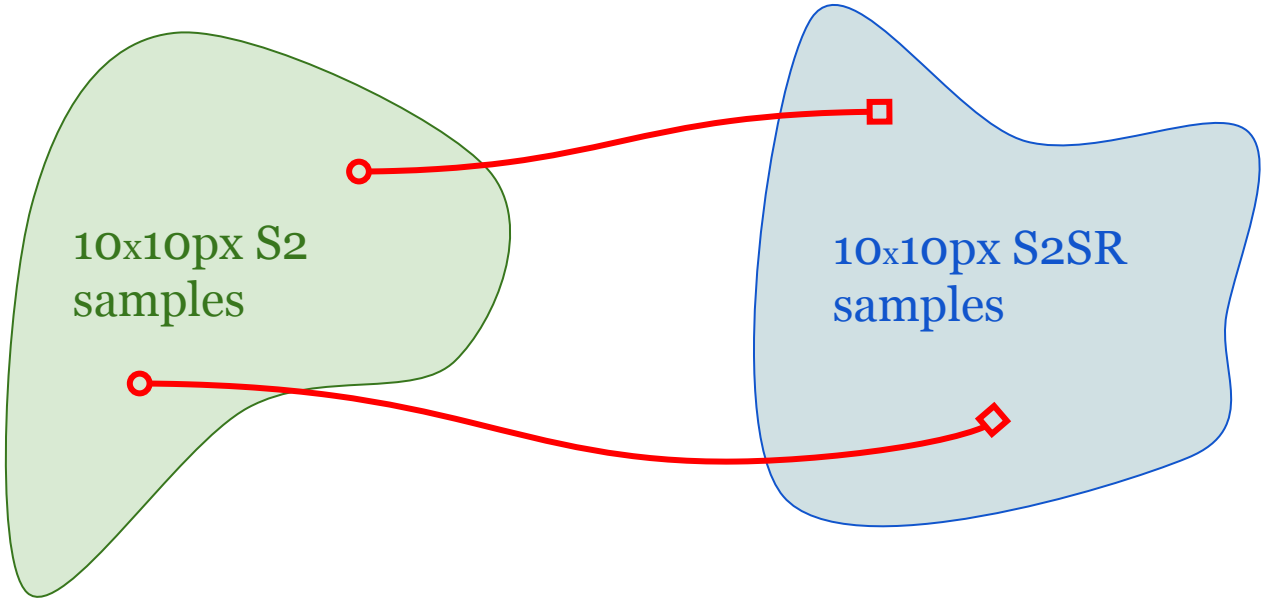
=


EXT 09.56
con supplemento
Gotthard Panc
S20 10.01 Castione Biasca
21 10.13 Luzern Basel SBB
S20 10.31 Castione-Arbedo

Sentinel-2 Processing Levels from Level-0 to Level-2a



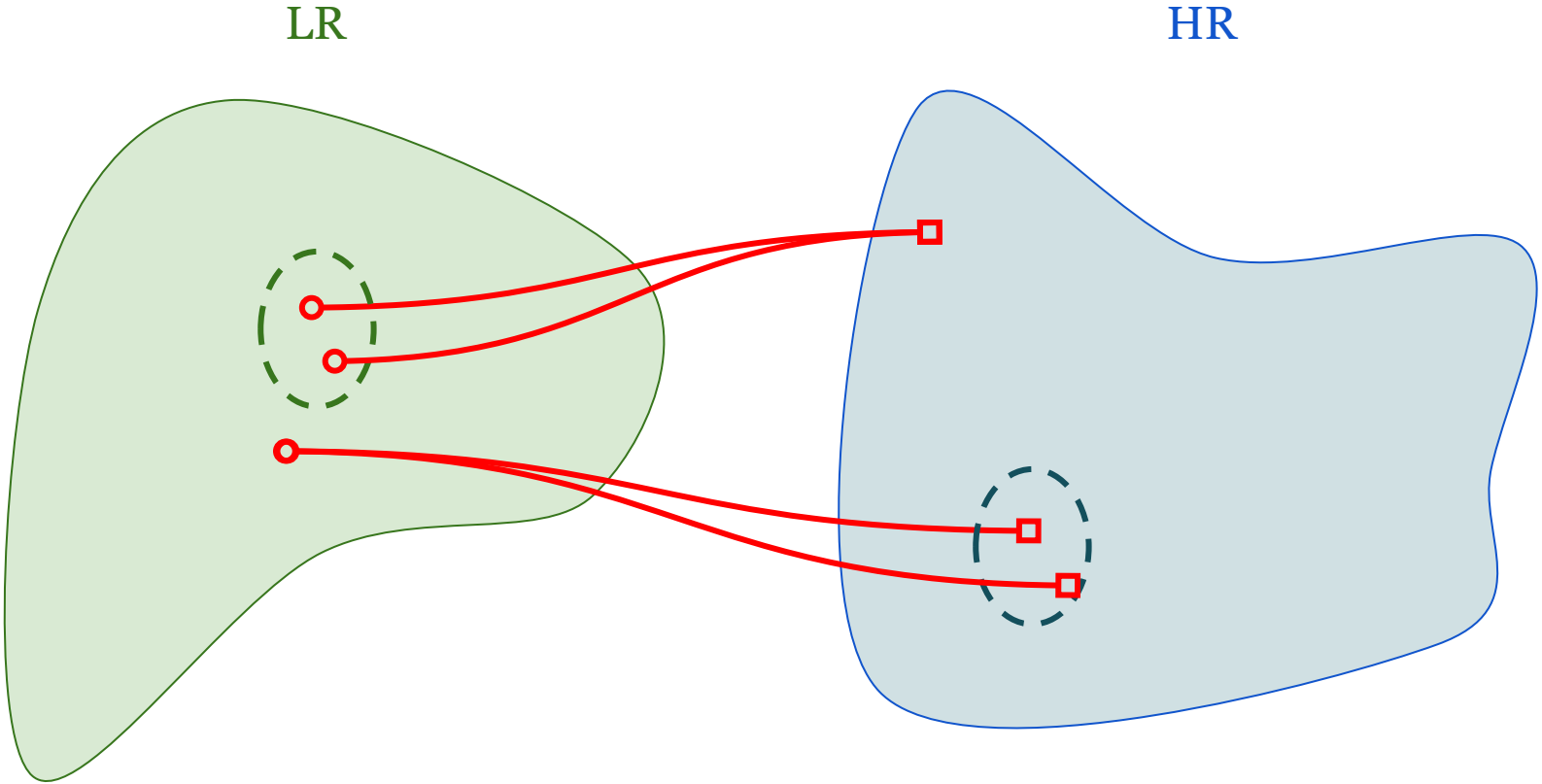
10x super-resolution

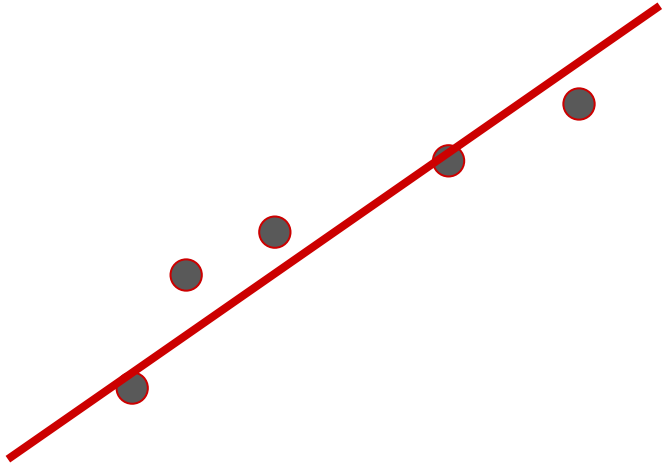


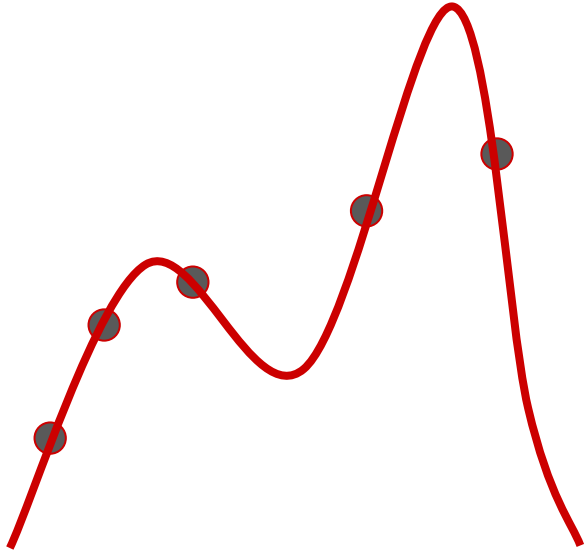
1e80 atoms in the known Universe

1e(3x10x100) = 1e3000

150 million sq. km = 1.5e12 S2 pixels


LR
HR





Why SISR works? (Or why it doesn't?)

1. It's all about platform specific know-how
2. It's all about the Data
3. Achieving 20x SR with satellite hardware optimisation is a no-brainer

Thank you.