# Predicting Landsat Reflectance with Deep Generative Fusion

Shahine Bouabid
Maxim Chernetskyi
Maxime Rischard
Jevgenij Gamper

Cervest Ltd.

Climate Change AI

NEURAL INFORMATION PROCESSING SYSTEMS

Cervest

# Motivation

– **Precision agriculture** and **humanitarian response** could benefit from detailed imagery
– Public missions bound to **trade-off** between **Spatial** and **Temporal** resolution

| | **Landsat** | **MODIS** |
|---|---|---|
| **Revisit cycle** | 16 days | 1-2 days |
| **Ground resolution cell size** | 30 m | 250-500 m |

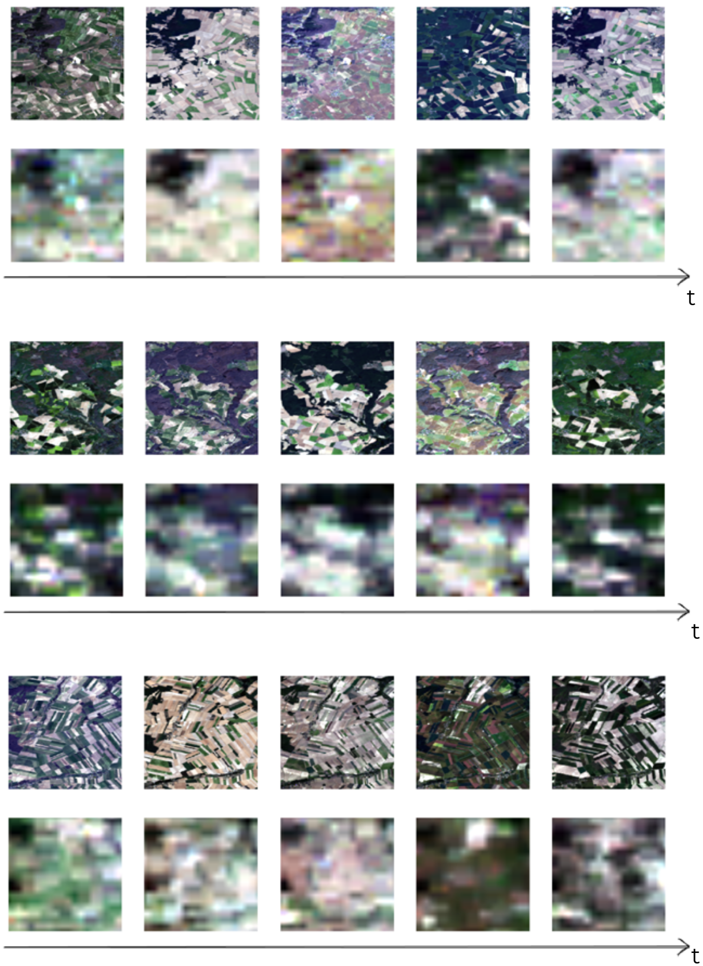
# Motivation

- **Precision agriculture** and **humanitarian response** could benefit from detailed imagery
- Public missions bound to **trade-off** between **Spatial** and **Temporal** resolution

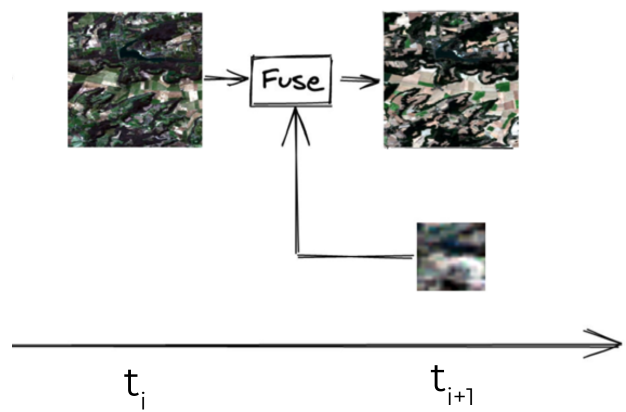
| | **Landsat** | **MODIS** |
|---|---|---|
| **Revisit cycle** | 16 days | 1-2 days |
| **Ground resolution cell size** | 30 m | 250-500 m |


**Predict in-between ?**

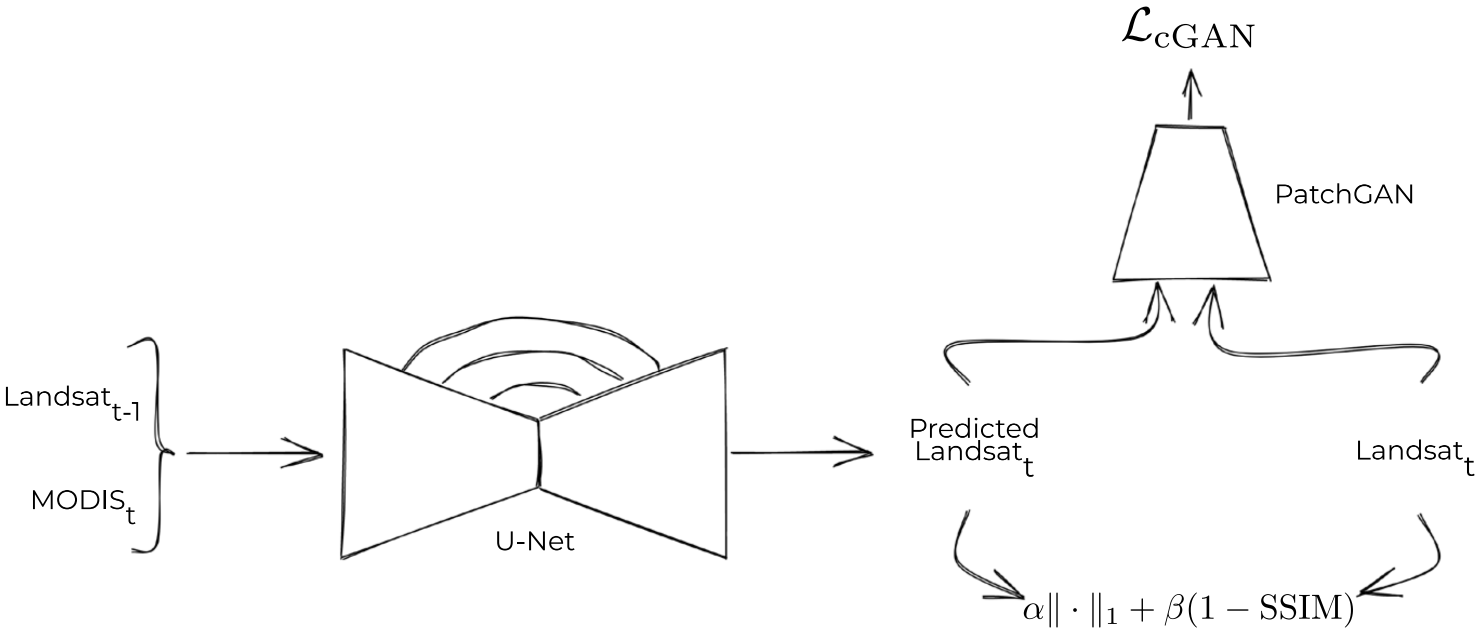
# Dataset and Problem




**Time series** of co-registered Landsat-MODIS **(256, 256) patches** for **550 locations** and **14 dates** on near-infrared, red, green and blue bands



# Experiment




**L1 supervision** → low-frequency components

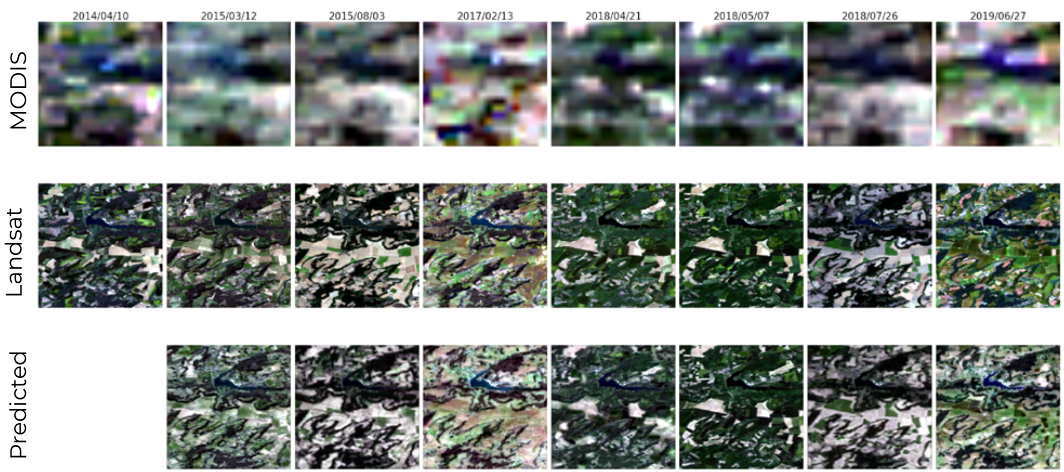
**SSIM supervision** → high-frequency components

# Results

## Substantial test Image Quality Metrics improvement againt SOTA

| Method | PSNR | | | | SSIM | | | | SAM ($10^{-2}$) |
|---|---|---|---|---|---|---|---|---|---|
| Band | NIR | R | G | B | NIR | R | G | B | |
| Bilinear Upsampling | 20.0 | 19.0 | 21.0 | 21.1 | 0.568 | 0.550 | 0.633 | 0.639 | 3.87 |
| ESTARFM [36] | 19.6 | 20.2 | 21.8 | 22.3 | 0.555 | 0.640 | 0.688 | 0.696 | 4.88 |
| cGAN Fusion + $L_1$ | 22.1 | 21.8 | 23.7 | 23.8 | 0.675 | 0.697 | 0.747 | 0.747 | 2.75 |
| cGAN Fusion + $L_1$ + SSIM | **22.3** | **22.0** | **23.9** | **24.0** | **0.694** | **0.714** | **0.761** | **0.760** | **2.70** |

Table 1: Image quality scores on testing set; cGAN models scores are averaged over 3 independently trained models




Captures and blends coarse reflectance in ground instances

Blurred predictions, struggles to fuse into small fields

SSIM improves stability of adversarial training

*Code available : https://github.com/Cervest/ds-generative-reflectance-fusion*