Deep learning on remote sensing images: a new era for environmental applications

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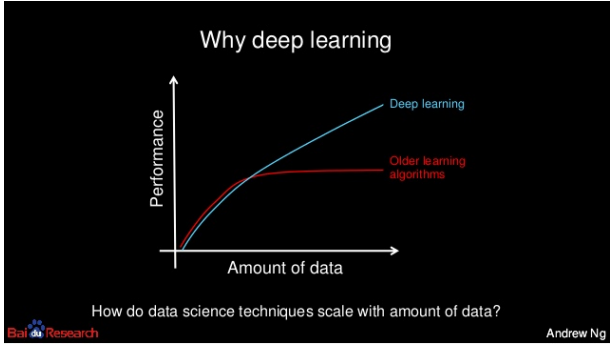
Science and technology

Earth Observation: growing data volumes

- ↗ images (USGS, ESA/Copernicus, THEIA, PEPS, GEOSUD/DINAMIS),
- ↗ sensors (optical, SAR, ...) with ↗ resolution (spatial, spectral, temporal, ...),
- ↗ geospatial data (open data, crowdsourcing, ...)

Big data processing: the deep learning era

- New methods suited for large data volumes,
- New hardware and high performance computing paradigms,
- New mature and accessible frameworks, mostly open-source (TensorFlow, PyTorch, ...)



Source: Andrew Y. Ng, Chief Scientist at Baidu (https://fr.slideshare.net/ExtractConf)

Open-source libraries

Deep learning

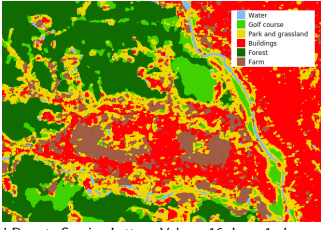
- **TensorFlow** (Google)
- PyTorch (Facebook)
- ...

Remote sensing

- GDAL
- **Orfeo ToolBox** (CNES)
- GRASS
- SAGA
- ...

OTBTF, an Orfeo ToolBox extension for deep learning

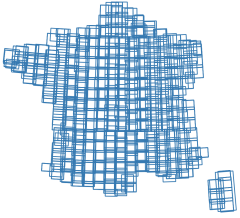
- Generic (network architectures, images types) and big data capable[1]
- Also great for teaching[2]



[1] "A Framework for Remote Sensing Images Processing Using Deep Learning Techniques", R. Cresson, IEEE Geoscience and Remote Sensing Letters, Volume 16, Issue 1, Jan. 2019, pp 25-29
[2] "Deep Learning for Remote Sensing Images with Open Source Software", R. Cresson, CRC Press, 2020.

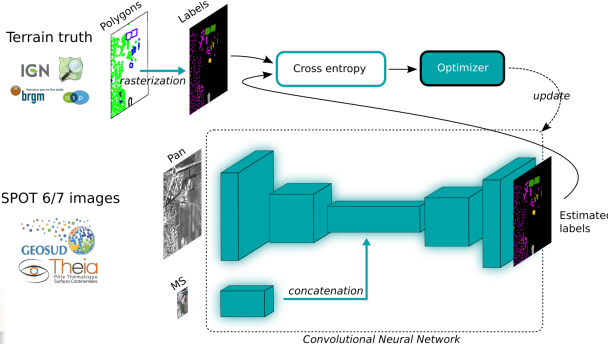
Use case: mapping man-made structures over France mainland (THEIA)

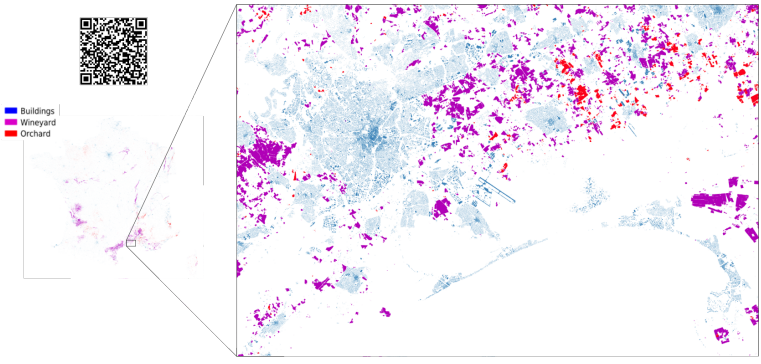
- 1.3k SPOT 6/7 acquisitions over France



- Model training: 30 days on 4x 1080Ti GPUs, 24 hours on Jean-Zay (IDRIS)

- Network architecture (semantic segmentation)





See the map → **https://tinyurl.com/cartefrancebati**

ai4ge

Artificial Intelligence at the service of Geospatial Information

AI4GEO, the context

Availability of **3D Geospatial information** is a **key stake for many soaring sectors**

Production is now possible thanks to the **abundance of available data** (Open Data and satellite constellations).

but manual interventions are still needed to guarantee a high level of quality, which prevents mass production.

Average annual growth of the earth observation related services market*

15%

Global market for earth observation related services in 2015 – 2026*

€ 7Md – 15Md

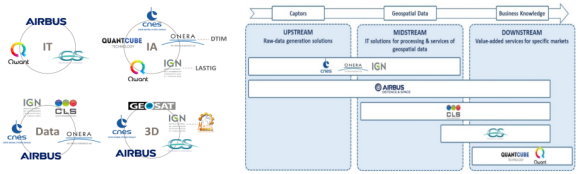
AI4GEO Aims at developing an **automated solution for producing 3D geospatial information** and offer new added-value services leveraging **innovative AI methods** and **Big Data** technologies adapted to 3D imagery.

« Data is the new oil » … the challenge is how to extract Valuable Information

QUANTCUBE TECHNOLOGY · IGN · ONERA · Qwant · cnes · GEOSAT · CLS · AIRBUS · bpifrance

AI4GEO, the project

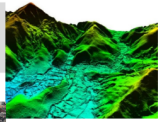
The AI4GEO consortium is constituted with **Institutions and Industrial groups** covering the whole value chain of Geospatial Information and providing complementary technical skills.



4 years' timeline **Developing a set of technological bricks allowing the automatic production of qualified 3D maps** and additional layers of information

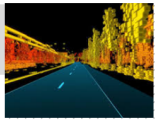
AXIS 2 : **Market targeted demonstrator,** *deriving from technological bricks a variety of services for different fields*

CLS — **Environment** : land cover, water resource management



AIRBUS — **Smart cities** : 3D semantic Urban Map, low cost, up to date

GEOSAT — **Transport** : 3D HD maps, brings context to embedded self driving algorithms



QUANTCUBE TECHNOLOGY — **Economic Intelligence** : Alternative financial and economical data, help with decision-making

ES GROUP — **IT Platform** : AI4GEO Engine, SaaS virtual research environment

Keep in touch!

https://www.ai4geo.eu

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