FUTURE FOR OTB :
HOW WILL YOU USE OTB IN THE NEXT FEW YEARS ?

30/11/2021
OTB User Days – @Artil ect TOULOUSE
Emmanuelle Sarrazin, Yannick Tanguy – CNES Toulouse
Back in the past: where does OTB come from?

**Image processing library**: covers all needs in Remote Sensing

**Funded and developed by CNES**: State of the art algorithms / in the frame of the development of Pleiades satellites.

**Open-Source**: Apache V2.0

**Maximum reach**: for all kind of users, SIG, scientists... laptop to clusters computers

**Software distribution**: built upon major libraries
Success stories: a nice 15 years old story…

- Used at CNES, ESA (European Space Agency), mission exploitation platforms, remote sensing labs
- More than twenty training sessions around the world 😊
- OTB helped to improve the open-source codec for JP2 OpenJpeg
- Lots of algorithms from PhD, internships, etc. have been developed in OTB

- Big data capable
- Streaming / pipeline

- Applications: write it once, use everywhere
- => ~ 100 applications, tens of Remote Modules

- User community
Every day irritating tasks

- Lots of libraries updates (> 15 main dependencies)
- Continuous Integration (lots of different builds)
- Installation/packaging issues
- Dynamic user community… but lots of issues/bugs and not enough time to correct them!
What’s prevent us to do more...

Lots of target platforms (Linux, Windows, Mac) + Conda, Docker + Linux distributions: (Debian, OSGeo Live, etc.)

Intrinsic code complexity (architecture, C++)

Many ways to use: command-line, GUI, Python, Monteverdi, QGIS

Remote-Module obsolescence…

(too ?) many applications
In the last years

Some processing chains are not based on OTB any more...

→ We need to understand why users/developers use other softwares

Brainstorming with the first OTB developers

- Compatibility with Python environments
- Execution pipeline (streaming, etc.)
→ OTB became too big / too heavy / too complex to maintain

User surveys (OTB user forum)

→ Try to clarify what is mainly used (OS, interfaces, applications, use case)

Software audit

→ Challenge OTB, understand its weaknesses, imagine the future
User survey (66 answers) : main tendencies

Where do you run OTB applications?
- Your own personal computer: 59
- A shared multi-core server: 25
- Cluster architecture: 18

Your operating system
- Windows: 36
- Any flavour of Linux: 45
- Mac OS: 3

How do you install OTB?
- Download & install binary packages: 54
- Compilation in your environment: 8
- Compilation with Superbuild: 15
- Install packages with Conda: 10

- Your own personal computer
- A shared multi-core server
- Cluster architecture
- Any flavour of Linux
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**User survey**

**How do you use OTB applications?**

- Command Line Interface: 48
- Graphical User Interface: 22
- Python notebook: 6
- Python script: 33
- From QGIS: 25

**How do you display images?**

- QGIS: 58
- Monteverdi: 18
- Jupyter Notebook: 9
- Another GIS viewer: 10
- Homemade visualization tool: 5
- I don’t need to visualize images: 1

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**Questions:**

1. How do you display images?
2. How do you use OTB applications?
User survey

Developers corner

C++ development: you develop remote module and use OTB filters and apps

Python development: you use OTB applications in a processing chain

Applications you use most

- Segmentation framework
- Classification framework
- Morphological operations
- Feature extraction
- Ridge extraction
- Stereo framework
- Image processing
- Vector data manipulation
- Optical vs SAR image processing

Applications you use most
Use cases (1/3)

Sparse images
Some basic treatments / use of the classification / segmentation framework

☑ Fonctions de base / frameworks segmentation & classification
☑ Binary packages installation
☑ QGIS
Use case (2/3)

« I develop / maintain a processing chain based on OTB »

☑️ Lots of base functions … plus some specific functions in OTB

❌ Software updates

Server
Heavy images processing
Use cases (3/3)

« I want to use OTB in an existing Python processing chain »

- Only a few specific functions
- Hard to install in a Python environment
- Hard to use with other Python libs (rasterio, xarray, etc.)
User satisfaction / use cases

Python processing chains with mix of libs

Pure OTB processing chains

Applications

Basic treatment
BandMath, ExtractROI, ConcatenateImages...

Specific processings
(calibration, orthorectification)

Meta-applications
(segmentation, classification)

User satisfaction / use cases

Python processing chains with mix of libs

Pure OTB processing chains

Applications

Basic treatment
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Specific processings
(calibration, orthorectification)

Meta-applications
(segmentation, classification)
A few conclusions from the survey

No need to maintain as many platforms (Linux / Windows ... very few mac users)
Binary packages / conda packages ... Few compilations from scratch

QGIS gain many users : QGIS interfaces can replace OTB gui
Drop Monteverdi

Python : favourite environment for developers

Applications : core OTB to identify (some low level applications, specific preprocessing applications, SAR applications)
Software audit: new ways to make data science

Jupyter notebooks / Jupyter hub virtual envs

Pip install

Lots of Python libs: gdal, numpy, sk-learn, scipy, (geo)pandas, etc.

New ways to deal with execution pipeline (dask..)

(...)

But a lot of tasks to tackle (satellite images reading, preprocessings, metadata, image registration / re-sampling, geometry/projection....)
Le “Why” de l’OTB

Nous vous proposons...

“Être la référence dans le traitement avancé d’images satellites”

Le NumPy de l’image satellite
Schéma de l’OTB actuel

**Thématiques couvertes**
- Pré-traitements imagerie optique (ortho, calibration)
- Filtres d’extraction de features
- Machine learning (classification pixellique, OBIA)
- Segmentation
- Traitements SAR
- Processing hyperspectral
- Détection de changements

**Plateformes & types de déploiements**

**Fondations**
- ITK

**Cœur**
- Filtres
- ML
- Applications
- Streaming

**API**
- CLI
- GUI
- Monteverdi
- QGIS
- Python
- C++

**Plugins**
- Remote Modules
- Remote
- Modules

**Profils utilisateurs**
- Utilisateur Python / scientifique
  - Traitement batch
  - Laptop > Serveur
  - Python
- Étude occasionnelle
  - Traitement 1 à quelques images
  - Laptop
  - QGIS
- Chaîne de traitement télédétection
  - Traitement images massif
  - Serveur > Cluster
  - C++ / Python

**Paquets binaires**
- Build complet
- Superbuild
- Conda
- Docker
Go toward an OTB « LTS »

OTB LTS:
- Lightest
- « Pip installable » \(\rightarrow\) what kind of installation process?
- Concentrate on a few OS
- Less interfaces, but more pythonic

- OTB « core »:
  - Preprocessing (calibration, orthorectification, re-sampling, etc.)
  - Main basic apps
  - SAR processing: specific to OTB / several processing chains
  - Segmentation / Machine learning / \(\rightarrow\) remote modules?

- Drop Monteverdi, QT GUI (replace by QGIS plugin)