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status of the initiative

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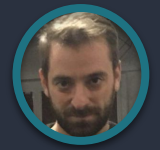
DORIAN (Diagnosis ORIented ANalysis)

DORIAN delivers a fast and reliable tool for the quantification of medical imaging to support the early and differential diagnosis of neurodegenerative disorders. It provides clinicians and researchers with state-of-the-art robust, rater-independent and reproducible quantitative biomarkers to better evaluate the β-amyloid load in brain tissue, complementing their ability to write an informed medical report and improve on the early detection and diagnosis of neurodegenerative diseases.

Dorian recent & next timepoints

> Meet in Italy 4 Lifesciences [Oct. 2019]
> Smartcup Regione Liguria | UNIGE StartCup [Oct. 2019]
> Premio Nazionale per l'innovazione [Nov. 2019]
> BIOGEN meeting [Feb. 2020]
> First business contract [Mar. 2020]
> Fondazione spin-off [May 2020]
> HoSession @ Nucl. Med. school in Neurology [Sep. 2021]
> HoSession @ EANM | Talk @ EADC [Dec. 2021]



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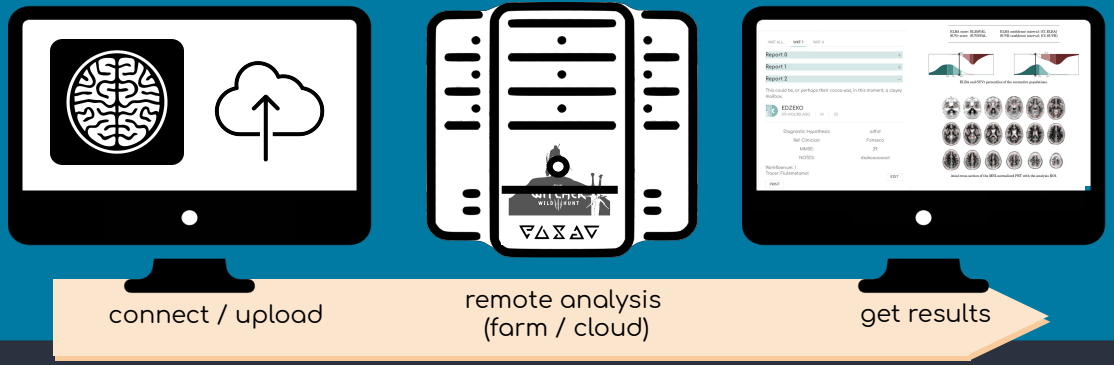
Dorian system

- Client app
- Back-end server
- Computing

(monitoring)



> Second opinion for **early diagnosis** of **Alzheimer' disease**

> **GDPR** compliant

> 20 min. / analysis

Desktop client

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Keys are generated inside client and handled / stored as SHA256 of SHA256

Credentials can be copied locally and exported

User

User Hospital/..

login

registration

desktop

Workflow selection

Metadata are always seen as cleartext inside client

Metadata are encrypted with AES key

metadata

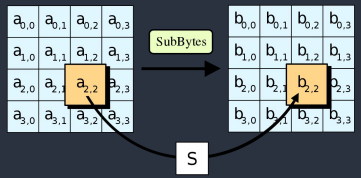
imaging

analysis

biomarker report

Report are saved locally / remotely, are searchable, editable and printable

user privKey
user pubKey



AES key

- recover lost data
- update certificates

“master” pubKey

cloud/farm

authentication

Getting ready for dockerized submission

GE-INFN farm
~150 cpu cores
2Gb RAM / core
10Tb shared storage

Desktop client

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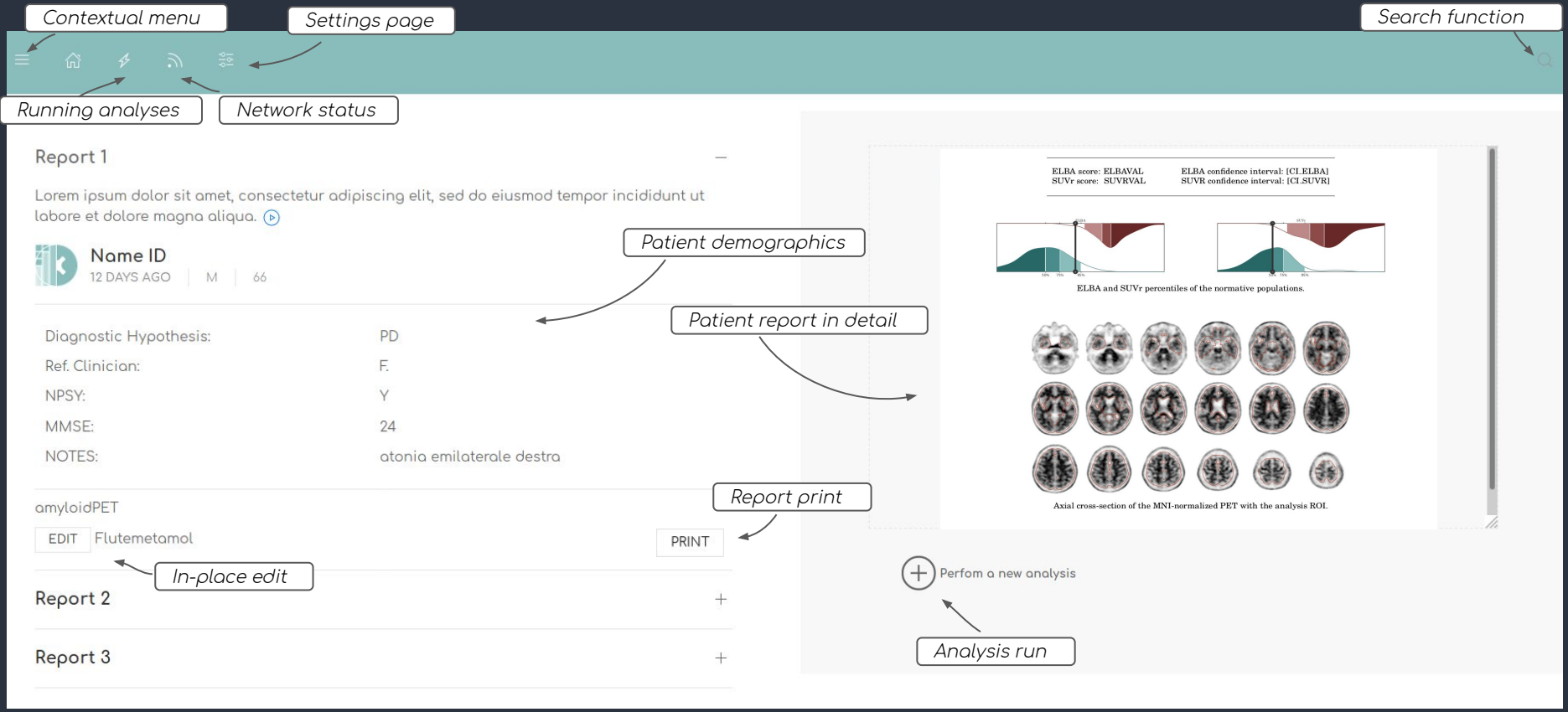


Collaboration with AIMN

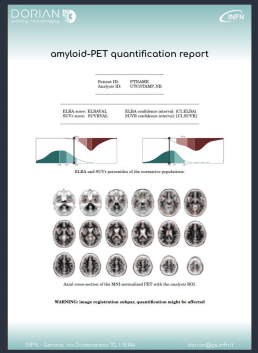
DORIAN - BRAIN SOFTWARE PROJECT

→ Host (& maintain) and give access to multiple research tools (amyloid-PET, FDG-PET, DATSPECT, MRI?)

→ Collect metadata / images into the first italian (normative)-database of amyloid PET images

→ Minimum image quality requirements (harmonization of acq. protocols)

→ Results visualization discussion



Metadata for this exam

Patient Name	
Birth Date	27/01/2020
Education	0..30
Patient Gender	○ F ○ M ◉ U
Initial subjective symptomatology	☐ Memory ☐ Language ☐ Visuospatial ☐ Executive ☐ Apraxy ☐ Attention ☑ Other (specify)
Pre-PET clinical suspicion	☐ MCI ☐ PossAD ☐ ProbAD (85%+) ☐ FTLD ☐ VAD ☐ DLB ☑ Other (non-specified dementia)
Comorbidity	☐ Diabetes ☐ Cardiopathy ☐ Arterious hypertension ☐ Major internal organ disease ☐ Depression ☑ Non-specified
Evidence of atrophy (MRI)	○ Not avail. ○ No ◉ Yes (specify)
Evidence of hypometaboism (FDGPET)	◉ Not avail. ○ No ○ Yes
MMSE	0..30
Amyloid-PET tracer	Florbetapir
Notes	...

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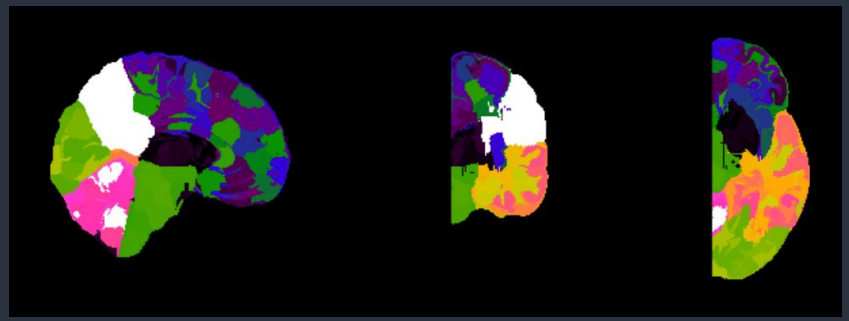

“Standard” atlas - cortical
25 contralateral + 1 regions

“Clinical” atlas - most explored in clinical reading

label	region
1	frontal (no basal area)
2	occipital
3	posterior parietal
4	temporal-lateral (no mesial-temporal)
5	striatus
6	thalamus
7	precuneus + posterior cingulate cortex

Data-driven atlas

IN PROGRESS..

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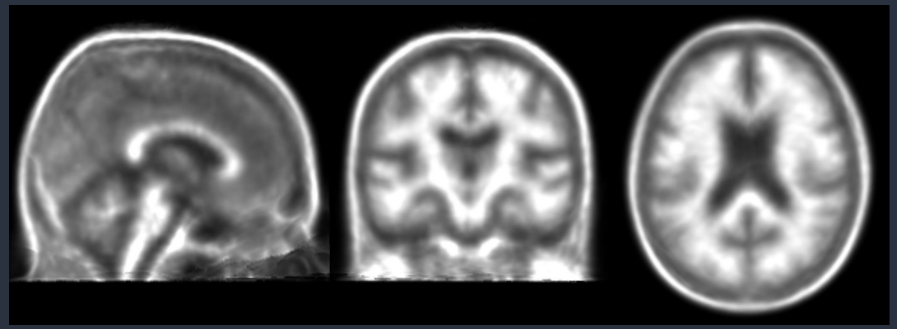
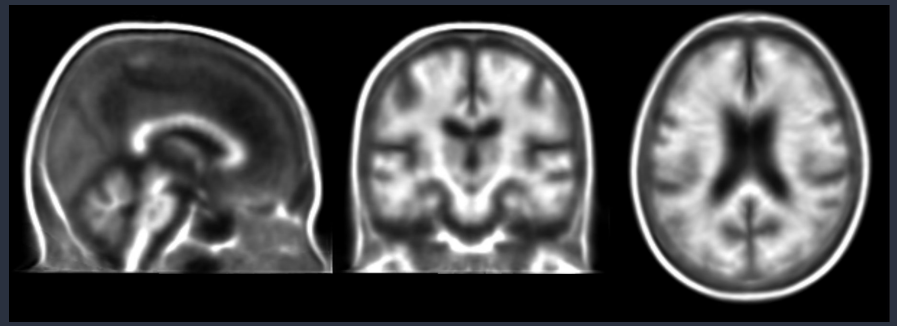
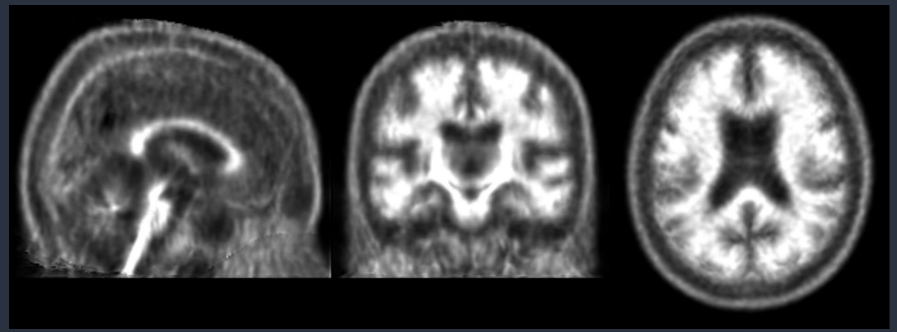


florbetaben



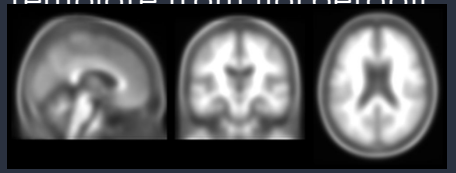
florbetapir



flutemetamol

A template for each amyloid (^{18}F) tracer, built from EADC PET-2 initiative data
(~50 amyloid neg / pos).

ANTS iterative registration (*multivariate template construction*, https://www.ncbi.nlm.nih.gov/pubmed/20851191). Registered on MNI by ADNI template from florbetapir

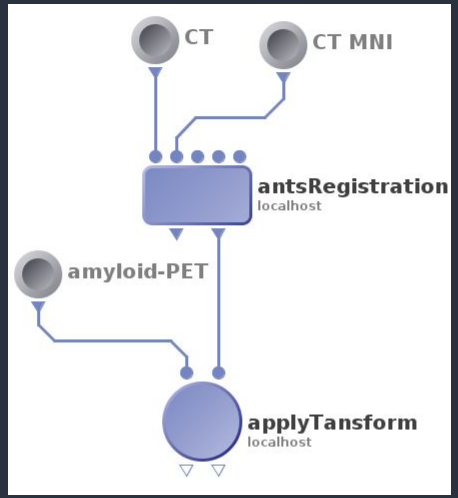


→ will be submitted as a paper

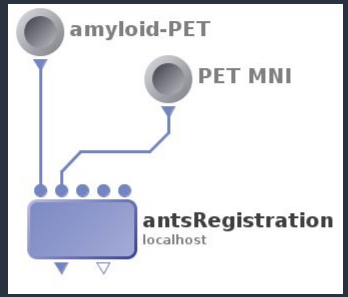
Registration & quality check

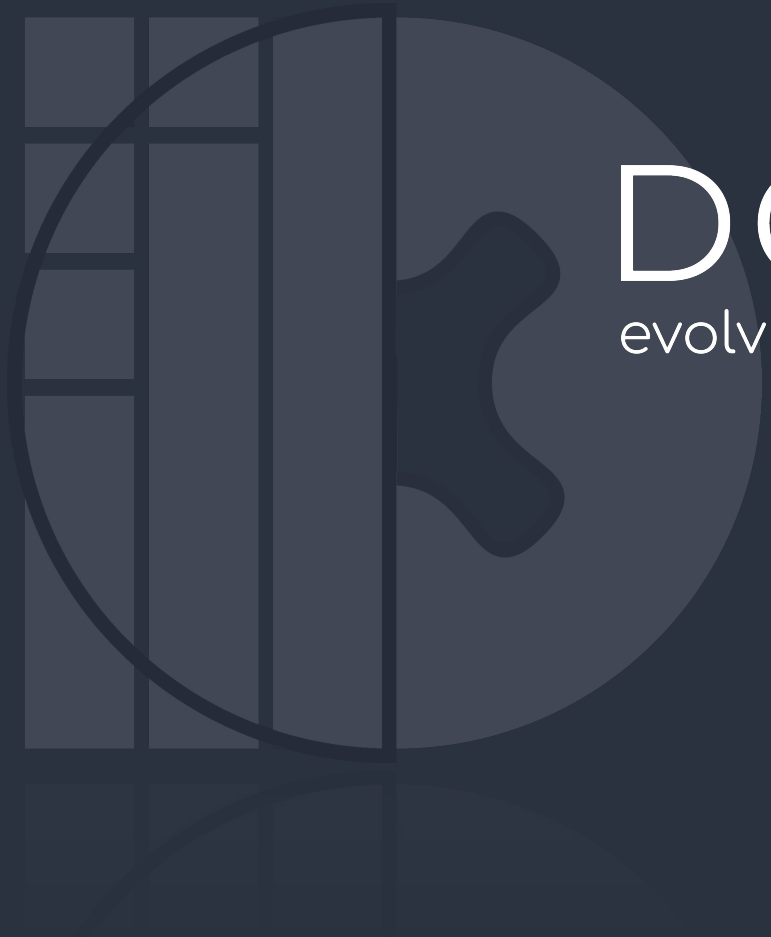
→ ANTS: PET / PET + CT (antsRegistrationSyN), CT on CT template (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3376197/) and transform applied to corresponding PET

1. Multiscale registration
2. Rigid + affine
3. MNI atlases / parcellations warped to target PET



→ Convolutional network classifier trained on good / bad registration





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Thank you