Artificial Intelligence in Medicine

A. Chincarini
INFN-GE

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Flavio Nobili, Matteo Pardini, Silvia Morbelli,
Dario Arnaldi, Matteo Bauckneht, Matteo Grazzini

The genoa group
is a multidisciplinary
research team from INFN &
IRCCS S. Martino (GE)

Andrea Chincarini, Francesco Sensi, Enrico Peira,
Nicola Alchera, Gloria Pedemonte

+AIMN, EANM, EADC,
PD univ Hosp, Geneve HUG, ...

Activities overview 2019/20

Nuclear Medicine Neuroimaging
data analysis towards novel biomarkers

Predictive models
hypothesis-driven associations for precision medicine

Radiomics & ML
methodological developments for better dimensionality reduction

The EADC is a fully functional network of European centres of excellence working in the field of Alzheimer's Disease.
It provides a setting in which to increase the scientific understanding of and to develop ways to prevent, delay, slow, or ameliorate the primary and secondary symptoms of Alzheimer's Disease.

22 countries
>50 centers

EADC PET 2.0 project update

OSPEDALE POLICLINICO SAN MARTINO
Sistema Sanitario Regione Liguria

INFN

UNIVERSITÀ DEGLI STUDI DI GENOVA

THE EADC GROUP OF GENOA

Andrea Chincarini, Silvia Morbelli, Matteo Pardini, Enrico Peira, Flavio Nobili

EADC
European Alzheimer's Disease Consortium

5 years into the EADC project

> Neuroimage Clin. 2019;23:101846. doi: 10.1016/j.nicl.2019.101846. Epub 2019 May 4.

Semi-quantification and grading of amyloid PET: A project of the European Alzheimer's Disease Consortium (EADC)

> Eur J Nucl Med Mol Imaging. 2020 Aug;47(9):2175-2185. doi: 10.1007/s00259-020-04689-y. Epub 2020 Jan 25.

A kinetics-based approach to amyloid PET semi-quantification

https://pubmed.ncbi.nlm.nih.gov/31077984/
https://pubmed.ncbi.nlm.nih.gov/31982991/

the amyloid PET project

- highly diversified, naturalistic dataset
- clinical baseline & follow-up
- possibility to tap into long term clinical outcome through EADC partners
- availability, easy-to-use XNAT implementation of the DB
- all available tracers are represented (although with unbalanced sample size)

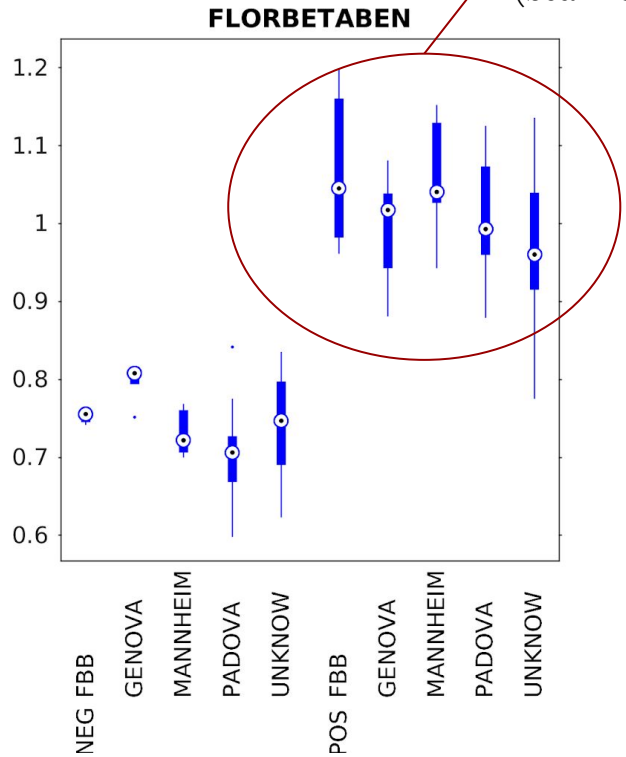
- ~ 700 amyloid scans + NPSY + >1y f-up
- data sparsity in 2y follow-up, MRI

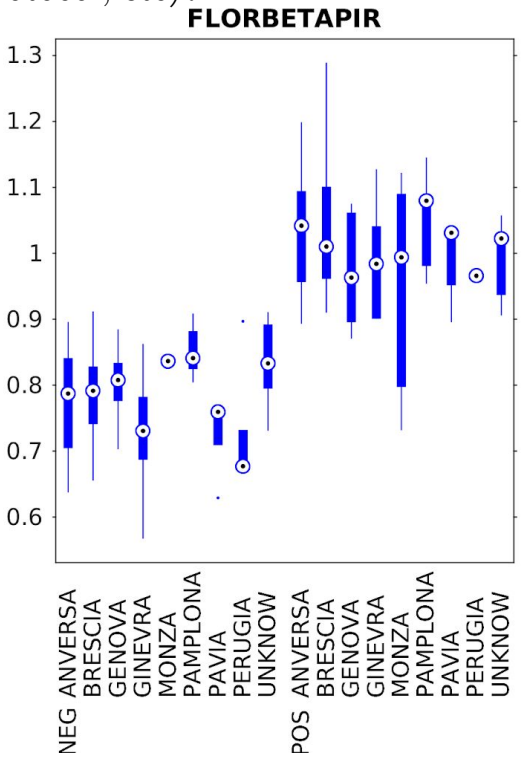
Please talk to us and submit analysis proposals!

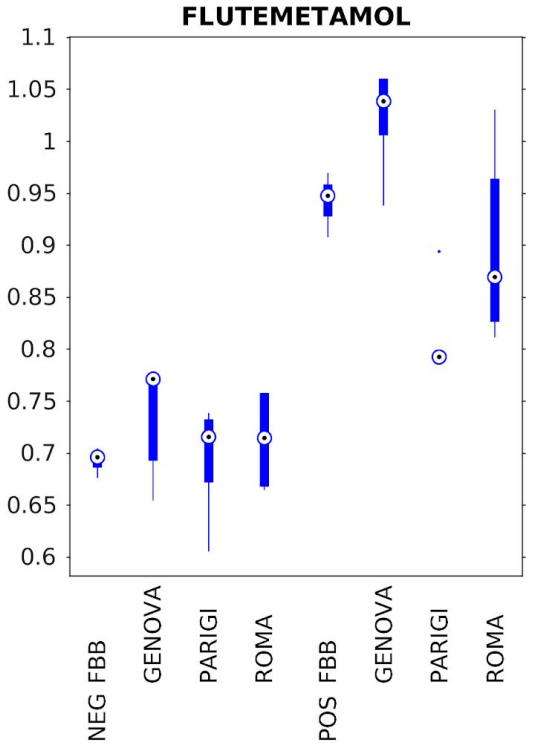
This EADC dataset is a **great research opportunity.**

data harmonization study: quantity vs. quality

what are these differences due to? can they be ascribed to technical issues alone (scanner, protocol, etc)?





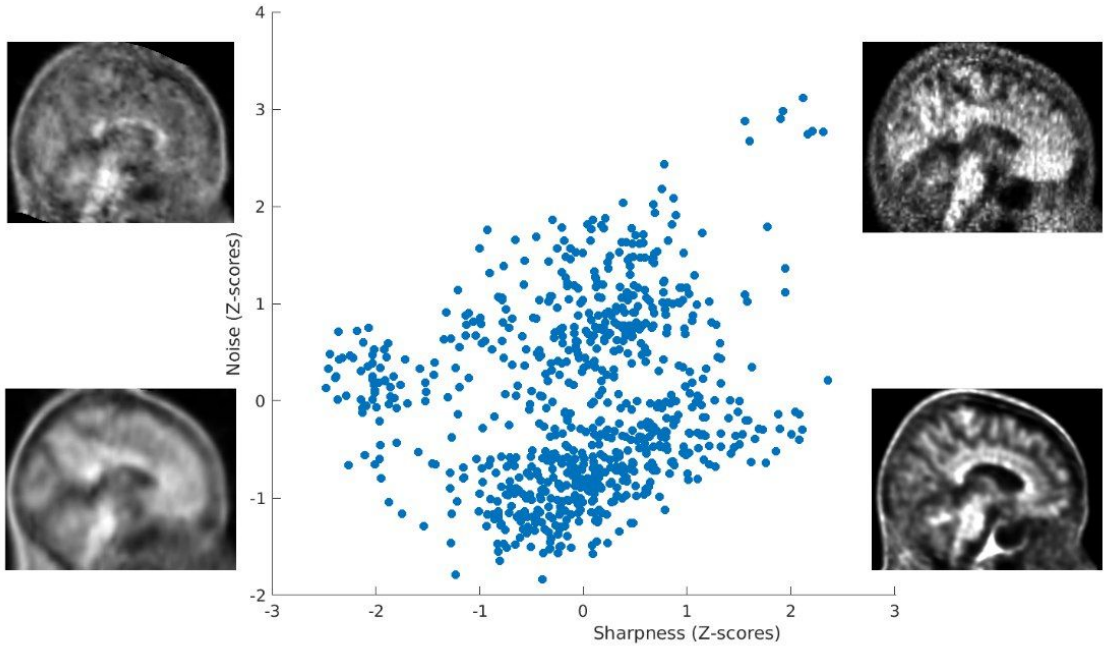


data harmonization study: quantity vs. quality

1. Quality Metrics [QM] validated by visual methods. NM phys. blindly rated sharpness, noise level, artefacts, ...

2. QM are naturally linked to scanner type, acquisition & reconstruction protocols.

3. QM are independent on positivity, gender, age & tracer.



data harmonization study: quantity vs. quality

expected results: ***image-driven correction on semi-quantification to boost robustness; heterogeneous data aggregation with center correction based on clinics only; weight of clinical vs technical heterogeneity***

thanks to the QM characteristics, we can decouple the weight of clinical vs scan/acq prot. to explain the effect of heterogeneous data

Prel. results:

Because the quality correction is generally less dramatic on the data distribution, we conclude that the patient heterogeneity is the most likely cause of center-driven bias. Prel. analyses on NPSY data confirm this hypothesis. Hence, the a-posteriori correction for center using it as covariate - assuming the effect of the center to stem from technical grounds - may lead to an overcompensation and should not be applied to retrospective datasets.