

Updated public CenTauR pipelines to measure CenTauR, CenTauR_Z, and SUVR tau PET units

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BACKGROUND

The CenTauR project [1] provides universal measurement scales and regions-of-interest (ROIs) for standardizing tau PET quantification units across tracers and pipelines.

In 2024, we released two fully automated software pipelines on GAAIN.

- 1) SPM8 “Centiloid Standard”, standard for old CenTauR_Z units.
- 2) SPM12 + MCALT: A more modern approach that quantifies images in MRI space incorporating SPM12 tissue-class segmentations and the Mayo Clinic Adult Lifespan Template (MCALT), new standard for new CenTauR units.

These compute numeric CenTauR_Z and CenTauR SUVR values for input pairs of T1-w MRI and late-uptake summed tau PET NIfTI files from 6 different tracers and 5 different CenTauR regions of interest (ROIs).

These pipelines are pre-calibrated to CenTauR unit scales using the measurements from the canonical SPM8 pipeline on the same images using Deming linear regression (Figure 1).

TRACERS

The 6 currently supported tau PET tracers are:

- [18F] Flortaucipir (AV-1451)
- [18F] MK-6240
- [18F] RO948
- [18F] GTP1
- [18F] PI2620
- [18F] PM-PBB3

REGIONS

The 6 CenTauR ROIs (Figure 2) [1]:

Universal (global): constructed by the CenTauR project from the intersection of six tracer-specific masks. The additional 4 subregions below were defined within the universal mask.

MesialTemporal: entorhinal, parahippocampus and amygdala

MetaTemporal: entorhinal, parahippocampus, amygdala, fusiform, inferior and middle temporal gyri

TemporoParietal: bankssts, cuneus, inferior-superior parietal, inferior-middle-superior temporal, isthmuscingulate, lateral occipital, lingal, posterior cingulate, precuneus and superior marginal

Frontal: caudate middle frontal, precentral, rostral middle frontal, superior frontal

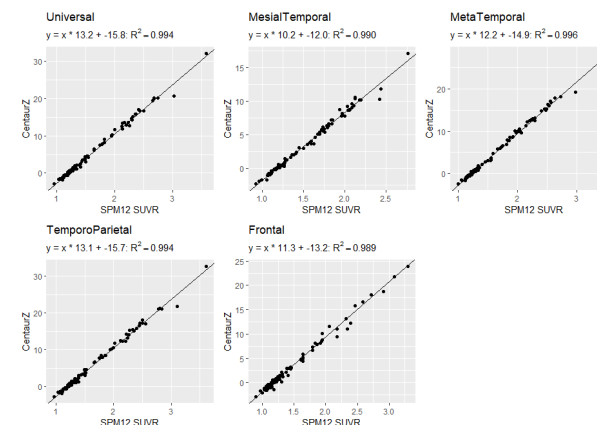
DATASET

We also released a dataset for calibrating arbitrary tau PET SUVR pipelines to CenTauR units:

100 participants from the Mayo Clinic Study of Aging (MCSA) and ADRC with paired 3T T1-weighted MRI and Flortaucipir (FTP) PET, including:

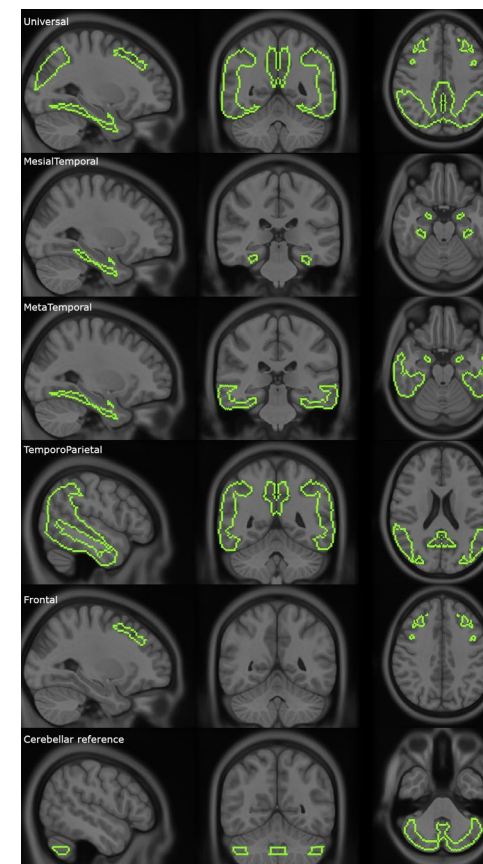
- 50 participants with clinical dementia with AD (Confirmed A+ with PiB) with exclusively amnesic phenotypes
- 50 age-and-sex-matched A- cognitively unimpaired participants

FIG. 1: CALIBRATION



Calibration of our proposed SPM12-based pipeline to CenTauR_Z units from the SPM8 pipeline, using our FTP calibration dataset. Agreements were very high.

FIG. 2: REGIONS



CenTauR ROIs, visualized using fsleyes on the MNI/ICBM152 nonlinear template.

UPDATES

The CenTauR group will soon release new calibration (slope and intercept) equations for “CenTauR” units, determined using their Joint Propagation Model (JPM) [2].

Unlike CenTauR_Z, CenTauR units are designed to allow quantitative comparison of continuous values across tracers at all levels of pathology, analogous to the typical usage of Centiloid units for amyloid PET.

With this release, the SPM12-based pipeline will be adopted as the standard pipeline with CenTauR units, which will deprecate both the SPM5-based pipeline and the previous CenTauR_Z units.

The publication (with the final equations) is currently under peer review. We will update these public software pipelines on GAAIN upon its acceptance.

CONCLUSIONS

These tools will facilitate the development and calibration of alternative pipelines for measuring in universal CenTauR and CenTauR_Z units.



All downloads are available at <https://www.gaain.org/centaur-project>

REFERENCES

1. Villemagne et al., CenTauR: Toward a universal scale and masks for standardizing tau imaging studies. Alz & Dem: DADM, 2023
2. Leuzy et al., Harmonizing tau positron emission tomography in Alzheimer's disease: The CenTauR scale and the joint propagation model, Alz & Dem, 2024.