**Overview**

The Brainstem Navigator toolkit is a collection of *in-vivo* brainstem and diencephalic nuclei atlas labels, MRI templates and documentation. The atlas is in stereotactic space and includes gray matter brainstem and diencephalic regions involved in arousal/sleep, autonomic, motor, sensory and limbic function. The atlas labels of brainstem and diencephalic nuclei were created by semi-automatic and manual segmentations of multi-contrast MRI *of living adult humans* at 7 Tesla (Bianciardi et al., 2015; 2018; Singh et al., 2020; 2021; García-Gomar et al., 2019; 2021). This package has been made available to enable researchers to identify the location of brainstem nuclei in both conventional and advanced MRI (e.g. 3 Tesla, 7 Tesla).

Note that this package does not contain the set of software needed to precisely apply the atlas to MRI of individual subjects. Future releases might include scripts with alignment routines of the atlas labels to MRI data.

**Components**

* 1/2a.BrainstemNucleiAtlas\_IIT/MNI: Brainstem nuclei atlas labels (1 mm isotropic resolution) in Illinois Institute of Technology (IIT, matrix: 256 x 256 x 256)/Montreal Neurological Institute (MNI, matrix: 182 x 218 x 182) stereotactic space
  + labels\_probabilistic: probabilistic labels (range: 0-1)
    - 31 nuclei labels (8 medial/23 bilateral), and 11 subnuclei labels (bilateral) for a total of 76 labels (see ListofNuclei.docx under Documentation)
  + labels\_thresholded\_binary\_0.35: Probabilistic labels thresholded at 35 % and binarized (values: 0 or 1)
    - 76 nuclei labels
  + labels\_thresholded\_probabilistic\_0.35: Probabilistic labels thresholded at 35 % (range: 0.35-1)
    - 76 nuclei labels
* 1/2b.DiencephalicNucleiAtlas\_IIT/MNI: Diencephalic nuclei atlas labels (1 mm isotropic resolution) in Illinois Institute of Technology (IIT)/Montreal Neurological Institute (MNI) stereotactic space
  + labels\_probabilistic: probabilistic labels (range: 0-1)
    - 3 nuclei labels (bilateral), and 2 subnuclei labels (bilateral) for a total of 10 labels (see ListofNuclei.docx under Documentation)
  + labels\_thresholded\_binary\_0.35: Probabilistic labels thresholded at 35 % and binarized (values: 0 or 1)
    - 10 nuclei labels
  + labels\_thresholded\_probabilistic\_0.35: Probabilistic labels thresholded at 35 % (range: 0.35-1)
    - 10 nuclei labels
* 1/2c.Templates\_IIT/MNI: Templates (1 mm isotropic resolution) in IIT and MNI space that can be used as underlay for nuclei display or as reference images for coregistration purposes
  + images\_BIlab:
    - FA.nii.gz, T2w.nii.gz: group average diffusion fractional anisotropy map and T2-weighted image obtained at 7 Tesla (Bianciardi et al., 2015). Partial coverage of the brain (e.g. no temporal lobes).
  + images\_IIT/MNI:
    - InstructionsToDownload\_IIT/MNItemplates: Instructions to download FA and T2-weighted templates in IIT space (1 mm isotropic resolution, matrix 256 x 256 x 256) or T1-weighted MRI template in MNI space (1 mm isotropic resolution, matrix 182 x 218 x 182 and other versions)
* Documentation
  + Copyright.txt
  + ListofNuclei.docx
  + Readme.docx

**References**

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**Updates**

For news about updates also check our lab webpage:

<https://brainstemimaginglab.martinos.org/>