

# BrainPainter: A software for the visualisation of brain structures, biomarkers and associated pathological processes

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# Current brain visualisation software has several limitations

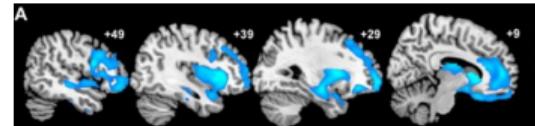
✗ requires specialised input files



✗ cannot automate image generation



✗ volumetric images hard to visualise

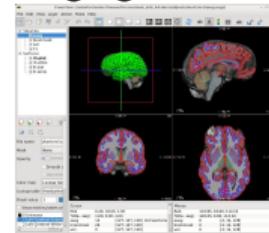


# Aim: Develop a brain visualisation software that overcomes such limitations

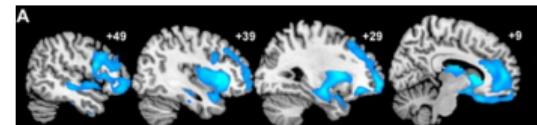
✗ requires specialised input files



✗ cannot be automated for image generation



✗ volumetric images hard to visualise



✓ generic and simple input files

- generated by e.g. spreadsheet
- list of colours, one for each ROI

✓ can automate image generation



✓ brain surface easy to visualise

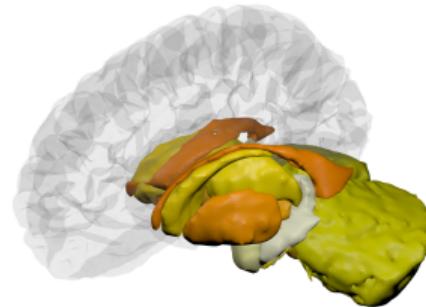


## Further motivation

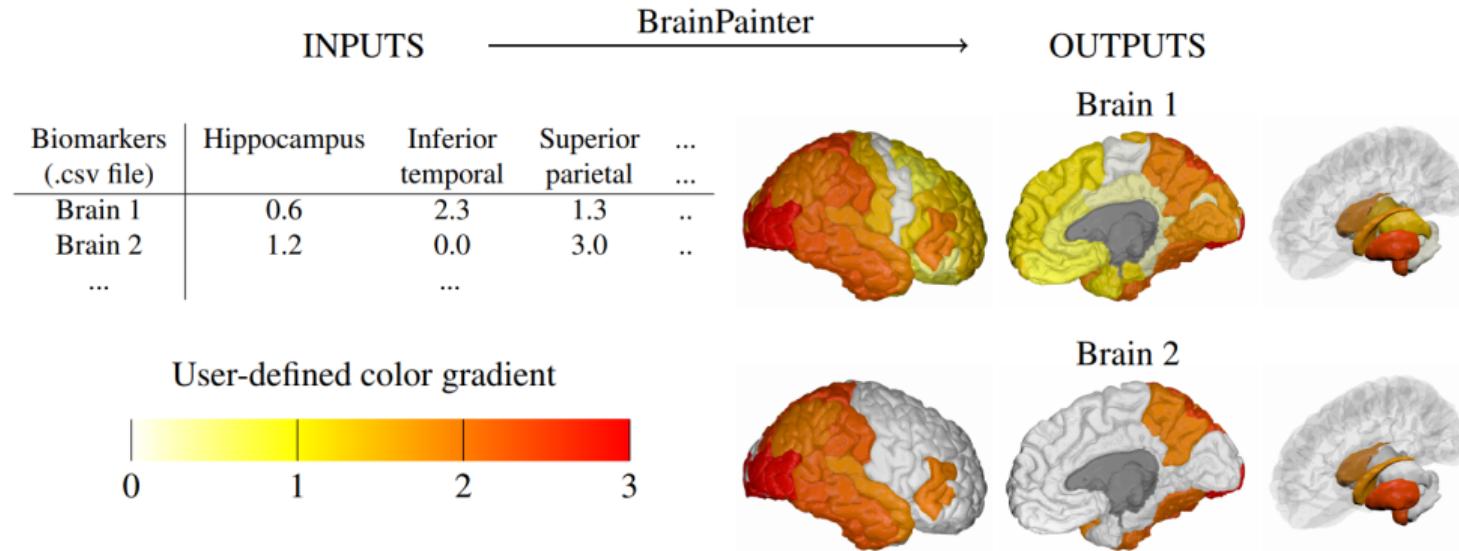
- simple input files → no need to read specifications and integrate with FreeSurfer, SPM, etc ..
- automated image generation → create movies showing e.g. progression of brain pathology



- surface representation → easy visualisation of subcortical structures
  - not possible in FreeSurfer



# BrainPainter: How it works



- Uses Blender to generate images from pre-defined templates

# BrainPainter is customisable

- supports three atlases:

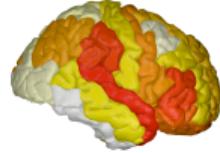
Desikan-Killiany



Destrieux



Tourville



- supports three pre-defined viewpoints

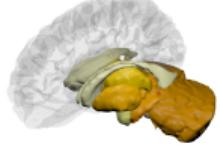
Outer Cortical



Inner Cortical



Subcortical



- supports different surfaces

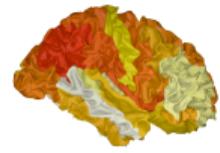
pial



inflated

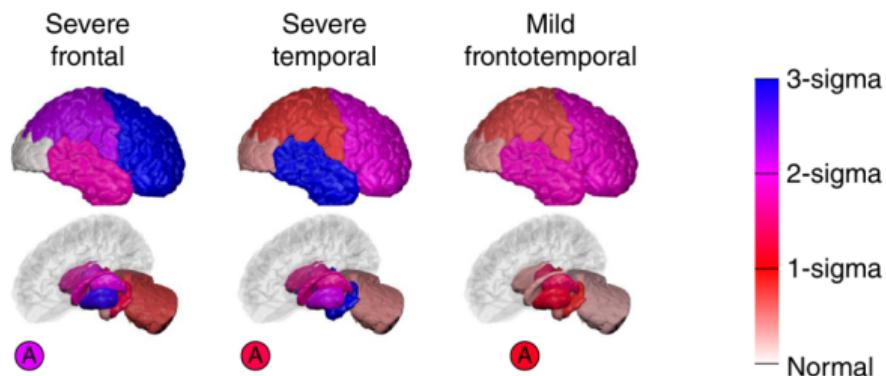


white matter



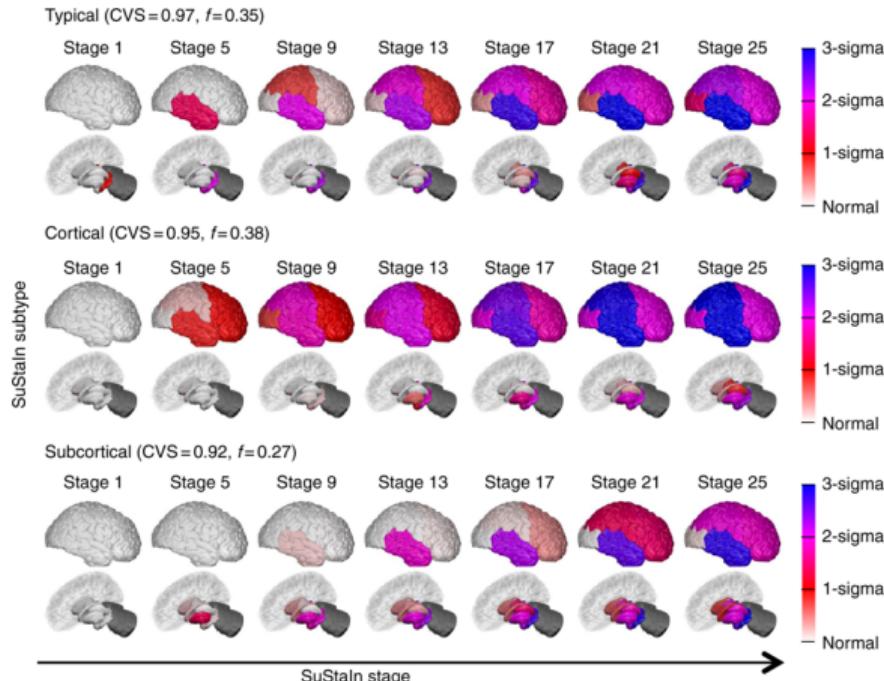
- user-defined colour gradient
- resolution
- background color
- ...

## Example Use 1: Visualise degree of atrophy in Alzheimer's disease



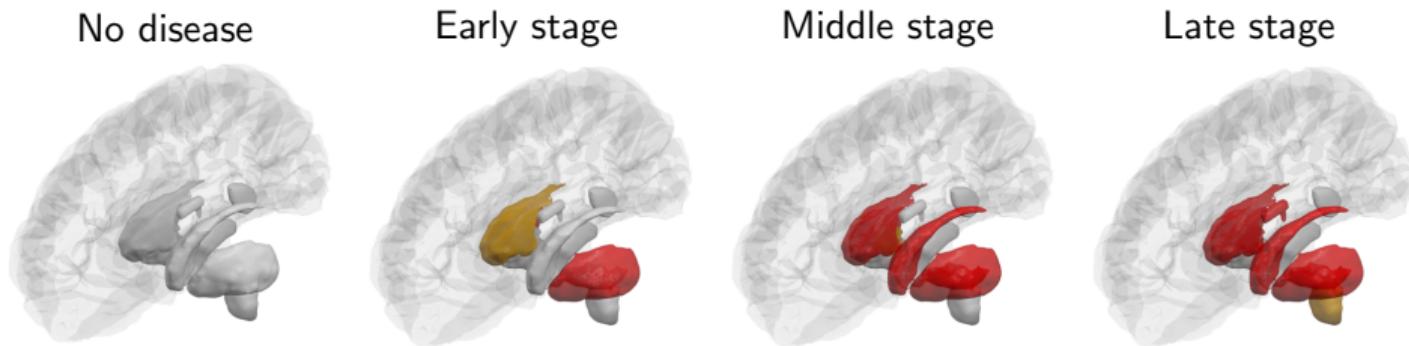
Young et al, Nature Comms., 2018

## Example Use 2: Visualise temporal progression of atrophy in Alzheimer's subtypes



Young et al, Nature Comms., 2018

## Example Use 3: Visualise subcortical atrophy in Huntington's disease



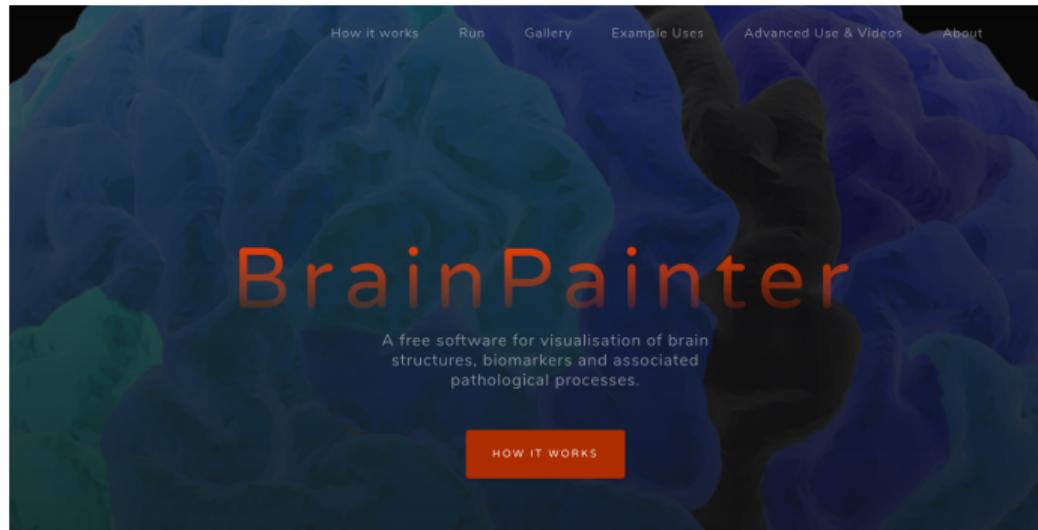
Wijeratne et al., Ann. Clin. Neurol., 2018

## Example Use 4: Animate the progression of amyloid spread in Alzheimer's disease

Garbarino and Lorenzi, IPMI, 2019

## BrainPainter runs straight from the browser - Live Demo

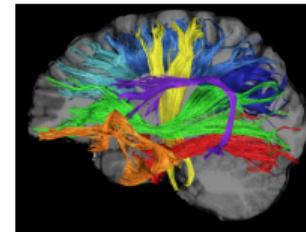
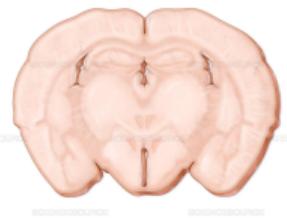
- <https://brainpainter.csail.mit.edu/>



- can also run from source: <https://github.com/mrazvan22/brain-coloring>
  - requires no installation, run straight from docker container

## Future work

- improve robustness of website, add error messages for wrong input
- support for other brain templates: e.g. infants, mice
- more atlases: e.g. Hammers
- other visualisations: e.g. white-matter tracts



# Acknowledgements

## Collaborators

Polina Golland



Daniel Alexander



Arman Eshaghi



- Alexandra Young
- Sara Garbarino
- Peter Wijeratne
- ...

## Funders



Pioneering research  
and skills

Anders Winkler for the 3D brain  
templates

- <https://brainder.org/research/brain-for-blender/>