Facilitating the reuse of brain imaging and clinical data from completed studies across the life course: the Brain Images of Normal Subjects (BRAINS) Imagebank.

Dealing with Data Conference
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Background:

- There is a global drive to increase value and reduce waste in research by archiving and sharing of research data.
- This is critical in imaging research and therefore a great demand in the use of imagebanks.
- Currently, nine repositories exist for brain images with 944 normal subjects aged ≥60 years in total, but only 98 subjects are openly accessible.
- The Brain Images of Normal Subjects (BRAINS) Imagebank:
  - an integrated repository project being developed by a team based in the Edinburgh University.
  - provides detailed brain imaging data across the normal human life-course from completed research projects: MRI sequences linked with related phenotypical, demographic and cognitive measures, without diagnosed disease.
Framework:

Original Data Area
- Original images
- Original textual data

Staging Area
- Light de-identified DICOM
- Database with de-identified textual data and DICOM headers
- Pre-processing: cleaning, mapping and harmonisation of textual data

Public Area
- Strongly de-identified DICOM and textual data hosted in XNAT
- Access-controlled web interface via REST data load
Ethics & Governance:

- Ethical approval was obtained from Caldicott Guardian which was described as “an exemplar for data sharing”.
- User account registration and validation.
- Data access request and usage agreement.
- Data contribution agreement.

Steering Committee:
- principal investigators of the original studies;
- experts in ethics, governance and law;
- two lay representatives or other relevant persons and/or bodies.
This is an early beta/ test release of BRAINS imagebank. This means:

- We are not currently accepting requests for data. The data request process is for illustrative purposes only.
- Availability of the website during the beta is not guaranteed.

For further information see the Contact Us page.

The BRAINS imagabnk is collating anonymised images and associated clinical data from 'normal' individuals at all ages (from prenatal to old age). These have been collected from participants in several healthy volunteer studies. BRAINS only includes information that the original study team have provided: additional data may have been collected (see Data Provenance for full details of the primary studies).

The BRAINS team based in the University of Edinburgh hosts the data, on behalf of, and under the governance of, a steering committee which comprises: principal investigators of the original studies (including experts in obstetrics, paediatrics, geriatrics, neuromaging, psychology); experts in ethics, governance and law, and two lay representatives (the ‘BRAINS Steering Committee’). All applications for data use will be reviewed and approved (or not) by the BRAINS Steering Committee. BRAINS provides a resource that offers numerous opportunities to reuse already collected data for studies across the life span with no additional data acquisition cost required. Examples of potential studies include:

- As a reference atlas, for interpretation of brain images in clinical diagnosis, such as having access to healthy subject reference images and linked data closely matched to a patient’s scan, to improve diagnostic accuracy (Farrell, C. et al., 2009)
- For the biomedical research community to develop and test new methods, e.g. machine learning, to detect brain pathology and associated clinical manifestations such as early markers of neurodevelopmental impairment or dementia, and precise estimates of disease risk and developmental ranked atlases across the life-course (Dickie, D.A., et al., 2013).

BRAINS atlases are based on calculated distributions of brain structure rather than parametric estimates. These will be used to support image analysis research and clinical reporting of brain images.

This image shows that the appearance of brain structure in a group of subjects diagnosed with Alzheimer’s disease (AD) versus a normal control group changes based on the method used. The image on the left shows voxel-wise parametric effect size and the image on the right shows voxel-wise NONParametric effect size (red areas = higher effect sizes > 0.75). If the voxel-wise data were Normally distributed then the parametric effect size would equal the NONparametric effect size. However, these voxel distributions are not Normally distributed.
Status:

- Currently, 584 subjects (average age: 61.3, SD: 15.7, range: 19 - 81) from projects in 3 centres.

<table>
<thead>
<tr>
<th>Study Name</th>
<th>Centre</th>
<th>N</th>
<th>T</th>
<th>Age years</th>
<th>Sequences and (sequences to be added)</th>
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<td>2.0</td>
<td>75-81</td>
<td>T2, T1, T2*, FLAIR</td>
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<td>1.0/1.5</td>
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<td>20-60</td>
<td>T2, T1</td>
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<tr>
<td>Amygdala 2</td>
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<td>19-60</td>
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<tr>
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</tbody>
</table>

- A further 2119 existing sets of data planned for immediate inclusion.
Conclusion & ongoing work:

- BRAINS provides a resource that offers numerous opportunities to reuse already collected data for studies across the life span with no additional data acquisition cost required.

- It is the first imagebank that provides detailed brain imaging with associated clinical linked data across the normal human life-course.

- Continue to process and add more data from studies of different populations and geographical locations.

- To produce brain templates for clinical research.

- Acting as a Dementia Platform UK cohort node.
Contact:

- Please visit, use it and let us know:

  Website: [www.brainsimagebank.ac.uk](http://www.brainsimagebank.ac.uk)

  Email: [brains@ed.ac.uk](mailto:brains@ed.ac.uk)
References:

