A neuroimaging dataset of brain tumour patients: metadata

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Context

The data presented here were acquired in the context of a pilot study looking at the feasibility and utility of functional magnetic resonance imaging (fMRI) for brain tumour surgical planning.

Data, data format and file structure

Data from 22 patients are in the repository. Each patient is identified with a unique set of random strings (the ID and sub-ID) for which we (the authors) have kept a reversal identifier, if the need to contact a given patient is identified in future. Patients' data are organized in tar files with the subject ID. Each tar file contains a folder with the sub-ID that relates to the examination date and contains the imaging data, stored into separate zip files. The data into those zip file are in the standard Nifti format (.nii). The original DICOM files from the scanner were stripped from personal information and then converted using dcm2nii. The structural images (T1 and T2) were also defaced using SPM12.

Along with this document, there is an excel file (metadata.xlsx) which contains additional metadata. The first sheet 'MRI_DES_data' (also available as NRI_DES_data.csv) lists the patients' ID/subID, pathology, tumour location, estimates of gray/white/csf and tumour volumes, if direct electrical stimulation was performed with its (global) outcome (see below non-imaging data), and the different type of imaging data acquired (T1, T2, fMRI, DTI). The second sheet 'clinical_data' (also available as 'clinical_data.csv) lists patients' demographic, handedness and scores to various clinical tests (see below non-imaging data). In both sheets, missing value/information are highlighted by colouring the cell with 'nil' as content.

Imaging Data

Data were acquired on a GE Signa HDxt 1.5 T scanner with an 8 channel phased-array head coil at the Brain Research Imaging Centre, University of Edinburgh, UK. In most patients (but see the excel file - metadata.xlsx) the following data were acquired

- T1 (coronal acquisition, field-of-view 256 × 256 mm, slice thickness 1.3 mm, 156 slices, acquisition matrix 256 × 256, TR = 10s, TE = 4 s, and inversion time (TI) 500 ms)
- T2 (spin-echo echo-planar imaging volumes with a filed of view 256 × 256 mm, slice thickness 2 mm, 72 axial slices, acquisition matrix 128 × 128, TR = 16.5 s, and TE = 98 ms)
- Diffusion Tensor Imaging (64 directions, b = 1000 s/mm^2; plus seven T2-weighted (b = 0 s/mm^2 single-shot spin-echo echo-planar imaging volumes with a filed of view 256 × 256 mm, slice thickness 2 mm, 72 axial slices, acquisition matrix 128 × 128, TR = 16.5 s, and TE = 98 ms)
- Functional MRI (single-shot gradient-echo echo-planar imaging sequence with a field-of-view 256 × 256 mm, slice thickness 4 mm, 30 slices per volume, interleaved slices order, acquisition matrix 64 × 64, and TR = 2.5 s, flip angle = 90 degrees, and echo time 50 ms)

Functional imaging data consisted (depending on patients) on one motor run, one word repetition run (mapping of Wernicke area), one verb generation run (mapping of Broca area and Supplementary Motor Area), and one resting state run. The details of the sequences are identical to the data obtained in control subjects used to validate the protocol and can be found in 'A test-retest fMRI dataset for motor, language and spatial attention functions' by Gorgolewski et al. GigaScience, 2, 6.

(1) overt word repetition task (block design alternating repetition with rest): 76 volumes with sparse sampling (effective TR = 5 s, real TR = 2.5 s), 4 dummy scans at start, block durations 30 sec, block_onsets = [4 16 28 40 52 64];

(2) covert verb generation task (block design alternating period in which patients have to mentally generate verbs associated to visually presented words vs rest during which noise (matching the amplitude spectrum of words) is presented and subjects have nothing to do): 173 volumes, 4 dummy scans at start, block durations 30 sec, block_onsets = [0 24 48 72 96 120 144];

(3) motor task (block design alternating finger tapping, foot flexing, mouth putting): 184 volumes, 4 dummy scans at start, block durations 15 sec, block onsets (in scans) finger_onsets = [0 36 72 108 144]; foot_onsets = [12 48 84 120 156]; lips_onsets = [24 60 96 132 168];

In addition to these raw data, we made available tissue classes: gray matter, white matter, csf and tumour with oedema in subject space. To generate these images, a mask of the tumour and oedema was generated semi-automatically using MRIcron 3D fill tool on the T1 and T2 images (http://www.mccauslandcenter.sc.edu/mricro/mricron/). This mask was then warped into standard space by estimating deformation form the T1 and T2 images (old segment in SPM12) which allowed to create a new a priori tissue class. Data were then segmented (new segment in SPM12) using the standard priors from the MNI template, augmented by the new tumour class. This resulted into probabilistic tissue classes that we make here available, along with the deformation filed to normalize data if needed (y_*.nii file).

Non-Imaging Data

Direct Electrical Stimulation (DES) was performed in most patients. This procedure gives different outcomes depending on the areas stimulated. When DES was performed in the motor region, a positive results indicates that the stimulation induced movements while when DES was performed in the language (Wernicke / Broca) regions this indicates either speech impairment or arrest. Along with the imaging data, there is a DES.zip file that contains pictures taken during surgery.

Clinical scores to various standardized tests were obtained pre- and post- surgery in most patients. Those test allow to judge changes in performances in motor and cognitive functions. The tests used were the National Adult Reading Test (NART), the Rey Adult Verbal learning test (RAVLT), the trail making test (TMT), the nine hole peg test (9HPT), a 10 meters walk, the controlled oral word association test (COWAT) and the Williams delayed recall test (WDRT).