Finding related functional neuroimaging volumes

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Introduction

Identification of related research in functional neuroimaging can be done, e.g., by searching in bibliographic databases such as Pubmed, browsing “table of contents” of scientific journals or searching BrainMap [1] with, e.g., behavioral or location criteria. Here we describe a new method based on activation volumes in 3D Talairach space. Usual visual-based and content-based image retrieval systems extract features such as color and textures [2], whereas we solely rely on voxel-similarity measures. Our method and a prototype are also described in [3]. Image-based searching was also suggested in [4].

Method

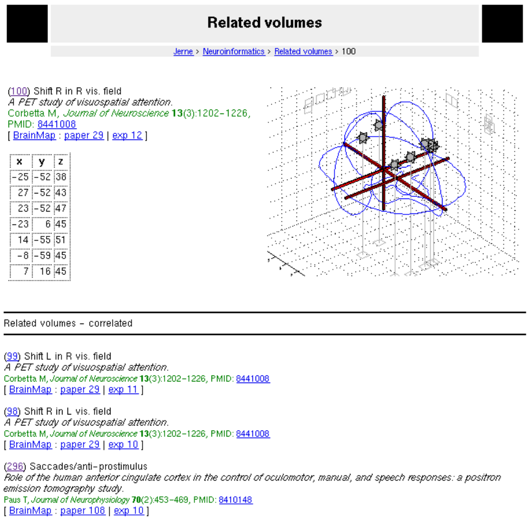
As our primary data set we use the BrainMap database [1], and our procedure for this data is displayed in figure 1.

Figure 1: A processing scheme for finding related BrainMap experiments based on volume comparisons.

We downloaded this database through its web-site and extracted fields that were relevant for our purpose. Since its activation data is in an “experiment” structure containing a list of activation foci we convert the 3D points to a voxel/volume representation by a *voxelization* step where each foci in an “experiment” is convolved with a Gaussian kernel in approximately the same manner as a Parzen window/Specht kernel estimation [5]. Due to memory restrictions we used a coarse sampling with 8mm voxel-sizes. Once all volumes are constructed we vectorize the volumes and compute a similarity measure as the inner product between the vectors. The similarities are sorted and for each volume the most similar and most dissimilar volumes are reported in two lists. Static HTML web-pages are generate with the two lists as well as summaries of the experiment, a simple Corner Cube visualization [6] and links to BrainMap and Pubmed. These web-pages are presently available from http://hendrix.imm.dtu.dk/services/jerne/. We further included volumes from a motor learning PET study [7]. These were resampled and converted from MNI to Talairach space with Brett’s transformation [8] before the similarity measure was computed.

Example

797 HTML pages were generated. An example of one of the generated web-pages is displayed in figure 2 with one of the 12 experiments/volumes reported in [9]. It shows two clusters of activations: one in the parietal lobe and an other in the frontal lobe. This pattern is repeated for the five most related experiments.


Related volumes

Jerne > Neuroinformatics > Related volumes > 100

(100) Shift R in R vis. field
A PET study of visuospatial attention.
Corbetta M, *Journal of Neuroscience* **13**(3):1202–1226, PMID: 8441008
[BrainMap : paper 29 | exp 12]

x	y	z
−25	−52	38
27	−52	43
23	−52	47
−23	6	45
14	−55	51
−8	−59	45
7	16	45

Related volumes – correlated

(99) Shift L in R vis. field
A PET study of visuospatial attention.
Corbetta M, *Journal of Neuroscience* **13**(3):1202–1226, PMID: 8441008
[BrainMap : paper 29 | exp 11]

(98) Shift R in L vis. field
A PET study of visuospatial attention.
Corbetta M, *Journal of Neuroscience* **13**(3):1202–1226, PMID: 8441008
[BrainMap : paper 29 | exp 10]

(296) Saccades/anti–prostimulus
Role of the human anterior cingulate cortex in the control of oculomotor, manual, and speech responses: a positron emission tomography study.
Paus T, *Journal of Neurophysiology* **70**(2):453–469, PMID: 8410148
[BrainMap : paper 108 | exp 10]

Figure 2: Generated web-page.

Conclusion

We have shown the possibility in performing volume searches where related experiments are found. Experiments that report activation as points can be compared to volumes by voxelization. Results are available on the Internet.

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