

Communities in the brain

Paul McCarthy

Supervisors: Lubica Benuskova and Liz Franz

Community identification

fMRI

fMRI analysis

Why?

End

Outline

Community identification

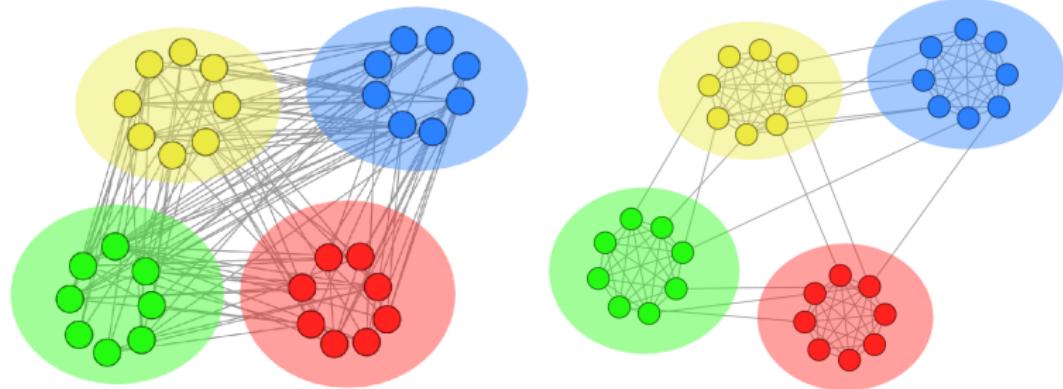
fMRI

fMRI analysis

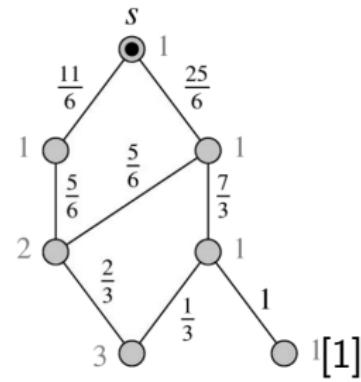
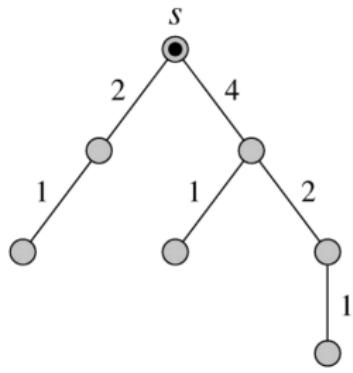
Why?

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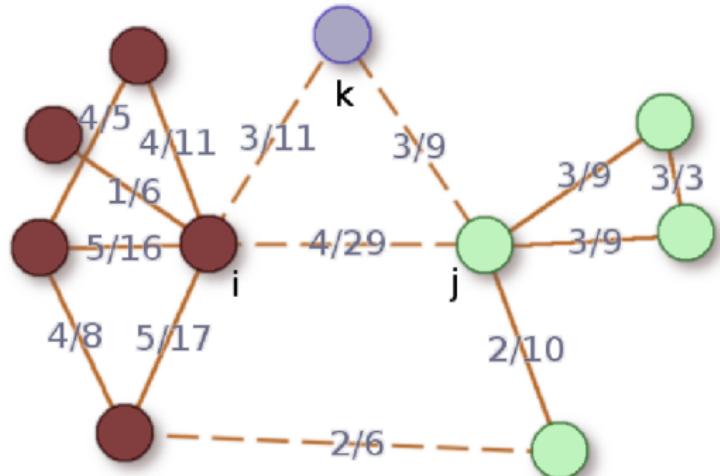
Community identification

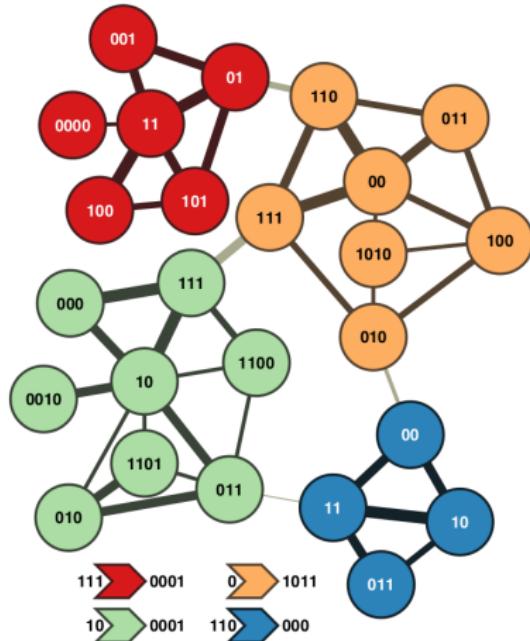


Edge betweenness



Path sharing

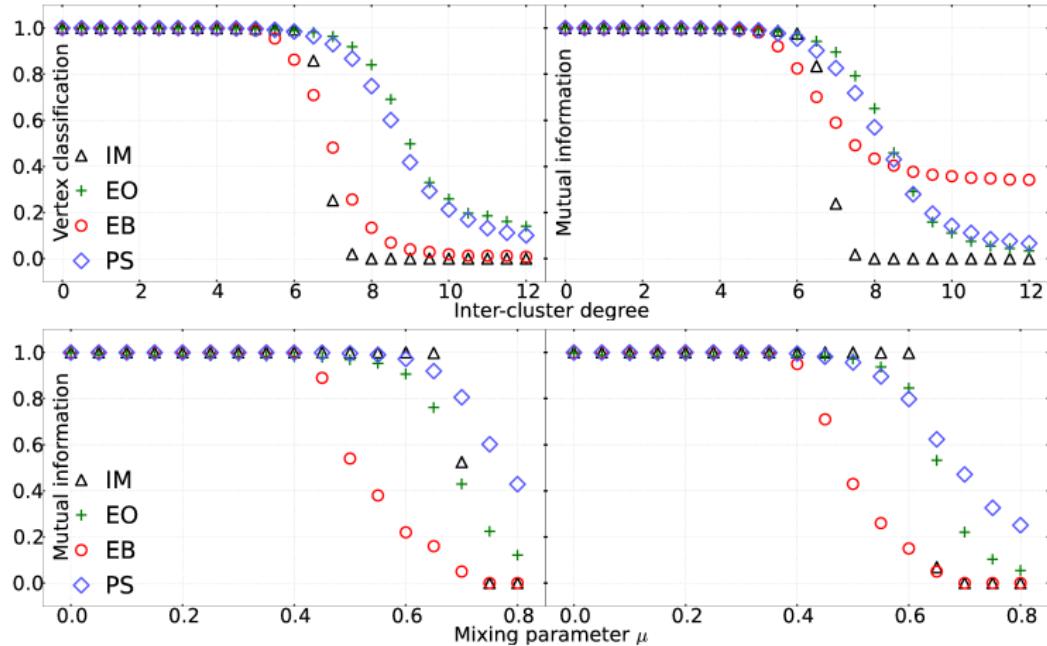




111 0000 11 01 101 100 101 01 0001 0 110 011 00 110 00 111 1011 10
111 0000 10 111 000 111 10 011 10 000 111 10 111 10 00010 10 011 010
011 10 100 111 0001 0 111 010 100 011 00 111 00 011 00 111 00 111
110 111 110 1011 111 01 101 01 0001 0 110 111 00 111 10 111 1011
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[2]

Comparison



Outline

Community identification

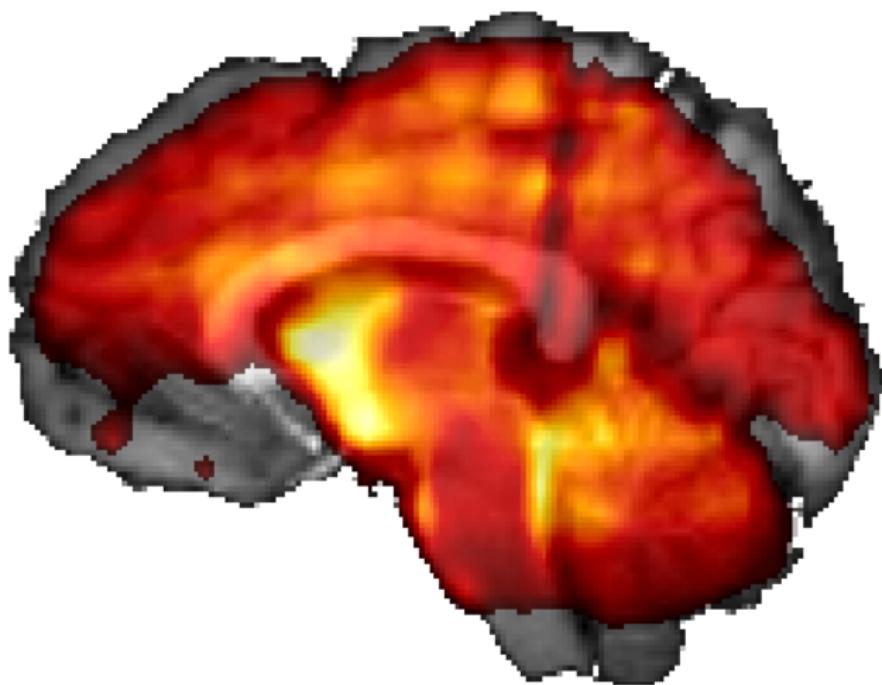
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fMRI



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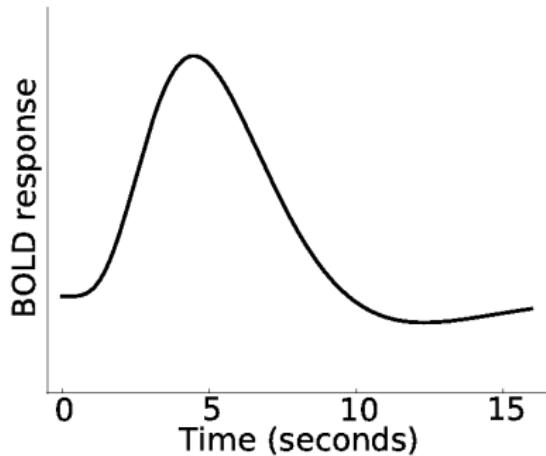
fMRI

fMRI analysis

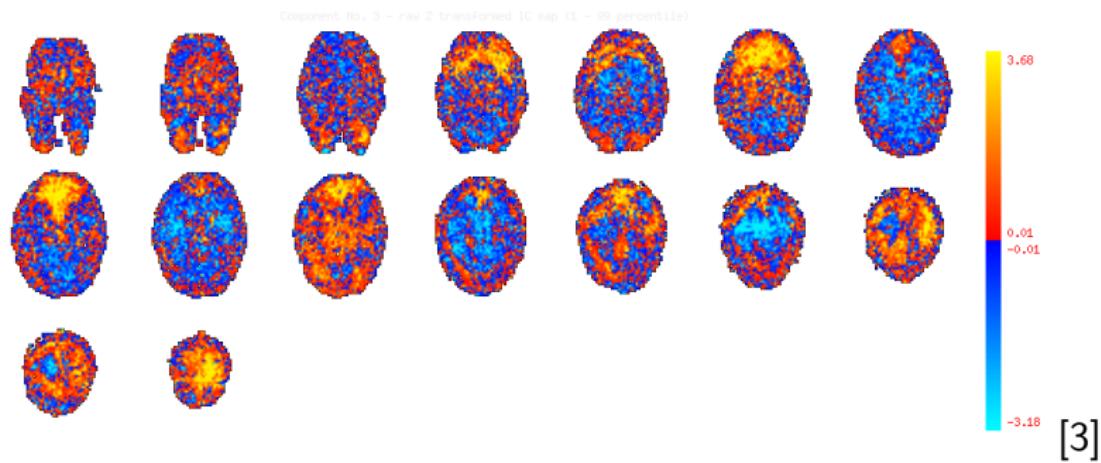
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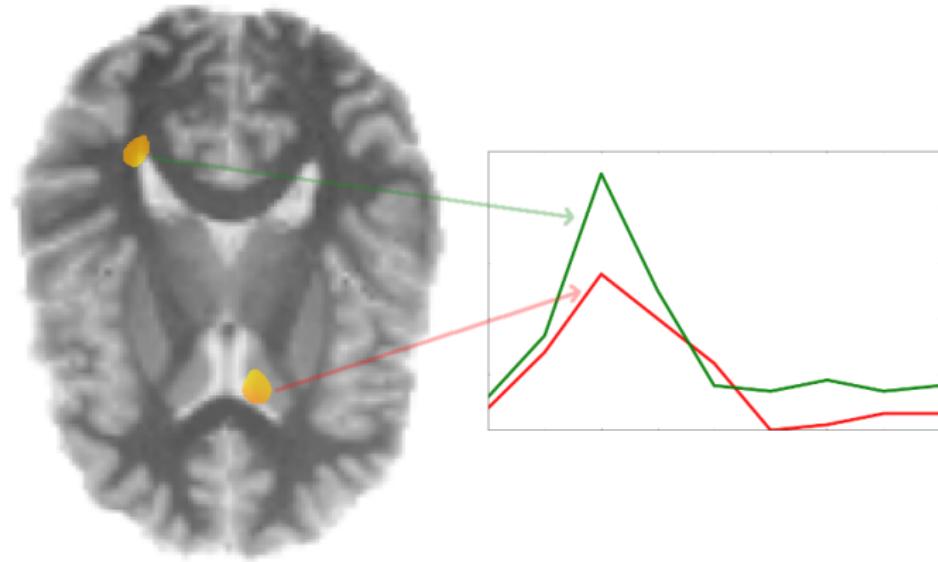
Statistical Parametric Mapping



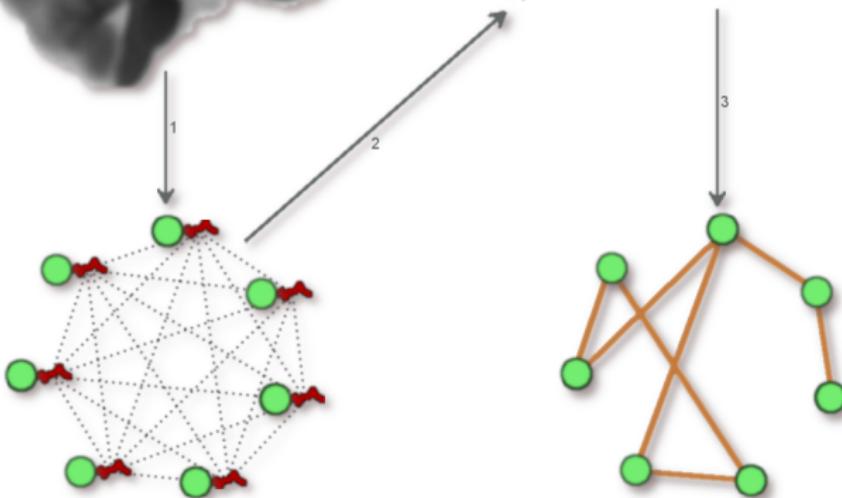
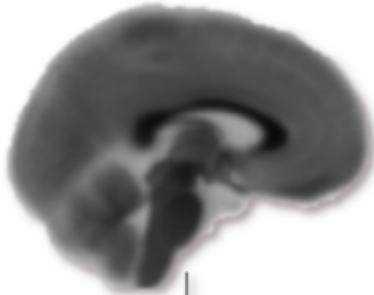
Independent Component Analysis



Functional connectivity



Graph theory



	0	1	2	3	4	5	6
0	0.99	0.37	0.86	0.06	0.32	0.71	0.86
1	0.37	0.00	0.18	0.21	0.84	0.92	0.91
2	0.86	0.18	0.00	0.65	0.42	0.58	0.91
3	0.06	0.21	0.65	0.00	0.11	0.89	0.96
4	0.32	0.84	0.42	0.11	0.00	0.27	0.82
5	0.71	0.92	0.58	0.89	0.27	0.00	0.73
6	0.86	0.01	0.91	0.96	0.82	0.73	0.00

Outline

Community identification

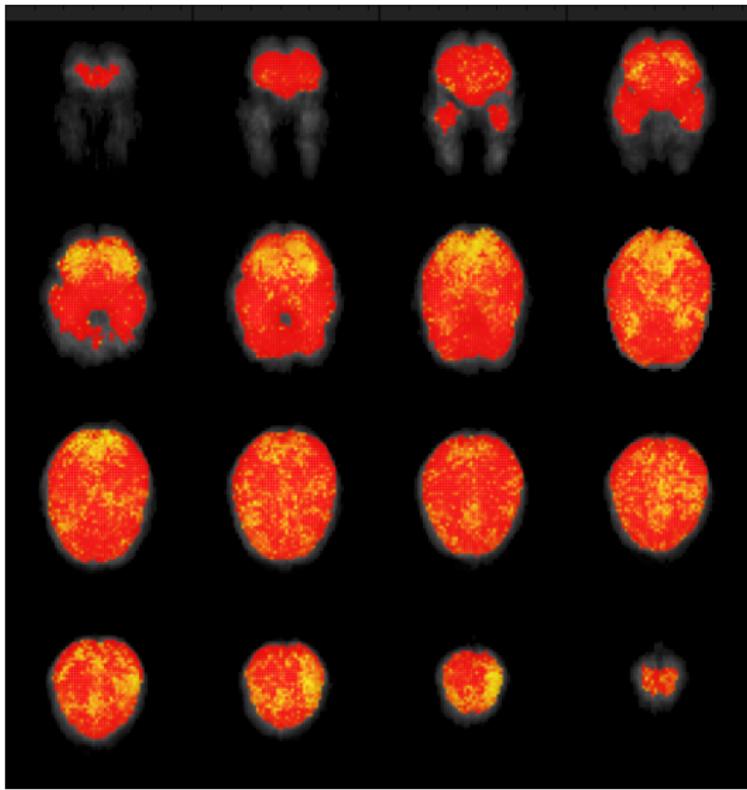
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fMRI analysis

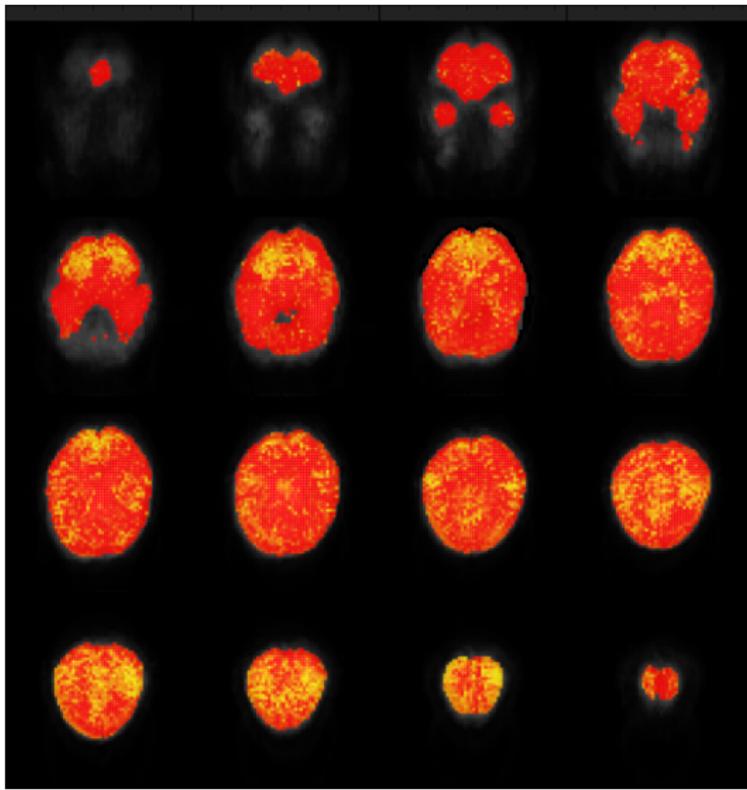
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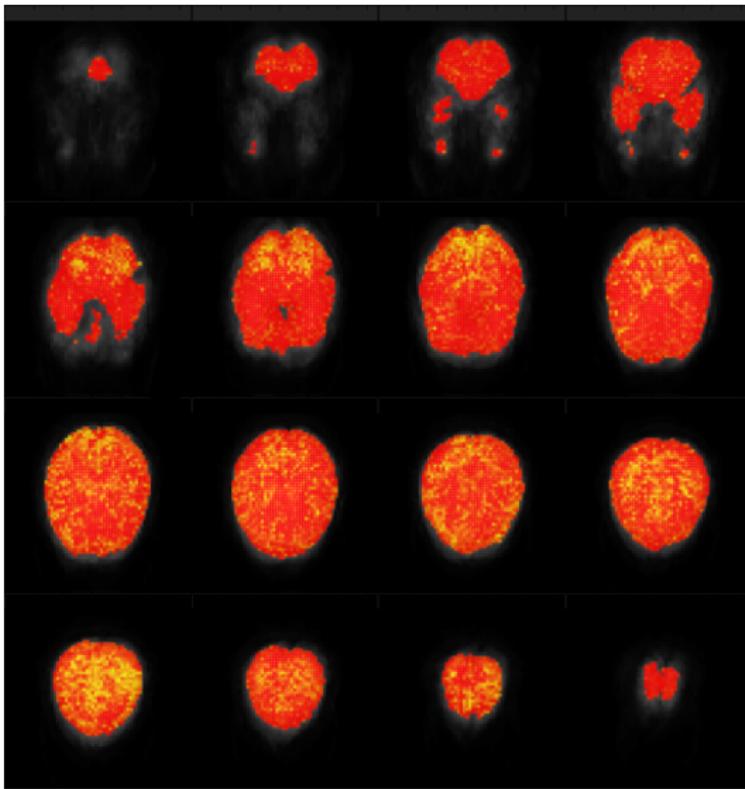
Young node degree map



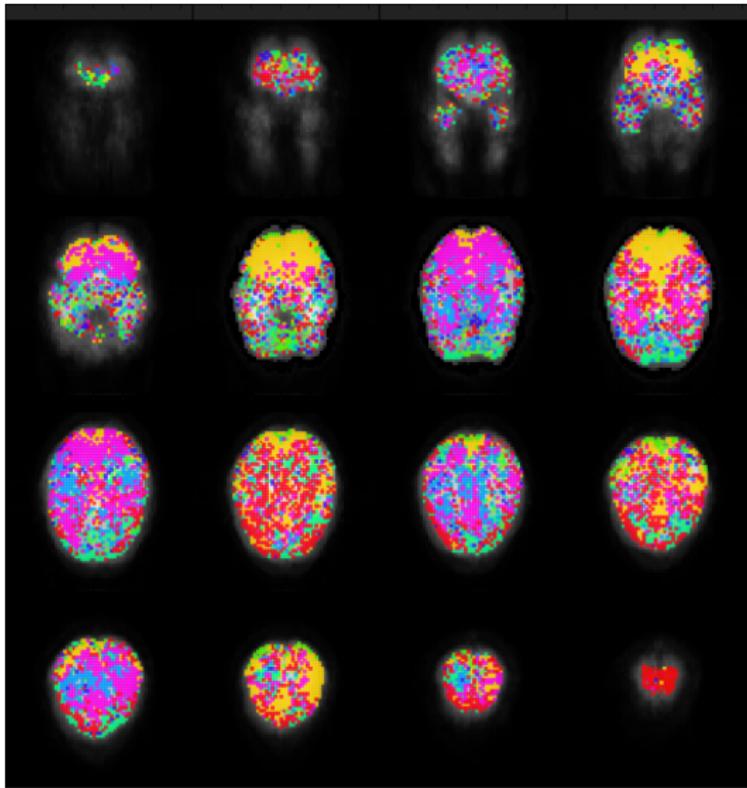
Aged node degree map



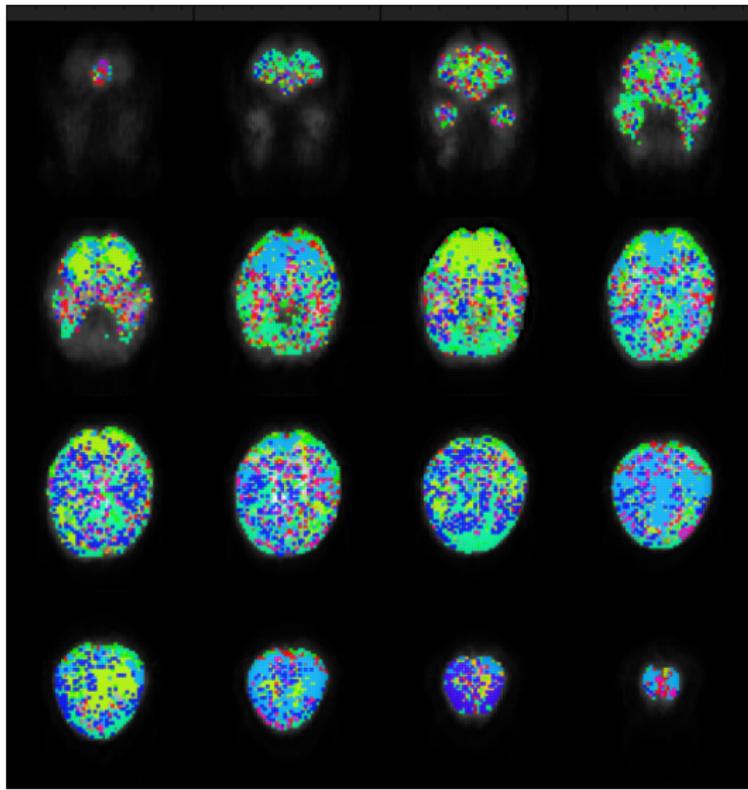
Demented node degree map



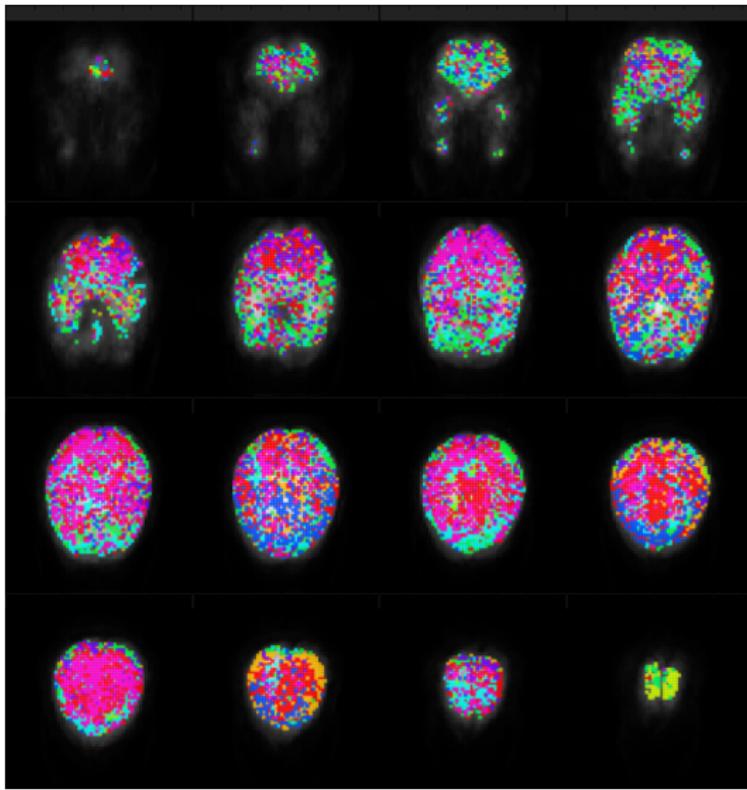
Young component map



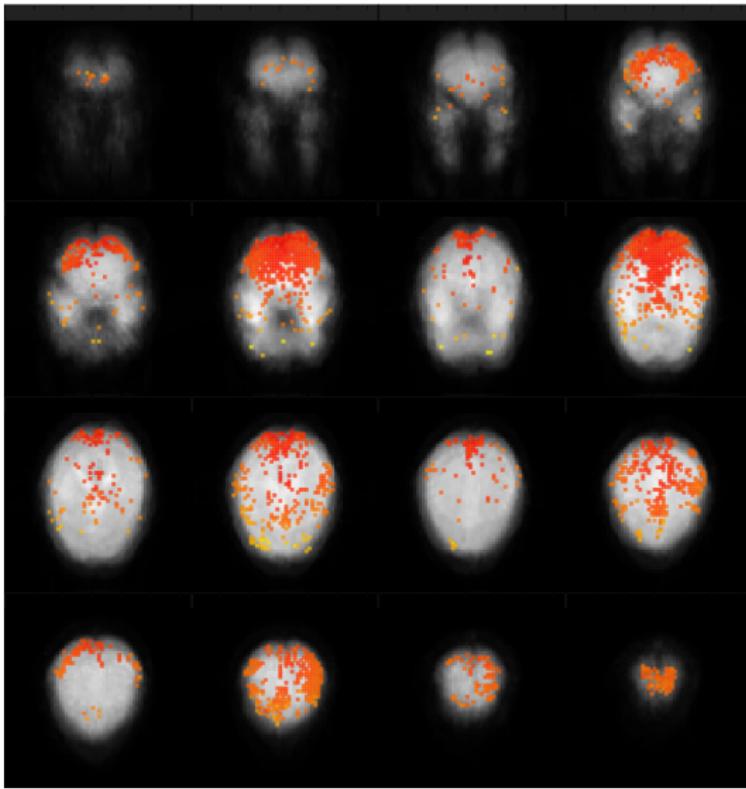
Aged component map

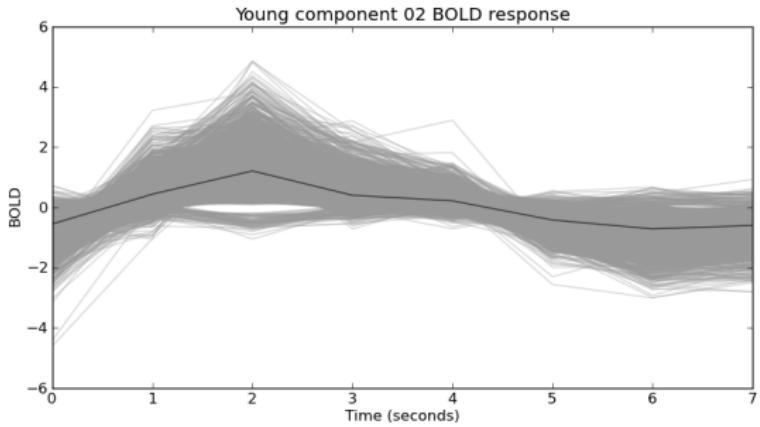


Demented component map



Young average edge distance (for one component)





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Thanks!

Questions?

References I

-  M. E. J. Newman and M. Girvan.
Finding and evaluating community structure in networks.
Physical Review E, 69:026113, 2004.
-  Martin Rosvall and Carl T. Bergstrom.
Maps of random walks on complex networks reveal community structure.
Proceedings of the National Academy of Sciences,
105(4):1118–1123, 2008.
-  Stephen M Smith, Mark Jenkinson, Mark W Woolrich,
Christian F Beckmann, Timothy E J Behrens, Heidi
Johansen-Berg, Peter R Bannister, Marilena De Luca, Ivana
Drobnjak, David E Flitney, Rami K Niazy, James Saunders,
John Vickers, Yongyue Zhang, Nicola De Stefano, J Michael
Brady, and Paul M Matthews.

References II

Advances in functional and structural MR image analysis and implementation as FSL.

Neuroimage, 23 Suppl 1:S208–19, 2004.



Olaf Sporns, Christopher J. Henry, and Rolf Kotter.

Identification and Classification of Hubs in Brain Networks.

Public Library of Science, (10):e1049, 2007.