【文献調査】
Parcellating Cortical Functional Networks in Individuals

中村　圭佑　　廣安 知之　　日和 悟

2017 年 11 月 6 日

1　タイトル

個人における皮質機能ネットワークの分割

2　著者

Danhong Wang, Randy L Buckner, Michael D Fox

3　出典

Nature Neuroscience, Volume 18, Pages 1853-1860

4　アブストラクト

個人の脳の機能的アーキテクチャを解明するということは，個人の医学における重要なステップであり，人間の認知および行動の変化における神経基盤の解明に寄与する．本研究では，静止状態の fMRI データを用いて個人のレベルで機能的に組織を正確にマッピングするための新しい皮質分割法を開発した．個々の被験者における脳機能ネットワークの反復的検索を行うために，集団ベースの機能アトラスと個人の変動性のマップを使用した．このアプローチによってマッピングされた機能アトラスは，被験者内において再現性が高く，また，被験者間の変動性を効果的に反映する．このアルゴリズムは，タスク fMRI を含む異なる被験者集団およびデータタイプにわたって良好に機能した．このアプローチは，外科的患者の侵襲性の皮質刺激の臨床応用における大きな可能性が存在することを示唆する．

5　キーワード

functional parcellation, resting-state fMRI, functional connectivity, individual differences, preoperative mapping

6　参考文献

[1] Brodmann, K. Brodmann ’ s: Localisation in the Cerebral Cortex 3rd edn. (Springer, 2006).

[2] Kaas, J.H. The organization of neocortex in mammals: implications for theories of brain function. Annu. Rev. Psychol. 38, 129-151 (1987).

[3] Toga, A.W., Thompson, P.M., Mori, S., Amunts, K. and Zilles, K. Towards multimodal atlases of the human brain. Nat. Rev. Neurosci. 7, 952-966 (2006).

[4] Zilles, K. and Amunts, K. Centenary of Brodmann ’ s map-conception and fate. Nat. Rev. Neurosci. 11, 139-145 (2010).

[5] Amunts, K. et al. Broca’s region revisited: cytoarchitecture and intersubject variability. J. Comp. Neurol. 412, 319-341 (1999).

[6] Goldman-Rakic, P.S. Topography of cognition: parallel distributed networks in primate association cortex. Annu. Rev. Neurosci. 11, 137-156 (1988).

[7] Felleman, D.J. and Van Essen, D.C. Distributed hierarchical processing in the primate cerebral cortex. Cereb. Cortex. 1, 1-47 (1991).

[8] Biswal, B., Yetkin, F.Z., Haughton, V.M. and Hyde, J.S. Functional connectivity in the motor cortex of resting human brain using echo-planar MRI. Magn. Reson. Med. 34, 537-541 (1995).

[9] Fox, M.D. and Raichle, M.E. Spontaneous fluctuations in brain activity observed with functional magnetic

resonance imaging. Nat. Rev. Neurosci. 8, 700-711 (2007).

[10] Yeo, B.T. et al. The organization of the human cerebral cortex estimated by intrinsic functional connectivity. J. Neurophysiol. 106, 1125-1165 (2011).

[11] Power, J.D. et al. Functional network organization of the human brain. Neuron 72, 665-678 (2011).

[12] Shen, X., Tokoglu, F., Papademetris, X. and Constable, R.T. Groupwise whole-brain parcellation from resting-state fMRI data for network node identification. Neuroimage 82, 403-415 (2013).

[13] Wig, G.S. et al. Parcellating an individual subject ' s cortical and subcortical brain structures using snowball sampling of resting-state correlations. Cereb. Cortex 24, 2036-2054 (2013).

[14] Wig, G.S., Laumann, T.O. and Petersen, S.E. An approach for parcellating human cortical areas using resting-state correlations. Neuroimage 93, 276-291 (2014).

[15] Laumann, T.O. et al. Functional system and areal organization of a highly sampled individual human brain. Neuron 87, 657-670 (2015).

[16] Penfield, W. and Jasper, H.H. Epilepsy and the Functional Anatomy of the Human Brain (Little, 1954).

[17] Ojemann, G., Ojemann, J., Lettich, E. and Berger, M. Cortical language localization in left, dominant hemisphere. An electrical stimulation mapping investigation in 117 patients. J. Neurosurg. 71, 316-326 (1989).

[18] J.P. Crutchfield, N.H. Packard Symbolic dynamics of noisy chaos Phys. D, 7 (1983), pp. 201-223

[19] Frost, M.A. and Goebel, R. Measuring structural-functional correspondence: spatial variability of specialised brain regions after macro-anatomical alignment. Neuroimage 59, 1369-1381 (2012).

[20] Binder, J.R. et al. Human brain language areas identified by functional magnetic resonance imaging. J. Neurosci. 17, 353-362 (1997).

[21] Fox, M.D., Liu, H. and Pascual-Leone, A. Identification of reproducible individualized targets for treatment of depression with TMS based on intrinsic connectivity. Neuroimage 66, 151-160 (2013).

[22] Fox, M.D. et al. Resting state networks link invasive and noninvasive brain stimulation across diverse psychiatric and neurological diseases. Proc. Natl. Acad. Sci. USA 111, E4367-E4375 (2014).

[23] Binder, J.R. Functional MRI is a valid noninvasive alternative to Wada testing. Epilepsy Behav. 20, 214-222 (2011).

[24] Wang, D. and Liu, H. Functional connectivity architecture of the human brain: not all the same. Neuroscientist 20, 432-438 (2014).

[25] Fedorenko, E., Hsieh, P.J., Nieto-Castanon, A., Whitfield-Gabrieli, S. and Kanwisher, N. New method for fMRI investigations of language: defining ROIs functionally in individual subjects. J. Neurophysiol. 104, 1177-1194 (2010).

[26] Sohn, W.S. et al. Influence of ROI selection on resting state functional connectivity: an individualized approach for resting state fMRI analysis Front. Neurosci. 9, 280 (2015).

[27] Hacker, C.D. et al. Resting state network estimation in individual subjects. Neuroimage 82, 616-633 (2013).

[28] Blumensath, T. et al. Spatially constrained hierarchical parcellation of the brain with resting-state fMRI. Neuroimage 76, 313-324 (2013).

[29] Goulas, A., Uylings, H.B. and Stiers, P. Unravelling the intrinsic functional organization of the human lateral frontal cortex: a parcellation scheme based on resting state fMRI. J. Neurosci. 32, 10238-10252 (2012).

[30] Craddock, R.C., James, G.A., Holtzheimer, P.E. III, Hu, X.P. and Mayberg, H.S. A whole brain fMRI atlas generated via spatially constrained spectral clustering. Hum. Brain Mapp. 33, 1914-1928 (2012).