Personal Profile

Name : Jayachandra.M.Raghava (PhD)
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Curriculum Vitae

Experience

Institute : Center for Neuropsychiatric Schizophrenia Research (CNSR), FIunit-Department of diagnostics (Glostrup, Denmark).
Title : Post-Doctoral Researcher
Duration : (January 2011 – Till date)
My research involves the study of structural/microstructural brain abnormalities associated with schizophrenia. I use structural MRI and DTI techniques to observe structural/microstructural alterations encountered not only at the onset of the illness but also to followup on the longitudinal effects of treatment or medication.

Institute : Philips Healthcare (Best, The Netherlands)
Title : MR Reconstruction Domain Expert
Duration : 3.5 years (2007 – 2010)
My area of expertise is medical image processing. I have worked in the production of MR software development for image processing algorithms and I implemented various solutions to handle image quality, resolution, SNR (signal to noise ratio) and artifacts. These improvements show high impact on the improved diagnostic procedure giving physicians / doctors more confidence in their treatment to the patient. Hence, making the Healthcare system more reliable and more sophisticated. I used C, C++ and Matlab programming languages.

Institute : Heidelberg Medical Center (Heidelberg, Germany)
Title : Research Scientist
Duration : 3 years (2004 – 2007)
The area of expertise is medical image post-processing. I have implemented many image post-processing algorithms to develop visualization software for statistical analyses and neural brain imaging. This tool guides brain surgeons on a daily basis in diagnosing various brain dys-functions and pathology. The process of planning brain surgery for tumors is very complex because care should be taken not only to remove the tumor but also not to damage other properly functioning parts of the brain. My software plays a very important role in reducing this complexity. I also was involved regularly in imaging seminars of our department. I used Matlab to develop this 3D visualization and post-processing tool for Diffusion Tensor imaging MR technique.

Internships

Company : Max Planck Institute for Biological Cybernetics, Tubingen, Germany
Duration : 4 months (2004)
The area of expertise is frequency domain (k-space) image processing. I was involved in development of
routines to calculate the error introduced by the MR imaging scanner. These error estimates from my algorithms are used as correction factors.

Company : GE Healthcare (Bangalore, India)
Duration : 6 months (2003)
The area of expertise is MR imaging. I developed a tool for remote desktop viewing which could be used for training multiple MR technicians at the same time from a remote location.

Education

- **PhD** in Medical Informatics, Medical Physics, Neuroscience – 2007 (Heidelberg, Germany): Fiber tracking algorithms are used to extract neural information of the human brain using the diffusion phenomenon from MRI images. Many algorithms were developed in the last decade but none of them could resolve intra-voxel inhomogeniety, because of which this technique is never used in clinical diagnoses. My solutions in this area resolve this limitation, making this technique a regular clinical routine, supporting physicians in their clinical evaluations.
- **M.S** (Master of Science) in Medical Informatics – 2003 (Manipal, India)
- **B.E** (Bachelor of Engineering) in Computer Science – 2000 (Bangalore, India)

Publication list

- Raghava JM, Mandl RCW, Nielsen MØ, Fagerlund B, Glenthøj BY, Rostrup E, Ebdrup BH. Multimodal assessment of white matter microstructure in antipsychotic-naïve schizophrenia patients and confounding effects of recreational drug use. Brain Imaging Behav. 2020 Jun 29. doi: 10.1007/s11682-019-00230-4.

- Andersen, H.G., Raghava, J.M., Svarer, C., Wulff, S., Johansen, L.B., Antonsen, P.K., Nielsen, M.Ø., Rostrup, E., Vernon, A.C., Jensen, L.T., Pinborg, L.H., Glenthøj, B.Y., Ebdrup, B.H. Striatal Volume Increase After Six Weeks of Selective Dopamine D2/3 Receptor Blockade in First-Episode, Antipsychotic-Naïve Schizophrenia Patients (2020) Frontiers in Neuroscience, 14, art. no. 484. DOI: 10.3389/fnins.2020.00484

- Fagerlund, B., Pantelis, C., Jepsen, J., Raghava, J., Rostrup, E., Thomas, M., . . . Glenthøj, B. (2020). Differential effects of age at illness onset on verbal memory

functions in antipsychotic-naïve schizophrenia patients aged 12–43 years. Psychological Medicine, 1-11. doi:10.1017/S0033291720000409

- Krzysztof Gbyl, Egill Rostrup, Jayachandra Mitta Raghava, Carsten Andersen, Raben Rosenberg, Henrik Bo Wiberg Larsson, Poul Videbech. Volume of hippocampal subregions and clinical improvement following electroconvulsive therapy in patients with depression, Progress in Neuro-Psychopharmacology and Biological Psychiatry, Volume 104, 2021, 110048, ISSN 0278-5846, https://doi.org/10.1016/j.pnpbp.2020.110048.

- Ebdrup, B., Axelsen, M., Bak, N., Fagerlund, B., Oranje, B., Raghava, J., . . . Glenthøj, B. (n.d.). Accuracy of diagnostic classification algorithms using cognitive-, electrophysiological-, and neuroanatomical data in antipsychotic-naïve schizophrenia patients. *Psychological Medicine,* 1-10. doi:10.1017/S0033291718003781

- Kasper Jessen, Rene C.W. Mandl, Birgitte Fagerlund, Kirsten B. Bojesen,Jayachandra M. Raghava, Hayder G. Obaid, Marie B. Jensen, Louise B. Johansen, Mette Ø. Nielsen, Christos Pantelis, Egill Rostrup, Birte Y. Glenthøj, and Bjørn H. Ebdrup (2018). Patterns of Cortical Structures and Cognition in Antipsychotic-Naïve Patients With First-Episode Schizophrenia: A Partial Least Squares Correlation Analysis. Biological psychiatry. Cognitive neuroscience and neuroimaging.

- Krakauer K, Nordentoft M, Glenthøj BY, Raghava JM, Nordholm D,Randers L, Glenthøj LB, Ebdrup BH, Rostrup E. White mattermaturation during 12 months in individuals at ultra-high-risk for psychosis. Acta Psychiatr Scand 2018: 137: 65–78.

- Krakauer K, Ebdrup BH, Glenthøj BY, Raghava JM, Nordholm D, Randers L, Rostrup E, Nordentoft M. Patterns of white matter microstructure in individuals at ultra-high-risk for psychosis: Associations to level of functioning and clinical symptoms. Psychological Medicine 2017, 47(15), 2689-2707.

- Marie B. Jensen, Jayachandra M. Raghava, René C.W. Mandl, Egill Rostrup, Mette Ø. Nielsen, Maria H. Jensen, Birte Y. Glenthøj, Bjørn H. Ebdrup, and Birgitte Fagerlund. Cognition and White Matter Integrity in Antipsychotic-Naive First-Episode Schizophrenia Patients.Schizophr Bull. 2017 Mar; 43(Suppl 1): S126–S127.

- Nørbak-Emig H, Pinborg LH, Raghava JM, Svarer C, Baaré WFC, Allerup P, Friberg L, Rostrup E, Glenthøj B, Ebdrup BH. Extrastriatal dopamine D2/3 receptors and cortical grey matter volumes in antipsychotic-naïve schizophrenia patients before and after initial antipsychotic treatment.World J Biol Psychiatry. 2017 Oct;18(7):539-549.

- Frontal fasciculi and psychotic symptoms in antipsychotic-naive patients with schizophrenia before and after 6 weeks of selective dopamine D2/3 receptor blockade Bjørn H. Ebdrup *; Jayachandra M. Raghava *; Mette Ø. Nielsen; Egill Rostrup; Birte Glenthøj. Journal of Psychiatry and Neuroscience 2015;40(6):10.1503/jpn.150030

- Longitudinal Magnetic Resonance Imaging (MRI) Analysis of the Developmental Changes of Tourette Syndrome Reveal Reduced Diffusion in the Cortico-Striato-Thalamo-Cortical Pathways. Debes N, Jeppesen S, Raghava JM, Groth C, Rostrup E, Skov L. Journal of Child Neurology. 2015 Sep;30(10):1315-26.

- White matter alterations in schizophrenia. Bjørn H Ebdrup · Nana Skovgaard · Jayachandra M Raghava ·Birte Glenthøj ·Ugeskrift for laeger 11/2014; 176(46).

- The cerebral representation of the Christmas spirit. A transcultural functional magnetic resonance study. Amin FM, Lindberg U, Raghava JM, Hougaard A. Ugeskr Laeger. 2012 Dec 3;174(49):3082-4.

- Fiber tracking of human brain using rank-4 tensor and high angular resolution diffusion imaging. Jayachandra MR, Rehbein N, Herweh C, Heiland S. Magnetic Resonance in Medicine 60:1207-1217 (2008).

- Quantitative DTI in Herpes Simplex Virus Encephalitis. Herweh C, Jayachandra MR, Hartmann M, Gass A, Sellner J, Heiland S, Nagel S, Hähnel S, Meyding-Lamadé U. Journal of NeuroVirology 13:5, 426-432 (2007).

- White Matter Alterations and Structural Connectivity in First-Episode Antipsychotic-Naïve Schizoprenia Patients. Raghava, J. M., Ebdrup, B. H., Nielsen, M. Ø., Wulff, S., Rostrup, E. & Glenthøj, B. Y. Apr 2014 In : Schizophrenia Research. 153, Suppl. 1, p. 110 1 p.

- Altered patterns of reward activation in a large cohort of antipsychotic naïve first episode schizophrenia patients. Mette Ødegaard Nielsen · Egill Rostrup · Sanne Wullf · Henrik Nørbak-Emig · Jayachandra Raghava · Birte Glenthøj · Schizophrenia Research 04/2014; 153:S50. DOI:10.1016/S0920-9964(14)70166-5

- Reward processing, dopamine d2/3 receptor binding, and treatment outcome: a longitudinal study of abnormalities in the reward circuit in initially antipsychotic-naive first-episode schizophrenia patients. Birte Glenthøj, Mette Ødegaard Nielsen, Sanne Wulff, Jayachandra Mitta Raghava, Bjørn Ebdrup, Shitij Kapur, Egill Rostrup· Schizophrenia Research 04/2014; 153:S84-S85. DOI:10.1016/S0920-9964(14)70272-5

- Integrity of Frontal Fasciculi in Antipsychotic-Naive First-episode Schizophrenia Patients before and after Antipsychotic Monotherapy. Bjorn Ebdrup, Jayachandra M. Raghava, Mette O. Nielsen, Egill Rostrup, Birte Y. Glenthoj· 53rd Annual Meeting of the American-College-of-Neuropsychopharmacology; 12/2014

- Comparison of experimental and theoretical spiral MR trajectories. Jayachandra MR, Nikos K. Logothetis, Josef Pfeuffer. http://www.kyb.tuebingen.mpg.de/fileadmin/user_upload/files/publications/pdfs/pdf2847.pdf

1. Please briefly describe (no more than ~300 words) what you expect to gain by attending this course and how you imagine it will impact your scientific work.

I am a computer science engineer and have been working as a post-doctoral researcher for the past 10 years in the present group, where my key areas of responsibility are MRI image processing and statistical analyses. I am not a statistician by education, and hence I would like to gain statistical expertise in the following areas of research that are in the interest of my group and myself.

In the area of "Statistics in neuroimaging", I do have experience with linear regression, GLM, mixed effects, random effects and longitudinal modeling using 2 time points. I am interested in "efficient longitudinal modeling" when there are more than two time points and more than two groups accompanied by missing data at random follow-up scans (e.g. Worst-Rank Score Methods?). Additionally, I am interested in Bayesian tackling of situations where there are no parametric frequentist solutions.

In the area of "Multi-modal statistics", I have designed joint models using partial least squares algorithm that showed higher sensitivity and specificity in identifying the pathology. I am interested in other multi-modal/fusion approaches especially in the context of predictive models.

In the area of "Network Science", I have implemented and analysed a brain connectome based on cortical parceling (T1 scan) and tractography (DWI scan) using MRrtrix software. I would like to gain expertise in network-based statistics and the understanding of network measures in the context of neuroscience. Further, I am interested in the implementation of multi-modal structure-function models (e.g. fMRI and DWI).

I do not have experience in the area of "Statistical genetics", but there are other studies (schizophrenia and a cohort study in children) in our group working with heritability and polygenetic risk scores and associations with neuroimaging data. I would be interested in taking back knowledge about heritability estimates using structural equation models and statistical genetics.

1. Please briefly describe (no more than ~300 words) past or current examples of when you have used neuroimaging or genetics in your career (while not required, you may reference ~4 of your citations, as appropriate).

My experience with neuroimaging in the past 17 years in broadly across industry and research domains.

The industrial work was at the development center of Philips MRI (Best, The Netherlands) where I had worked as a "MRI Reconstruction Domain Expert". This domain involves the entire image processing pipeline from the conversion of the acquired raw/complex k-space data into an artifact free image. My responsibilities were to implement various solutions to handle image quality, resolution, SNR (signal to noise ratio) and artifacts in k-space (e.g ringing filters) and image space (e.g geometric distortion).

The research work during my PhD was in the area of high-rank diffusion tensor modeling to develop and implement cerebral white matter fiber tracking algorithms which could overcome/resolve limitations of the tensor model in crossing fiber regions of the human brain.

My work as a post-doctoral researcher had been mainly focused on identifying cerebral white matter alterations in antipsychotic naïve schizophrenia patients at baseline and at follow-up after treatment with antipsychotic medication. I have implemented various processing pipelines for diffusion weighted imaging (DWI) scans using the tensor and spherical deconvolution models. I have used the parameter maps obtained from these models for further statistical analyses.

I have mainly used GLM (general linear model) to model group differences and associations with psychopathology at baseline. I have modeled for mixed effects to analyse the interaction in longitudinal data across patients and controls. I have mainly used permutation tests to obtain exact inference from voxelwise analyses, fixel based analyses and ROI based analyses.

I have developed joint modeling of data from different neuroimaging modalities in order enhance specificity and sensitivity of the tests using PLS (partial least square) and PALM (Permutation Analysis of Linear Models).

I have developed a pipeline to generate a brain connectome and analyse network measures.

References

Ebdrup, B. H., Raghava, J. M., Nielsen, M. Ø., Rostrup, E., & Glenthøj, B. (2016). Frontal fasciculi and psychotic symptoms in antipsychotic-naive patients with schizophrenia before and after 6 weeks of selective dopamine D2/3 receptor blockade. Journal of Psychiatry & Neuroscience : JPN, 41(2), 133–141. https://doi.org/10.1503/jpn.150030

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Andersen, H.G., Raghava, J.M., Svarer, C., Wulff, S., Johansen, L.B., Antonsen, P.K., Nielsen, M.Ø., Rostrup, E., Vernon, A.C., Jensen, L.T., Pinborg, L.H., Glenthøj, B.Y., Ebdrup, B.H. Striatal Volume Increase After Six Weeks of Selective Dopamine D2/3 Receptor Blockade in First-Episode, Antipsychotic-Naïve Schizophrenia Patients (2020) Frontiers in Neuroscience, 14, art. no. 484. DOI: 10.3389/fnins.2020.00484

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1. This course is dedicated to diversity. Please provide a brief statement (~½ page) of your commitment and contributions to the advancement of diversity, equity, and inclusion in science.

Schizophrenia is a complex and progressive brain disease characterized by a spectrum of subtle neurobiological changes. When a patient who is at an initial stage of illness undergoes a MRI (magnetic resonance imaging) scan of the brain, the pathology is not directly visible to the naked eye on the scanned image. This indicates that subtle neurobilogical changes in the receptor profiles, white matter changes, grey matter loss, altered structural and functional connectivity, genetic predisposition might be involved in this illness. It is very important to identify the problem, so that the psychiatrists can treat the illness effectively.

In order to identify these subtle changes that are not visible to the naked eye, we need to gather lot of data, process the data (to remove noise) and perform meaningful statistics to enhance the signal associating to the illness. This is where I use my education and experience in computer science, mathematical modeling, MRI, neuroscience, statistics to promote the field. In my experience, I have realized that reproducibility and consistency of the findings across different modalities are important for the progress of any field.

In order to reproduce the test results reliably, we not only need a good data sample but also standard processing pipelines and a meaningful statistical approach. There is also a huge diversity in the field and its necessary to identify the right statistical approach for a particular analysis or study (e.g voxel-wise statistics, network-based statistics, genetic statistics, multi-modal statistics, cross-sectional and longitudinal statistics etc). I think that multi-modal approaches that unifies (conjoint analyses) the signal across these diverse modalities might be more informative (e.g specific to a particular neurobilogical substrate) and reliable. Further, we need complex network measures in order to understand complex psychopathology (e.g hallucinations).

I have been working in the field of neuroimaging and have contributed in the advancement in diverse fields. In the near future, I am committed to take the field forward in the area of multi-modal and network statistics. Hence, my participation in this course is very crucial.