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Notice for the PhD Viva-Voce Examination

Mr Manjunath Ramanna Lamani, Registration Number: 2170267, PhD Scholar at the School of Engineering and Technology, CHRIST (Deemed to be University), Bangalore Kengeri Campus will defend his PhD thesis at the public viva-voce examination on Friday, 04 April 2025 at 10.30 am in the CDI Conference Room, III Floor, Block V, Bangalore Kengeri Campus, Bengaluru 560074, Karnataka, India.

Title of the Thesis	:	**Deep Learning Ensemble for the Early Detection of Autism Spectrum Disorder Using Resting-State FMRI**
Discipline	:	**Computer Science and Engineering**
External Examiner - I	:	**Dr Sanjay Kumar Kuanar** Associate Professor Department of Computer Science and Engineering Birla Global University IDCO, Plot No. 2, Institutional Area Gothapatna Bhubaneswar – 751029, Odisha
External Examiner - II	:	**Dr Vasanthakumar G U** Professor Department of Computer Science and Engineering Nitte Meenakshi Institute of Technology, Yelahanka Bengaluru - 560064, Karnataka
Supervisor	:	**Dr Julian Benadit P** Associate Professor Department of Computer Science and Engineering School of Engineering and Technology Bangalore Kengeri Campus CHRIST (Deemed to be University) Bengaluru - 560074, Karnataka

The members of the Research Advisory Committee of the Scholar, the faculty members of the Department and the School, interested experts and research scholars of all the branches of research are cordially invited to attend this open viva-voce examination.

Place: Bengaluru
Date: 26 March 2025

Registrar (Academics)

ABSTRACT

Autism Spectrum Disorder (ASD) is a developmental disorder that is evident in children and may impact social interaction and communication skills and interaction and repetitive behavior. That is why early diagnosis is vital because early interventions mean that the quality of life of the ASD person can be highly increased. The advancements in neuroimaging that have occurred in the past decade, along with fast and advanced computational science methods such as Deep Learning (DL), have paved the way to improved diagnostic accuracies and efficiency. The signal acquired by resting-state functional magnetic resonance imaging (rs-fMRI) can identify functional connectivity changes in the brain that can act as an ASD biomarker. In this thesis, both rs-fMRI data and state-of-the-art DL techniques are used to train more reliable and precise models for ASD screening. To assess cerebral connectivity, the work assesses and compares the current advanced methods such as Convolutional Neural Networks (CNN), Graph Convolutional Networks (GCNs), and the combination of both types. Feature extraction, selection, and classification are integral parts of the proposed frameworks for achieving high-performance models.

This study has also presented a new method for feature selection called Adaptive Bacterial Foraging Optimization (ABFO), Support Vector Machines-Recursive Feature Elimination (SVM-RFE), and Minimum Redundancy Maximum Relevance (mRMR). This pipeline, along with the GCN classifier, was recognized accurately as 97.51% of diagnoses in this Autism Brain Imaging Data Exchange (ABIDE) dataset. Further, a novel integration of Spatial-Attention-based CNN (SA-CNN) and Bi-LSTM networks is proposed along with the augmentations of Stockwell Transform (SW) and Relativistic Super-Resolution Generative Adversarial Networks (RS-GAN). This new strategy achieves an accuracy of 98.73% in the examination of rs-fMRI data sets. Moreover, this research compares an encoding CNN-based model on functional connectivity pattern (FCP). When used to detect ASD, these models yield an average accuracy of 92.22% on the ABIDE database. The conclusions drawn from this thesis support the hypothesis that the incorporation of rs-fMRI signals with DL frameworks significantly improves the diagnostic accuracy of ASD. The proposed methods help to detect minor interconnectedness of the brain regions characteristic of ASD and to promote early diagnosis and individualized therapeutic management of the disorder. These contributions contribute not only to the development of new knowledge and new approaches to the study of neurodevelopmental disorders but also to the prospect of developing new technologies in the field of mental health.

Keywords: *ASD, Neurodevelopmental conditions, CNNs, GCNs, DL, Feature Selection, rs-fMRI, SA-CNN, Bi-LSTM, Stockwell Transform, RSRGAN, ABFO, SVM-RFE, mRMR, ABIDE.*

Publications:

1. **Lamani, M.R.,** Benadit, P.J. Automatic Diagnosis of Autism Spectrum Disorder Detection Using a Hybrid Feature Selection Model with Graph Convolution Network. SN COMPUT. SCI. 5, 126 (2024). https://doi.org/10.1007/s42979-023-02439-z (Springer-Scopus-Q2).
2. **Lamani, M. R.,** & Pernabas, J. B. (2024). A Thorough Review of Deep Learning in Autism Spectrum Disorder Detection: From Data to Diagnosis. *Recent Advances in Computer Science and Communications (Formerly: Recent Patents on Computer Science), 17*(8), 73-91.
3. **Lamani, M.R.,** Benadit, P.J. & Vaithinathan, K. Multi-atlas Graph Convolutional Networks and Convolutional Recurrent Neural Networks-Based Ensemble Learning for Classification of Autism Spectrum Disorders. SN COMPUT. SCI. 4, 213 (2023). https://doi.org/10.1007/s42979-022-01617-9(Springer-Scopus-Q2)
4. **Lamani, M. R.,** Benadit, P. J., & Vaithinathan, K. (2023, April). Autism Spectrum Disorder: Automated Detection based on rs-fMRI images using CNN. In 2023 IEEE International Conference on Contemporary Computing and Communications (InC4) (Vol. 1, pp. 1-5). IEEE.
5. **Lamani, M. R.,** & Julian Benadit, P. (2023, August). An early detection of autism spectrum disorder using PDNN and ABIDE I&II dataset. In International Conference on Artificial Intelligence on Textile and Apparel (pp. 295-310). Singapore: Springer Nature Singapore.
6. **Lamani, M. R.,** & Julian Benadit, P. (2023, September). A Review on Deep Learning Algorithms in the Detection of Autism Spectrum Disorder. In Congress on Intelligent Systems (pp. 283-297). Singapore: Springer Nature Singapore.
7. **Lamani, M. R.,** Julian Benadit, P., & Guruprasad, C. (2024). AdvanDNN: Deep Neural Network Analysis of Neuroimaging for Identifying Vulnerable Brain Regions in Autism Spectrum Disorder. In International Conference on Power Engineering and Intelligent Systems (PEIS) (pp. 497-510). Springer, Singapore