Notice for the PhD Viva Voce Examination

Mr Naived George Eapen, Registration Number: 2270138, PhD Scholar at the Department of Computer Science, School of Sciences, CHRIST (Deemed to be University), Pune Lavasa Off-Campus will defend his PhD thesis at the public viva-voce examination on Tuesday, 30 September 2025 at 2.00 pm in the Seminar Hall (Room No. 2208), Management Block, CHRIST (Deemed to be University), Pune Lavasa - 412112, India.

Title of the Thesis	:	**An Efficient Framework for Feature Extraction in Remote Sensing Data Using Self Supervised Learning**
Discipline	:	**Computer Science**
External Examiner - I	:	**Dr Durgesh Kumar Mishra** Director and Professor Computer Science and Information Technology Symbiosis University of Applied Science, Indore Bada Bangadda, Super Corridor Indore - 453112 Madhya Pradesh
External Examiner - II	:	**Dr Sashikala Mishra** Professor Computer Science and Engineering Symbiosis Institute of Technology (SIT) Constituent of Symbiosis International (Deemed University) Pune - 412115 Maharashtra
Supervisor	:	**Dr Jossy P George** Professor Department of Computer Science School of Sciences CHRIST (Deemed to be University) Bengaluru - 560029 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.

Registrar (Academics)

Place: Bengaluru
Date: 25 September 2025

ABSTRACT

Remote sensing imagery is used to understand the Earth's surface dynamics with the help of Geospatial Analysis systems, providing abundant data for earth observation solutions. Geographic Information Systems (GIS) integrate techniques such as Land Use Land Cover (LULC) classification to achieve reliable analysis of remotely sensed satellite imagery. High spatial and spectral resolution data from satellites like Sentinel-2 are particularly effective for detailed mapping, environmental assessments, and change mapping. Machine Learning (ML) and Deep Learning (DL) based approaches that are supervised in their learning nature have demonstrated high reliability for automated predictions and analysis based on the satellite imagery. Nevertheless, these approaches often lack label-efficient and raw-data friendly strategies; the scarcity of labelled datasets significantly affects the performance of these supervised learning approaches. Self-Supervised Learning (SSL) has exhibited a promising scope by enabling autonomous feature extraction for representation learning of remotely sensed data, primarily due to its reduced requirement of extensively annotated datasets for training. In this regard, the present research introduces an efficient SSL-based framework, incorporating the design and evaluation of multiple pretext tasks, automatic labelling techniques, and comparative analysis with the existing state-of-the-art models. The framework is developed and validated using imagery from open-source remote sensing datasets captured by the Sentinel-2 satellite. A Simple Framework for Contrastive Learning of Visual Representations (SimCLR) with VGGNet CNN is trained on the imagery that effectively aids the representation learning process of the feature learning system. The Hybrid Learning and Remote Sensing with Self-Supervision (HyReSS) makes use of various pretext tasks and advanced feature extraction approaches for effective representation learning. Algorithms such as Cross-Model SSL Feature Extraction (CMSFE) and Multi-task Framework for Simultaneous Feature Extraction and Pseudo Label Refinement (MTSFE) are developed to make a framework for representation learning techniques involving LULC problems. The experimental evaluation confirms substantial improvements in visual representation quality, feature representation efficiency, classification accuracy and greater adaptability to diverse remote sensing scenarios. These enhancements are achieved without manual intervention or the need for labelling processes, contributing towards the development of intelligent GeoSSL (Geospatial Self-Supervised Learning) systems. The hybrid pretext task strategy and optimised pseudo-labelling algorithms substantially outperform traditional techniques, confirming the robustness, suitability and applicability. The framework conjoining the SSL methods and Remote Sensing is a robust theoretical and practical autonomous paradigm, featuring comprehensive representation learning methods. Detailed comparative analysis and insights validate the optimality of the feature learning framework, which establishes a solid foundation for automated earth observation systems. The approach demonstrates potential for real-time land use monitoring, urban planning, environmental change detection, land cover change detection, spatio-temporal analysis, disaster management, and a wide range of applications within GIS and geospatial analysis.

Keywords: Self-Supervised Learning (SSL), Remote Sensing (RS), Feature Learning, Deep Representation Learning, Land Cover Land Use (LULC)

Publications:

1. **Naived George Eapen**, Jossy P George (2024), Ensemble Representation Learning for Land Use Land Cover Classification," 2024 IEEE 4th International Conference on ICT in Business Industry Government (ICTBIG), Indore, India, 2024, pp. 1-6
   doi: 10.1109/ICTBIG64922.2024.10911832.
2. **Naived George Eapen**, Jossy P George (2024), Exploring Self-Supervised Learning Architectures for Image Processing: Milestones and Challenges," 2024 IEEE 4th International Conference on ICT in Business Industry & Government (ICTBIG), Indore, India, 2024, pp. 1-5
   doi: 10.1109/ICTBIG64922.2024.10911752.
3. **Naived George Eapen**, Jossy P George (2025), "Ensemble Learning Framework for Enhanced Land Use Land Cover Classification". Patent. Published Awaiting Examination. Application No: 202541011285. The Patent Office Journal No. 09/2025 Dated 28/02/2025.
4. **Naived George Eapen**, Jossy P George (2025), "Method for Cross-Model Self-Supervised Feature Extraction (CMSFE) in Remote Sensing Data". Patent. Published Awaiting Examination. Application No: 202541011374. The Patent Office Journal No. 09/2025 Dated 28/02/2025.
5. **Naived George Eapen**, Jossy P George (2025), "Cross-Model SSL Feature Extraction for Enhanced Remote Sensing Data Representation", Lecture Notes in Networks and Systems - Springer Nature, eBook ISBN: 978-981-96-4880-1 (Accepted: To be published).