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Notice for the PhD Viva-Voce Examination

Ms Sania Thomas, Registration Number: 1982410, PhD Scholar at the Department of Computer Science and Engineering, School of Engineering and Technology, CHRIST (Deemed to be University) will defend her PhD thesis at the public viva-voce examination on Friday, 26 September 2025 at 10.30 am in the Conference Room, Block I, Bangalore Kengeri Campus, Bengaluru 560074, Karnataka, India.

Title of the Thesis	:	**Non-Destructive and Cost-Effective Method for Sex Classification of Silkworm Pupa Using Machine Learning**
Discipline	:	**Computer Science and Engineering**
External Examiner - I	:	**Dr Rangith Baby Kuriakose** Associate Professor Department of Electrical, Electronic and Computer Engineering, Central University of Technology Free State (CUT), 20 Pres. Brand Street, Private Bag X20539 Bloemfontein, 9300, South Africa
External Examiner - II	:	**Dr Rajendra Hegadi** Associate Professor Department of Data Science and Intelligent Systems Indian Institute of Information Technology Dharwad Dharwad - 580009, Karnataka
Supervisor	:	**Dr Jyothi Thomas** 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.

Registrar (Academics)

Place: Bengaluru
Date: 08 September 2025

ABSTRACT

India, a leading exporter of silk, heavily relies on the sericulture industry for its economic and cultural development. The production of high-yielding hybrid silk cocoons necessitates efficient and accurate classification of silkworm pupae based on sex. Traditional methods, which involve manual inspection and cutting of cocoons, are labour-intensive and prone to errors. This study introduces non-destructive techniques using X-ray and camera imaging to classify FC1 and FC2 silkworm pupae within cocoons. By utilizing advanced feature extraction methods and machine learning algorithms, the proposed methods aim to enhance the accuracy and efficiency of pupae classification. The X-ray imaging technique involves Gaussian blur for noise reduction, Otsu's binarization for segmentation, and skewness correction to align pupae. Innovative width and height measurements, along with additional morphological features, are extracted and subjected to Linear Discriminant Analysis (LDA) for dimensionality reduction. An AdaBoost classifier optimized with grid search achieves classification accuracies of 97.1% for FC1 and 96.3% for FC2 during cross-validation, and 95.3% for FC1 and 95.1% for FC2 during external validation. This method demonstrates high computational efficiency and is suitable for applications requiring detailed anatomical insights. Conversely, the camera imaging method utilizes accelerated HOG(AHOG) for feature extraction proceeded with block level dimensionality reduction using LDA and a hybrid RFEXGBoost classifier for the classification process. The XGBoost classifier is enhanced with a Teaching Learning Based Population Selection Genetic Algorithm (TLBPSGA), achieves accuracies of 98.5% for FC1 and 98.2% for FC2. This method is distinguished by its computational efficiency and cost-effectiveness. The research highlights the potential of integrating non-destructive imaging technologies with machine learning to revolutionize silk production, boost productivity, and support sustainable development in sericulture. The findings offer valuable insights for both the scientific community and practical applications in agriculture and silk production.

Keywords: *Sericulture, Sex Classification, Machine learning, Accelerated Histogram Oriented Gradient (A-HOG), Teaching Learning Based Population Selection Genetic Algorithm (TLBPSGA).*

Publications:

1. **Sania Thomas** and Jyothi Thomas, "Non-destructive silkworm pupa gender classification with X-ray images using ensemble learning," Artificial Intelligence in Agriculture, vol. 6, pp. 100–110, 2022.
2. **Sania Thomas** and Jyothi Thomas, "Nondestructive and cost-effective silkworm, Bombyx mori (Lepidoptera: Bombycidae) cocoon sex classification using machine learning," International Journal of Tropical Insect Science, pp.1–13,2024, doi:10.1007/s42690-024-01207-7.
3. **Sania Thomas** and Jyothi Thomas, "An optimized method for mulberry silkworm, Bombyx mori (Bombycidae: Lepidoptera) sex classification using TLBPSGARFEXGBoost," Biology Open, vol. 13, 2024.
4. **Sania Thomas** and Jyothi Thomas, "A review on existing methods and classification algorithms used for sex determination of silkworm in sericulture," in Proceedings of the International Conference on Intelligent Systems Design and Applications (ISDA), 2020, pp. 567–579, Springer, doi: 10.1007/978-3-030-71187-0_52.
5. **Sania Thomas** and Jyothi Thomas, "Comparative Analysis of Non-Destructive Silkworm Cocoon Sex Classification Using Machine Learning Models Based on XRay and Camera Images," in Proceedings of the International Conference on Intelligent Algorithms for Computational Intelligence Systems (IACIS), 2024, pp. 1–7, IEEE, doi:10.1109/IACIS61494.2024.10721914.