

Venkatesh Thirugnana Sambandham

Data/Computer Vision Scientist

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Professional Summary

Experienced Data Scientist with over three years of expertise in developing and deploying machine learning models across various domains, including digital farming, medical imaging, and autonomous systems. Published track record of working on safe AI/ML frameworks, cloud platforms, and data science projects. Enthusiastic about contributing to innovative and impactful projects at your organization.

Experience

Otto von Guericke University

Magdeburg, Germany

Research Assistant

Sep 2022. – present.

- **safeTrAI Project:** Conducted Operation Design Domain (ODD) coverage testing and model validation, ensuring robust performance across diverse operational scenarios.
- Conducted comprehensive literature reviews and implemented state-of-the-art (SOTA) Uncertainty Quantification techniques for Deep Learning systems.
- Supervised Master Thesis and Co-Coordinated seminar on Machine Learning Safety topics.

BASF Digital Farming GmbH

Köln, Germany

Master Thesis Student

Oct. 2021 - May. 2022

- Designed and implemented an inter-sensor harmonization pipeline to minimize spectral differences among images sourced from various satellite platforms.
- Achieved approximately a 5% enhancement in structural similarity and spectral consistency compared to conventional techniques, demonstrating the efficacy of the proposed pipeline.

Working Student - Data Science

Mar. 2021 - Sep. 2021

- Conducted in-depth research focused on developing a Data-Driven Crop Disease Modeling system aimed at early detection of crop diseases.
- Analyzed diverse datasets from multiple sources, including Remote Sensing, meteorological data, and phenology-based features to identify early-stage crop stress.

Data Science Intern

Dec. 2020 - Feb. 2021

- Conducted meticulous analysis and data cleaning procedures, including rigorous temporal and geospatial data sanity checks, ensuring the quality and reliability of the generated dataset.
- Applied advanced feature engineering techniques using diverse Machine Learning frameworks, such as Gradient Boosting, Ensembled Tree Learning, LSTM models, and other multivariate time series frameworks.

Project

Medical Image - Super Resolution & Uncertainty Estimation

Aug. 2020 - Sept. 2021

- Conducted extensive literature review on Single-Image and MRI super-resolution techniques, informing research direction.
- Developed and evaluated advanced architectures for 3D MRI super-resolution, demonstrating expertise in image processing.
- Implemented scalable training framework and explored novel uncertainty quantification methods, contributing to robust model development and leadership in team projects.

Education

Otto von Guericke University

M.Sc, Digital Engineering. Grade 2.0

Relevant Coursework: [Machine Learning, Deep Learning, Medical Image Super-Resolution (project)]

Magdeburg, Germany

Apr 2019 - Jun 2022 [Thesis grade: 1.0]

Mepco Schlenk Engineering College

Bachelors in Mechanical Engineering. Grade 1.8

Sivakasi, India

Apr 2013 – Apr 2017

Technical Skills

Programming : • Python • JAVA • C++ • COBOL **OS :** • linux • Windows

Deep Learning Frameworks: • Pytorch • Tensorflow • huggingface • LightningAI

MLOPs : • Version Control (Git) • Docker • wandb (Model Tracking & Configurations Management) • AWS - EC2, S3, Sagemaker

Computer Vision : • Semantic Segmentation • Object Detection • Panoptic Segmentation • Image Enhancement and Restoration • Uncertainty Quantification • Data Drift and Out of Distribution Detection

• Image Analysis • Pattern Recognition • Medical Image Processing • Contrastive Learning • Feature Extraction

Probabilistic Deep Learning : • Bayesian Neural Networks • Gaussian Processes • Monte-Carlo Simulation

• Deep Ensembles • Laplacian Approximation

Machine Learning & Statistics : • NumPy • Scikit-Learn • Scipy • Pandas • Gradient Boosting methods

• Stochastic Optimization Algorithms • Model Confidence Calibration • Key Performance Indicators (KPIs) and Operational Design Domain (ODD) Definition • Significance Testing

Soft Skills

Languages : • *English* – Professional Fluency • *Deutsch* – Pre-Intermediate Level • *Tamil* – Mother Tongue

Writing & Presentation Tools : • \LaTeX • RevealJS • Beamer • DrawIO

Publications

Remote Sensing and Applications

- **Venkatesh Thirugnana Sambandham**, Konstantin Kirchheim, Frank Ortmeier, and Sayan Mukhopadhyaya. **Deep learning-based harmonization and super-resolution of Landsat-8 and Sentinel-2 images.** ISPRS Journal of Photogrammetry and Remote Sensing (impact factor: 12.7), doi: <https://doi.org/10.1016/j.isprsjprs.2024.04.026>
- **Sambandham, V. T.**, Kirchheim, K., Mukhopadhyaya, S., Ortmeier, F. (2022). **Towards transformer-based homogenization of satellite imagery for Landsat-8 and Sentinel-2.** Transformers Workshop for Environmental Science, <https://doi.org/10.48550/arxiv.2210.07654>
- **Thirugnana Sambandham, V.**, Shankar, P., Mukhopadhyaya, S. (2022). Early onset yellow rust detection guided by remote sensing indices. Agriculture 12(8), 1206, doi: <https://doi.org/10.3390/agriculture12081206>

Machine Learning Safety

- **Thirugnana Sambandham, V.**, Kirchheim, K., Ortmeier, F. (2023). **Evaluating and Increasing Segmentation Robustness in CARLA.** In Proceedings of **SAFECOMP 2023 Workshops**. Lecture Notes in Computer Science, vol 14182. Springer, Cham. https://doi.org/10.1007/978-3-031-40953-0_33

Medical Imaging

- Chatterjee S, Sciarra A, Dünnwald M, Ashoka ABT, **Sambandham V**, Oeltze-Jafra S, et al. **Uncertainty quantification for ground-truth free evaluation of deep learning reconstructions.** In Proceedings of **ISMRM-ESMRMB 2022, London**, doi: <https://doi.org/10.58530/2022/1875>