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SUMMARY

Ph.D. Research Scientist and Data Science Lead with 7+ years of experience bridging the gap between complex scientific domains (Semiconductors, Life sciences, Materials science) and scalable AI solutions. As a Systems Thinker with expertise in Algorithm Design, I translate ambiguous physical and biological problems into rigorous mathematical models and production grade software. Proven proficiency in building and deploying robust computational workflows (Docker, WIPP) and validating AI models against physical ground truths to drive decision-making in high-stakes environments.

TECHNICAL SKILLS

Software and Infrastructure: Python, Java, R, Visual Basic (VB), ImageJ/Fiji, Git, Docker, Linux/HPC (SLURM), WIPP, MATLAB, Mathematica, CAD, Autodesk Moldflow, L^AT_EX, ParaView, Legacy plotting and statistical softwares.

AI & Data Science: PyTorch, Computer Vision, Scientific Python (SciPy, Scikit-learn, etc.), complex data visualization, statistical modeling, and time series analysis, spatiotemporal analysis, diffusion models, synthetic data generation.

Metrology and characterization: Tomography (ASTRA), semiconductor metrology, inverse problems, spectroscopy, Optical and Electron Microscopy, materials characterization, surface science, 3D Printing.

PROFESSIONAL EXPERIENCE

Research Scientist/Data Scientist - SSD, Information Technology Laboratory (ITL) **Jul 2022 - Present**
National Institute of Standards and Technology [C-Prometheus Computing], Gaithersburg, MD, USA

- **Algorithmic Metrology:** Characterized spatial and spectral metrics for **Critical Dimension (CD)** and Line Edge Roughness (LER), assessing their implications for manufacturing precision and process control in semiconductor lithography.
- **Simulations and Synthetic Data:** Mitigated critical data scarcity caused by prolonged neutron source shutdowns by designing a synthetic data pipeline. Demonstrated the effectiveness of data-driven simulations using a single measurement using a checkerboard-based class-balancing strategy to train **dual-domain AI segmentation** models with **>90%** label efficiency. Explained AI discrepancies with test sample segmentation using known physical phenomenon.
- **3D Tomography and Inverse problems:** Implemented **3D tomographic reconstruction** pipelines for neutron interferometry. Developed workflows to **quantify uncertainty** and correct for sensor defects (hot/dead pixels) in tomographic volumes. Implemented **registration** of image sequences and **inpainting** for sparse-sampled data.
- **Scalable Scientific Infrastructure:** Standardized the computational workflow for simulation, model training & inference for Neutron Interferometric Microscopy (**INFER**) by containerizing (**Docker**) and deploying plugins into the **Web Image Processing Pipeline (WIPP)**. Automated metadata generation to enable high-throughput scientific reproducibility.

Research Engineer – OGVFB, National Eye Institute (NEI) **Dec 2019 - Jul 2022**
National Institutes of Health [C-Astrix Technology Group], Bethesda, MD, USA

- **Systems Architecture:** Designed end-to-end 3D image analysis system to quantify subcellular organization in human RPE cells. Primary "Technical Translator," – converted biological expert insights into rigorous mathematical equations.
- **Advanced 3D Metrology:** Developed morphological segmentation and metrology algorithms to extract high-fidelity shape and distribution metrics for populations of cells from multichannel confocal stacks, solving spatial biology challenges. Implemented novel metrics to measure uncharacterized features such as retinal invaginations.
- **Validation & Impact:** Published results in npj Artificial Intelligence (2026).

Graduate Research Assistant – Complex Engineering Systems Lab (CESL) **Jan 2017 - Dec 2019**
The University of Akron, Akron, OH, USA

- Developed **sensor fusion** using a **client-server** based synchronized multi-Kinect™ system to improve tracking of landmark joints addressing body segment occlusion and sensor jitter. Demonstrated a classification system capable of recognizing poses live with <4 second latency using streaming sensor data.
- Engineered interpretable pattern recognition pipelines (Clustering, Dimensionality Reduction) to analyze skeletal joint trajectories. Applied these models to automated activity classification, forecasting, and explored diagnostic guidance.

Industrial Research Assistant - Avery Dennison, Mentor, OH, USA**Sept 2014 - Dec 2016**

- **Defect Analysis:** Investigated physical phenomena (coffee ring effect, additive migration) and chemical parameters (chain length, end-groups, etc.) to identify root causes of surface defects in industrial inkjet printing.
- **Surface Characterization:** Qualified formulations for pilot-scale production by optimizing additive selection using (wettability, contact angle hysteresis, etc.) and advanced spectroscopy techniques. Identified critical raw material quality anomalies to resolve persistent defect modes in vinyl prints. Findings were showcased at corporate conference.

ENGINEERING PROJECTS AND INTERSHIPS**Metallurgy Intern, Bharat Forge Ltd., Pune, MH, India****Nov - Dec 2010**

- Implemented a VB application to predict hardenability of steels by consolidating empirical mathematical models. Automated complex calculations for parameters (e.g. elemental composition, grain size), saving metallurgists' time.

Engineering Intern, WEG Equipamentos Elétricos S A., Jaraguá do Sul, SC, Brazil**May - Jul 2010**

- **WEG Automação (Automation):** Optimized the design of circuit breaker parts (Autodesk Moldflow), achieving >30% improvements in material efficiency, process cycle time, shrinkage & warpage, while improving mechanical properties.
- **WEG Pesquisa e Desenvolvimento (R&D):** Executed metallurgical welding qualification tests and quality assurance including hardness and micro hardness characterization coating thickness, and tensile tests.

Summer Intern, National Metallurgical Laboratory (NML), Jamshedpur, JH, India**May - Dec 2009**

- Used Ceramic Tracer particles to observe and analyze Residence Time Distribution dependence on particles' size, density, and teeter water flow in a pilot-scale Floatex Density Separator. Results published in a peer-reviewed journal.

Summer Intern, Precision Automation & Robotics India Ltd., Pune, MH, India**May - Jul 2008**

- Developed and implemented control logic and path-planning algorithms for a Rubik's cube solver. Created a GUI for generating discrete logical commands for the simulated robotic system.

SELECTED PUBLICATIONS

- AI Driven 3D Subcellular RPE Map Discovers Cell State Transitions in Establishment of Apical/Basal Polarity, **P. Sathe***, D. Ortolan*, et. al., *accepted*, npj Artificial Intelligence, 2026.
- Relating human and AI-based detection limits in scanning electron microscopy dimensional metrology, P. Bajcsy, **P. Sathe**, A. Vladoar, Journal of Micro/Nanopatterning, Materials, and Metrology 24 (4), 044201-044201.
- Data-driven simulations for training AI based segmentation of Neutron Images, **P. Sathe***, C. Wolf, Y. Kim, et al., Scientific Reports. 14 (1), 6614, 2024.

LEADERSHIP AND STRATEGY:

- **Reviewer:** Peer reviewer for **SciPy Conference** (2023, 2024, 2025) and **ICCV** (2024), **PLOS Computational Biology** (2025). Scribe for 2nd International Workshop on FAIR Containerized Computational Software (2023).
- **BienaTech (2014-2018):** Served as **CTO/Technical Advisor**. Authored federal research proposals (SBIR/STTR) and managed university-industry partnerships for R&D in applied ML, molecular dynamics, marine coatings and 3D printing.
- **Entrepreneurial Lead (REsoluT, NSF I-Corps 2019):** Led customer discovery and market validation for a deep-tech startup concept based on PhD research. Also served as **Mentor (BienaTech, NSF I-Corps 2018)**
- **NASA-SUITS (2018): Co-Lead for Team VEST**, managing a multidisciplinary team (**Top 10 in USA**) to design an Augmented Reality (AR) system to aid astronauts for extravehicular activity (EVA) spacewalks.
- **Northeast Ohio Student Venture Fund - NEOSVF (2014-2016): Partner.** Conducted technical due diligence on early-stage startups to advise on venture capital investment decisions.

EDUCATION**Ph.D. in Polymer Science (Data Science focus), The University of Akron****2019****M.Tech. & B.Tech.(Hons.) in Metallurgical and Materials Engineering, IIT-Kharagpur****2012**