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Abhishek (Abhi) Hanchate

"The future of manufacturing lies in the seamless integration of data, AI, and human ingenuity."– and I'm dedicated to making that future a reality. Recognized as one of **"SME's 30 Under 30"**, I drive innovation in AI-driven smart manufacturing. With experience across industry and research collaborations, I transform traditional machinery into secure intelligent systems by integrating IIoT sensors, advanced sensing schemes, and manufacturing cybersecurity.

Education

2021–Present **PhD, Industrial Engineering - Data Science and Machine Learning**,
Texas A&M University, US, Current GPA - 3.7,
Committee - Dr. STS Bukkapatnam (Chair), Dr. PR Kumar, Dr. ALN Reddy, & Dr. C Eksin

2018–2020 **Master of Science, Industrial Engineering - Data Science and Machine Learning**,
Texas A&M University, US, GPA - 3.8

2016–2017 **Student Exchange, Operations Research and Supply Chain Management**,
Nanyang Technological University, Singapore, GPA - 4.0

2013–2017 **Bachelor of Technology, Production Engineering and Industrial Management**,
College of Engineering, Pune (COEP), India, GPA - 4.0

Research Interests

Multimodal data, machine & deep learning, AI, Signal analysis, Federated Internet of Things (IoT), Smart additive manufacturing, Digital twins, Personalization, Recommendation systems, Cybersecurity

Work and Research Experience

Sep–Dec 2024 **Data Scientist Intern (Personalization and Recommendations)**, American Airlines, US
- Developing an in-house loyalty system for customer personalization and recommendation system via transactional and emotional sentiment scoring

Aug–Sep 2024 **Head Mentor for Machine Learning and AI**, Massachusetts Institute of Technology (MIT), US
- Managed a team of 4 to build KineX, an innovative physical therapy app that leverages multimodal pose estimation, wearable tech, and LLM-based recommendation system
- Delivered daily presentations for 40 students, simplifying AI concepts into engaging, digestible lessons while tracking program milestones

August 2023–Present **Research Associate**, Crider Foods, US
- Spearheading the smart transformation of can seaming process via smart manufacturing and industry 4.0
- Sensorized the seaming process with IoT sensors and developed a data sensing pipeline with data analytics and machine learning-based predictions

June 2023–Present **Founder**, AlignAI, US
- Developing a flagship end-to-end solution, **FusionPro**, for aligning, synchronizing, and fusing multimodal data with high spatio-temporal resolutions

June 2021–Present **Graduate Researcher**, Texas A&M Engineering Experiment Station (TEES), US
- Developing a framework for privacy-preserving federated and incremental learning for a network of manufacturers
- Aligned and synchronized multiple high-throughput data streams with best resolution of 10μs to bolster data richness and voxelized 3D-printed surfaces
- Employed an array of computer vision (CV), digital signal processing (DSP), and state-of-the-art (SOTA) ML techniques to estimate multimodal sensor data-based KPIs.
- Developed a plug-and-play open-source smart manufacturing implementation with real-time high-fidelity multimodal data

Jul–Dec 2020 **Data Scientist**, Texas A&M Aggies Football, US

- Developed a cross-platform web analytics app for an interactive and widget-friendly experience for the coach
- Utilized GPS, sleep, and biomechanics data to enhance team performance, productivity metrics, and KPI

Skills

Languages Python (NumPy, Pandas, Scikit-learn, Matplotlib, Bokeh, TensorFlow, Keras, PyTorch, Pygame, nltk, PySpark, OpenCV, SpaCy, Gensim), R, C, Cpp

Relevant Skills Data science & analytics, Machine & deep learning, Reinforcement learning, Federated learning, Active learning, Bayesian optimization, Data pipelines, Smart additive manufacturing, Cybersecurity

Tools MATLAB, Tableau, LabView, Basic SQL, AWS, Excel, Minitab, SAS JMP, PowerBI, Gurobi, LaTeX

Instruments Scanning Electron Microscope (SEM), Optical microscope, 3D Optical profilometer, Siemens controllers

Publications

1. **Hanchate, A.**, Tiwari, A., & Bukkapatnam, S. (2024). Toward digitally twinning the process of creating machine controller digital twins–A G-code generation scenario. *Manufacturing Letters*, 41, 1556-1567.
2. Balhara, H., Karthikeyan, A., **Hanchate, A.**, Nakkina, T. G., & Bukkapatnam, S. T. (2023). Imaging systems and techniques for fusion-based metal additive manufacturing: a review. *Frontiers in Manufacturing Technology*, 3, 1271190.
3. **Hanchate, A.**, Bukkapatnam, S. T., Lee, K. H., Srivastava, A., & Kumara, S. R. (2023). Explainable AI (XAI)-driven vibration sensing scheme for surface quality monitoring in a smart surface grinding process. *Journal of Manufacturing Processes*, 99, 184-194.
4. **Hanchate, A.**, Dave, P. S., Verma, A., Tiwari, A., Mishra, C. S., Kumara, S. R., ... & Bukkapatnam, S. T. (2023). A graphical representation of sensor mapping for machine tool fault monitoring and prognostics for smart manufacturing. *Smart and Sustainable Manufacturing Systems*, 7(1), 82-110.
5. Wang, K., Dave, P. S., **Hanchate, A.**, Sagapuram, D., Natarajan, G., & Bukkapatnam, S. T. (2022). Implementing an open-source sensor data ingestion, fusion, and analysis capabilities for smart manufacturing. *Manufacturing Letters*, 33, 893-901.

Conference Proceedings and Presentations

1. **Hanchate, A.** & Bukkapatnam, S. T. (2024). Smart and Secure Manufacturing: Maintainable Digital Twins (DTs) via Bayesian Optimization and Active Learning. *INFORMS Annual Conference*.
2. Aftabi, N., **Hanchate, A.**, Bukkapatnam, S. T., & Li, D. (2024). A Reinforcement Learning Framework for Dynamic Watermarking in the Industrial Machine Tool Controllers. *INFORMS Annual Conference*.
3. Aftabi, N., **Hanchate, A.**, Bukkapatnam, S. T., & Li, D. (2024). A Case Study on Optimal Watermarking in Machine Tool Controllers. *ASME International Mechanical Engineering Congress and Exposition*.
4. **Hanchate, A.** & Bukkapatnam, S. T. (2024). Revolutionizing the Canning Industry: A Leap Towards Smart Manufacturing. *IISE Annual Conference & Expo*.
5. **Hanchate, A.**, Balhara, H., & Bukkapatnam, S. T. (2023). Voxel-wise high resolution time-space alignment of multimodal signals - a process physics driven approach. *IISE Annual Conference & Expo*.
6. Karthikeyan, A., Balhara, H., Lianos, A. K., **Hanchate, A.** & Bukkapatnam, S. T. (2023). In-situ Surface Porosity Estimation in Direct Energy Deposition (DED) Process using Multimodal Sensor Fusion. *IISE Annual Conference & Expo*.

Panel Discussions and Invited Talks

1. Baetz J. A., Inskeep, J., Bukkapatnam, S. T., Dave, P. S., & **Hanchate, A.** (2021). IBM's Partnership with AT&T and Texas A&M University for Smarter Factories - A Panel Discussion. *IISE Lean Six Sigma and Data Science (LSSDS) Conference*.

Accepted and Preprints

1. Zhong, Y., **Hanchate, A.**, & Bukkapatnam, S. T. (2025). Safety and Production Quality Assurance in Human-Centric Collaborative Manufacturing and Assembly Systems. *CIRP Novel Topics in Production Engineering: Volume 3*
2. **Hanchate, A.**, Balhara, H., Chindepalli, V. S., & Bukkapatnam, S. T. (2024). Process signature-driven high spatio-temporal resolution alignment of multimodal data. *arXiv preprint arXiv:2403.06888*

Under Review

1. **Hanchate, A.**, Balhara, H., Chindepalli, V. S., & Bukkapatnam, S. T. (2023+). HiRA-Pro: High resolution alignment of multimodal spatio-temporal data: a process physics driven approach. *ASME Journal of Computing and Information Science in Engineering*.
2. Karthikeyan, A., Balhara, H., **Hanchate, A.**, Lianos, A. K., & Bukkapatnam, S. T. (2023+). In-situ surface porosity prediction in hybrid-directed energy deposition process using explainable multimodal sensor fusion. *Journal of Manufacturing Processes*.

In Preparation

1. Galla, S., **Hanchate, A.**, Garudkar, V., & Bukkapatnam, S. T. (2025+). End-2-end cyberattack resilience for machine tool controllers in manufacturing systems.
2. Aftabi, N., **Hanchate, A.**, Bukkapatnam, S. T., & Li, D. (2025+). DynaMark: A Reinforcement Learning Framework for Dynamic Watermarking in Industrial Machine Tool Controllers
3. **Hanchate, A.**, Tiwari, A., Kumar, P. R., & Bukkapatnam, S. T. (2025+). Dynamic Watermarking for Cybersecurity of Machine Tool Controllers.
4. **Hanchate, A.**, Das, D., Kumara, S. R., & Bukkapatnam, S. T. (2025+). PPmEDL: Privacy-preserving m-Edge Distributed Learning.
5. **Hanchate, A.** (2025+). Policy Inferencing in Multi-agent Reinforcement Learning.

Teaching Experience

Spring 2023	ISEN 281 - Modern Manufacturing Methods for Engineering Design, Texas A&M University
Fall 2022	ISEN 613 - Engineering Data Analysis, Texas A&M University

Mentoring Experience

Grads	Haopeng Tian, Vaishnavi Garudkar, and Raksheet Chawathe
Undergrads	Pranav Sundar, Andres Sanchez, Noah Lane, John Salvin, Ryan Palanna, Vishal Chindepalli, and Kerry Wang
Cross-university	Annika Sachdeva (Massachusetts Institute of Technology), Zenia Haroon (Duke University), Netra Rameshbabu (Northwestern University), Erin Brunson (University of North Carolina at Charlotte)

Professional Membership

2025–Present	Society of Manufacturing Engineers (SME)
2022–Present	Institute of Industrial and Systems Engineers (IISE)
2017–Present	Institute for Operations Research and the Management Sciences (INFORMS)

Leadership and Honors

2025	**Data Science Ambassador Scholarship**, Texas A&M Institute of Data Science (TAMIDS)
2025	**Dr. Milden J. Fox Jr. '69 and Mary P. Fox '73 Fellowship**, Texas A&M University
2025, 2024	**Finalist**, IISE Annual Conference Data Analytics & Information Systems (DAIS) Competition
2024	**SME's "30 Under 30" 2024**, Society of Manufacturing Engineers Recognized as a talented young leader in manufacturing
2024, 2023	**Industrial & Systems Engineering Travel Award**, Texas A&M University

2023 **NSF I-Corps Texas A&M University Site**, National Science Foundation (NSF)
Recipient of a $\$5{,}000$ grant for entrepreneurial venture of multimodal data synchronization and alignment for AI

2023 **Student Researcher Travel Award**, National Science Foundation (NSF)

2019–2020 Executive Director, **INFORMS Student Chapter** at Texas A&M University

2016 Led a team and secured a **Guinness World Record** for creating the largest floating image