ARJUN SRINIVASAN AMBALAM

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PROFESSIONAL SUMMARY

Applied AI Scientist with **6+ years of experience** building and deploying **production-scale ML systems**, specializing in **generative AI, synthetic data, and large-scale image/video synthesis**. Expert in **diffusion, VAE, and temporal deep learning models** with proven impact across **manufacturing and geospatial domains**. Adept at **bridging research and engineering** to deliver **scalable, high-impact solutions**..

EDUCATION

University of Maryland at College Park — College Park, MD
M.Eng. in Robotics Engineering GPA: 3.94 / 4.0 — *August 2019–May 2021*

National Institute of Technology — Tiruchirappalli, Tamil Nadu,India
B.Tech in Mechanical Engineering — *July 2013–May 2017*

TECHNICAL SKILLS

Programming & Scripting: Python, C++, SQL, Bash.
Machine Learning & AI: PyTorch, TensorFlow, Lightning, Transformers, OpenCV, Optuna, XGBoost, SpaCy.
Generative & Video AI: Latent Diffusion, Video Synthesis & Frame Interpolation, Synthetic Data Generation
MLOps & Deployment: Docker, MLflow, DVC,, Weights & Biases (W&B), FSDP, Deepspeed, Model Optimization ,TensorRT.
Big Data & Cloud: GCP, AWS (S3, EC2), Azure Data Factory.
Collaboration & Tools: Git, Jira, Agile/Scrum, Lucidchart.

PROFESSIONAL EXPERIENCE

Fraunhofer USA Center Mid-Atlantic (CMA) — ***Riverdale, MD***
Research Data Scientist — **Oct 2020 – Present (4 yrs)**
Driving applied research and deployment of generative and predictive AI models for high-impact industrial and geospatial applications funded by NSF and DoD.

- ***Image Synthesis for Geospatial AI*** – Engineered a **latent diffusion + VAE pipeline** for aerial image generation, enabling **controlled synthetic augmentation** (illumination, shadows, contrast) that improved segmentation **mIoU by 3%** on ISPRS Potsdam.
- ***Predictive Video Modeling*** – Architected **CNN-LSTM generative models** for crystal growth sequence forecasting, achieving **~99% accuracy** with **6-hour early anomaly detection**; integrated **DVC versioned pipelines** for reproducibility and scalability.
- ***Real-Time AI for Manufacturing*** – Led cross-functional design of a **3 ms latency inference pipeline** integrating multi-modal sensors (camera, audio, 3D scanner) with **Triton Inference Server**, reducing weld defects by **30%**.
- ***AI Robustness & Testing Frameworks*** – Built a testing platform for image classification, detection, and segmentation systems under adversarial noise and perturbations, integrating **latent diffusion models and GANs** to enhance model coverage in edge cases.
- ***Leadership & Collaboration*** – Mentored **4 engineers/interns**, guided sprint planning, and implemented MLOps best practices for distributed multi-GPU training and mlflow-driven automation.
- Authored **3 peer-reviewed papers**; contributed to transitioning advanced research into **production-deployable systems**.

University of Maryland, College Park — ***College Park, MD***
Research Assistant — **Jun 2020 – Oct 2020 (5 months)**

- **Developed trust-aware reinforcement learning policies** using **PPO in PyTorch** for socially compliant robot navigation in shared environments.
- Built and curated a **multi-modal dataset of 200+ natural language instructions** and simulated navigation tasks in **Gazebo and ROS** for real-time testing.
- Co-authored a paper at **IEEE ICRA**, advancing research in interpretable reinforcement learning and multi-modal AI systems.

SimInsights — ***Irvine, CA***
Machine Learning Intern — **May 2020 – Jun 2020 (2 months)**

- Built a **synthetic data generation pipeline** using Unity3D and NVIDIA Isaac Sim, enabling domain-randomized datasets for industrial object detection tasks.
- Trained and optimized **YOLOv3 models with NVIDIA TLT** and **TensorRT**, achieving **real-time inference speeds** on Jetson Nano devices.
- Automated simulation workflows with Python scripting, reducing dataset generation time by **40%** and improving model generalization across edge environments.

Fiat Chrysler Automobiles (FCA) *Chennai, India*
R&D Engineer **Jul 2017 – Jul 2019 (2 years)**

- Designed and deployed a **vision-based occupant detection system** using TensorFlow, optimizing **HVAC automation** for in-cabin thermal comfort.
- Integrated **real-time computer vision pipelines** with Raspberry Pi controllers, reducing response latency by **~40%** during field validation.
- Partnered with cross-functional teams to embed AI modules into vehicle prototypes, bridging research and production integratio

RELEVANT PROJECTS

Adversarial Reinforcement Learning for Autonomous Driving | Github

Developed a **learning-based adversarial framework** to generate failure scenarios for rule-based autonomous driving agents using **PPO and TD3**.

- Formulated **adversarial rewards** to train surrounding agents to degrade ego-agent performance (measured by **~30% reduction in cumulative reward**).
- Designed a **defense pipeline** (Robust-PPO) to improve ego-agent resilience against adversarial attacks, achieving **higher rewards and longer episode durations**.
- Extended **Highway-Env simulator** for multi-agent adversarial training with kinematic observations (5×5 vehicle feature arrays) and discrete meta-actions.

Visual Odometry Implementation from scratch using python | Github

- **Developed a Visual Odometry Pipeline:** Engineered a full Visual Odometry (VO) pipeline from the ground up in **Python**, including both a custom solution and an **OpenCV** implementation.
- Implemented key computer vision algorithms like the **8-point algorithm** for fundamental matrix estimation and RANSAC for robust pose estimation, demonstrating strong mathematical and theoretical understanding.
- Utilized **SIFT** and **FLANN** for feature detection and matching, and created algorithms for rotation and translation estimation to reconstruct the camera's 3D motion.

LLaMA 3 Model Optimization and Alignment (July 2024)

- Fine-tuned LLaMA 3-8B using LoRA on UltraChat-200K, improving AlpacaEval win-rate by 15.3% to 68.7%.
- Applied Direct Preference Optimization with HH-RLHF dataset, achieving 74.5% win-rate and 17% better MT-Bench helpfulness.
- Utilized memory-efficient techniques to optimize large language model performance under computational constraints.

Deep Learning for User Requirement Classification

- Fine-Tuned **BERT**-based sequence classifier to automatically categorize online user feedback, achieving **87%**overall accuracy and outperforming previous benchmarks.
- Successfully addressed **small dataset** limitations by leveraging transfer learning, achieving over **91%** precision and recall with minimal task-specific training data.

PUBLICATIONS

- V. S. Dorbala, A. Srinivasan, and A. Bera, "Can a robot trust you?: A drl-based approach to trust-driven human-guided navigation," in 2021 IEEE International Conference on Robotics and Automation (ICRA),2021, pp. 3538–3545.
- Mekala, R. R., Srinivasan, A., Muehle, M., Garratt, E., Porter, A., & Lindvall, M. (2025). AI-guided frame prediction techniques to model single crystal diamond growth. *Journal of Vacuum Science & Technology A*, *43*(3).
- Mekala, R. R., Garratt, E., Muehle, M., Srinivasan, A., Porter, A., & Lindvall, M. (2024). AI-Guided Defect Detection Techniques to Model Single Crystal Diamond Growth. *arXiv preprint arXiv:2404.07306*.
- Mekala, R. R., Garratt, E., Muehle, M., Srinivasan, A., Porter, A., & Lindvall, M. (2024). AI-Guided Feature Segmentation Techniques to Model Features from Single Crystal Diamond Growth. *Key Engineering Materials*, *993*, 67-74.
- Nandakumar, G., Srinivasan, A., & Thondiyath, A. (2018). Theoretical and experimental investigations on the effect of overlap and offset on the design of a novel quadrotor configuration, VOOPS. *Journal of Intelligent & Robotic Systems*, *92*(3), 615-628.