Darrin Bright

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Research Interests

Medical Imaging | 3D Vision | Multimodal Learning

Education

Vellore Institute of Technology (VIT) — Vellore, India
Integrated Master of Technology in Software Engineering — *2022 – 2027 (Expected)*

CGPA: 8.78/10.0
Relevant Coursework: Artificial Intelligence, Machine Learning, Natural Language Processing, Data Mining, Database Management Systems, Python Programming

Publications

[1] D. Bright, R. Raj, K. Keisham. "PortionNet: Distilling 3D Geometric Knowledge for Food Nutrition Estimation." *Accepted at Conference on Vision and Intelligent Systems (CVIS)*, 2025. [arXiv][GitHub]

[2] D. Bright, P. Kumar. "Explainable Transfer Learning Ensemble with Dynamic Weighting for Kidney Disease Classification in CT Images." *Under review at Cogent Engineering.* [GitHub]

Research Experience

Indian Institute of Technology, Hyderabad — Hyderabad, India
Research Intern | Advisor: Dr. Krishna Mohan — *December 2025 – Present*

- Exploring vision–language models and federated learning applied to medical image segmentation and detection.

Simon Fraser University — Vancouver, Canada
Research Intern | Advisor: Dr. Ghassan Hamarneh — *December 2025 – Present*

- Developing a deep learning pipeline for automated Mitochondria-Endoplasmic Reticulum Contact Site detection from 3D STED microscopy by implementing a 3D U-Net with physics-based simulation.

Vellore Institute of Technology — Vellore, India
Undergraduate Researcher — *July 2025 – November 2025*

PortionNet: Distilling 3D Geometric Knowledge for Food Nutrition Estimation
Advisor: Dr. Kanchan Keisham

- Developed PortionNet, a novel cross-modal knowledge distillation framework that allows RGB models to learn 3D geometric features from point clouds during training, eliminating depth sensor requirements at inference.
- Designed a dual-mode training strategy with a lightweight RGB-to-Geometry Adapter that learns to generate pseudo-3D features for accurate geometric reasoning from a standard RGB image.
- Achieved state-of-the-art performance on MetaFood3D dataset with 17.43% volume MAPE and 15.36% energy MAPE. Cross-dataset evaluation on SimpleFood45 achieves state-of-the-art energy estimation (12.17% MAPE), demonstrating effective generalization.

Explainable AI Framework for Kidney Pathology Classification from CT Scans
Advisor: Dr. Praveen Kumar

- Designed a dynamic weighted ensemble combining MobileNetV2, ResNet-50, and EfficientNet-B1 for multi-class kidney disease classification on 12,446 CT images across four diagnostic categories.
- Implemented explainability framework using Grad-CAM and LIME with domain-specific augmentations to provide interpretable predictions for clinical decision support.

- Achieved 99.14% test accuracy using focal loss with label smoothing, effectively addressing class imbalance.

Indian Institute of Technology, Jodhpur   Jodhpur, India
Research Intern | Advisor: Dr. Deepak Mishra   *May 2025 – July 2025*

Self-Supervised Medical Image Segmentation with Vector Quantization

- Developed a hierarchical vector quantization framework that addresses limited labeled data in medical imaging by learning discrete representations from 2,594 unlabeled ISIC 2018 images and using them as structured regularizers during segmentation fine-tuning on the PH2 dataset.
- Designed three-stage training pipeline integrating VQ-VAE, SimCLR contrastive learning and segmentation fine-tuning, with multi-layer quantization capturing features across semantic scales.
- Achieved 79.76% Dice score with +1.38% consistent improvement over baseline without VQ across multiple runs, demonstrating the effectiveness of discrete representations as regularizers for medical imaging with limited labeled data.

Ablation Study: Vector Quantization Integration in Transformer based Segmentation

- Conducted 13-experiment ablation study on Pascal VOC 2012 dataset investigating vector quantization integration with Swin Transformer encoders, testing codebook configurations, fusion mechanisms and initialization strategies.
- Achieved 74.61% Dice score with optimized vector quantization configuration, demonstrating +7.34% improvement over baseline CNN and +3.91% over vanilla Swin Transformer, validating VQ effectiveness for semantic segmentation.

Technical Skills

Languages: Python, C++, C, SQL
ML/DL Frameworks: PyTorch, TensorFlow, Keras, Transformers
Computer Vision: OpenCV, PointNet, Albumentations, torchvision
Tools & Libraries: NumPy, Pandas, Matplotlib, Seaborn, SciPy, scikit-learn

Honors & Awards

- **Runner-up**, Startup Demo Day, Vellore Institute of Technology, 2025
- **Second Runner-up**, HackWar Hackathon, Vellore Institute of Technology, 2025
- **Winner**, Project 2039 Hackathon, Vellore Institute of Technology, 2024
- **Winner**, Alphaforge Ideathon, Vellore Institute of Technology, 2024
- **Runner-up**, Biomimicry Innovation Challenge, Vellore Institute of Technology, 2024

Service & Leadership

IEEE Robotics and Automation Society, VIT   Vellore, India
Chairperson   *December 2024 – Present*

- Lead student chapter of 500+ members, organizing technical workshops, hackathons, and research talks focused on robotics, machine learning, and automation technologies.
- Mentor junior students through hands-on sessions on ML fundamentals, Generative AI frameworks (LangChain, LLMs).

National Service Scheme   Vellore, India
Volunteer   *2023 – 2024*

- Engaged with government school students conducting career guidance sessions on educational pathways and professional opportunities.