

Latchan Chhetri

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Profile & Research Focus

My research centers on building efficient, scalable deep learning systems for high-degradation and low-resource environments. I specialize in applying novel state-space models, self-supervised pretraining, and uncertainty-aware learning across diverse domains, ranging from biomedical signal processing and medical imaging to complex computer vision and document analysis. Driven by end-to-end ML workflows, I actively open-source my architectures and am preparing for a direct PhD to advance foundational AI representations.

Education

Sikkim Manipal Institute of Technology (SMIT)

Bachelor of Technology in Computer Science and Engineering (Data Science)

Sikkim, India

Expected 2027

Experience

Research Intern - (Computer Vision, OCR & Document Analytics)

Indian Statistical Institute, Kolkata

Jun 2026 – Present

Hybrid

- Conducting research in computer vision, degraded document analysis & OCR under the supervision of Prof. Umapada Pal.
- Investigating deep learning architectures for text and image restoration, bypassing traditional segmentation bottlenecks.

Research Intern - (Computer Vision, OCR & Document Analytics)

The University of Salford

Jun 2026 – Present

Remote

- Collaborating internationally on scene text recognition and sequence modeling frameworks under the joint supervision of Prof. Shivakumara Palaiahnakote.

Undergraduate AI Researcher & Team Lead (Computer Vision)

Sikkim Manipal Institute of Technology (SMIT)

Sept 2025 – Present

Onsite

- Spearheaded independent research in deep learning architectures, authoring 5+ first-author and senior-author manuscripts across computer vision, biomedical imaging, and OCR domains.
- Directed and mentored student research teams, teaching core methodologies and guiding end-to-end projects from conceptualization to multiple acceptances in IEEE venues.
- Developed and open-sourced novel, hardware-efficient state-space models for high-throughput sequence and spatial modeling.
- Collaborated on cross-disciplinary uncertainty-aware AI frameworks with distinguished faculty, including highly cited researchers (Dr. Swalpa Kumar Roy, Prof. Palash Ghoshal).

Data Science Intern

Soft Nexis Technology

Jul 2025 – Aug 2025

Remote

- Engineered and deployed **RealVisor**, an end-to-end AI real estate analytics platform, developing a robust predictive pipeline utilizing **XGBoost** and **Random Forest Regressors** to estimate property valuations based on complex spatial and architectural features.
- Conducted rigorous model evaluation across curated real-world housing datasets, with the optimized Random Forest architecture achieving the peak R^2 performance, strictly outperforming baseline linear regression models.
- Designed a production-ready **Streamlit** dashboard integrating interactive market trend visualizations, a dynamic property recommendation engine, and automated EMI calculations for data-driven investment analysis.

Research Manuscripts

- **L. Chhetri**, A. Datta, P. Ghosal. "Attention-Enhanced Swin Transformers for Robust Brain Tumor Classification Under Patient-Level Data Splitting." *Accepted at IEEE GCON, 2026.*
- **L. Chhetri**, Aman Kumar. "Beyond Limited Labels: Safe Semi-Supervised Learning for Malaria Diagnosis." *Under Review at IEEE DSAA, 2026.*
- **L. Chhetri**, A. Kumar, G. Sarma. "Deep Delta Vision Mamba: A Lightweight State Space Architecture with Deep Delta Learning for Efficient Remote Sensing." *Accepted at IEEE CONECCT, 2026.*
- **L. Chhetri**, A. Kumar. "DDV-GNet: High-Throughput Defect Detection for Space Manufacturing via Deep Delta Gated Networks." *Accepted at IEEE SPACE, 2026.*
- R. Das, **L. Chhetri**, A. Kumar, P. Ghosal. "Intrinsic Neural Firewalls for Cyber-Physical Systems: Robust Anomaly Rejection via Deep Delta Residual Overwrites." *Under Review at WIN 6.0, 2026.*
- R. Verma, A. Kumar, H. Das, **L. Chhetri**, P. Ghosal. "Interpretable Solar Panel Defect Detection via Fuzzy Rule Extraction from Deep Learning Architectures." *Under Review at WIN 6.0, 2026.*
- A. Kumar, A. Mukherjee, H. Das, **L. Chhetri**, P. Ghosal. "Risk-Controlled Urban Change Detection: Conformal Prediction Wrappers for Provable Reliability in High-Resolution Satellite Imagery." *Under Review at ICCI, 2026.*
- **L. Chhetri**, A. Kumar. "Optimizing Deep Learning for Brain Tumor Classification: A Comparative Ablation Study of Preprocessing and Augmentation Strategies." *Accepted at IEEE GCON, 2026.*

Active Research & Projects

Ionospheric TEC Forecasting

Under Review at Advances in Space Research (SCIE Q2) | PyTorch, Deep Delta Learning, Conformal Prediction

- Co-authored a CNN-DDL architecture featuring a dynamic β -gate that conditions real-time solar wind drivers to scale non-linear corrections over physical persistence baselines.

- Evaluated via zero-shot cross-solar-cycle testing (SC25 to SC24), achieving SOTA storm-time error rates (2.30 RMSE) and outperforming deep sequential baselines and IRI-2020.
- Integrated Marginal Split Conformal Prediction to establish distribution-free uncertainty quantification, providing a mathematically guaranteed 90% empirical coverage bound during extreme geomagnetic superstorms.

DDL-Mamba – Geometric Residual Learning for 3D Medical Image Segmentation

Targeting Journal of Biomedical and Health Informatics (Q1) | PyTorch, U-Mamba, DDL, 3D Medical Imaging

- Developing a novel **Delta-Mamba** framework integrating **Deep Delta Learning (DDL)** blocks into a U-Mamba backbone for 3D volumetric medical image segmentation, targeting concentric cardiac structures on the **ACDC** and **Synapse** benchmarks.
- Engineered a **DDL** block with **L2-normalized, Softplus-constrained** weights to enforce strictly non-negative global slot amplitudes, stabilizing the geometric manifold across deep encoder layers and resolving the representation drift inherent in dense 3D State Space Models.
- Implemented β -gate visualization providing a geometrically interpretable, layer-wise explainability mechanism for segmentation decisions — structurally impossible in standard Transformer or prior Mamba-based architectures.
- Experiments currently in progress; architecture validated on ACDC cardiac and Synapse datasets.

Degraded Ancient Ashokan Brahmi Script Recognition (ML/CV Lead)

Targeting ICDAR (2027) | PyTorch, WGAN-GP, SimCLR, OCR Pipelines

- Leading a computer vision team alongside A. Anand, A. Kumar, and G. Sarma to engineer a data generation and ETL pipeline using WGAN-GP to synthesize 20K+ Brahmi characters, applying physically-motivated degradation to construct a 150K sequence dataset.
- Developed an end-to-end OCR architecture integrating SimCLR self-supervised pretraining on a ResNet34 backbone with a BiLSTM-CTC decoder.
- Conducted a synthetic-to-real domain gap study, establishing the first severity-based Character Error Rate (CER) evaluation benchmark for ancient Indic scripts.

AHF-RBFNet – Medical Image Segmentation

Targeting Expert Systems with Applications (Q1) | PyTorch, AHF-Net, Fuzzy Logic

- Collaborating under the supervision of Dr. Swalpa Kumar Roy and Prof. Palash Ghoshal to engineer AHF-RBFNet by integrating a learnable Radial Basis Function (RBF) fuzzy membership kernel into an Attention-Guided Hierarchical Fusion U-Net to dynamically filter semantic uncertainty.
- Achieved SOTA performance on the ISIC 2016 dataset (84.55% IoU, 91.97% Dice), strictly outperforming 11 baselines including the original AHF-U-Net architecture.
- Orchestrated massive hyperparameter optimization via Optuna and executed rigorous multi-dataset evaluations (ISIC, BUSI, PH2) with systematic 5-variant ablation studies.

Honors, Certifications & Academic Service

- **Technical Peer Reviewer:** Invited and served as an official peer reviewer for the **IEEE GCON** conference, evaluating manuscripts in applied deep learning and computer vision.
- **Top 1% Topper & Gold Medalist:** Introduction to Internet of Things, NPTEL (Funded by MoE, Govt. of India). Elite score: 91%.
- **Deep Learning & AI Certifications:** NLP with DL, PyTorch for Medical Imaging (Udemy); GenAI for Data Scientists (Coursera); Applied Machine Learning (AMII).

Technical Skills

Languages & Frameworks: Python, C, Java, PyTorch, TensorFlow, Keras, Streamlit, LaTeX, Git, GitHub

Computer Vision: Vision Transformers, Mamba, SSMS, U-Net, CNNs, Deep Delta Learning, Diffusion Models, GANs, YOLO, CNN's

Signal Processing & NLP: 1D CNNs, Signal Analysis, Spacy, NLTK, Text Mining, OCR Pipelines

Data Engineering & Tools: Pandas, NumPy, SciPy, Scikit-learn, ETL Workflows, Hadoop, Spark