DEEPAN SADHUKHAN

Phone: +91 70035 74257 Kolkata, West Bengal, India
Email: sadhukhandeepan@gmail.com LinkedIn: linkedin.com/in/deepan-sadhukhan
GitHub: github.com/DeepanIsCool Website: deepansadhukhan.com Google Scholar: Google Scholar Profile

EDUCATION

Institute of Engineering & Management, Kolkata, India Jul 2023 – Jul 2027 (expected)
Bachelor of Technology (BTech), Computer Science and Engineering (AI and Machine Learning)

M. P. Birla Foundation Higher Secondary School, Kolkata 2023
Indian School Certificate (ISC, Class XII), CISCE

Meghmala Roy Education Centre, Kolkata 2021
Indian Certificate of Secondary Education (ICSE, Class X), CISCE

PUBLICATIONS

CultureHaystack: Probing Per-Image State and Attribute Binding in Multi-Image VLMs **WACV 2027** *(Workshop poster)*
- Multi-image VLM benchmark: given up to 5 photos of cultural items, name one photo's item and country.
- Of 6 open VLMs (3–12B), 7B-plus stayed accurate; smaller ones kept 53–65% of single-photo answers.

The Quantized Blind Spot: Task-Asymmetric Collapse in Foundation Vision–Language Models for Medical Imaging **IEEE IPTA 2026** *(Accepted)*
- Built the evaluation harness: 7 open VLMs (3–26B), 5 bitsandbytes precisions, 10 medical datasets.
- At 4-bit NF4, classification lost at most 3.7 points while SAM2 segmentation Dice fell by up to 11.8.
- Traced 71% of Qwen2.5-VL-7B's 4-bit loss to its LLM; box parse failures tracked Dice loss ($r = 0.84$).

SAFE-Bench: A Sensor-Aware Framework for Evaluating Detection and Vision-Language Models **IEEE IPTA 2026** *(Accepted)*
- Models see only RGB frames while radar, GNSS and IMU signals enrich scoring, over 3 sensor setups on TIAND.
- Benchmarks YOLOv5/v8/v26, SAM, Grounding DINO and YOLO-World with 5 new sensor-aware metrics.

When Explainability Goes Silent: Diagnosing XAI Failure Modes in Medical Imaging **IEEE IPTA 2026** *(Accepted)*
- Faithfulness test of 6 explanation methods on 7 CNN, Transformer and VLM models over BUSI and KvasirSEG.
- Only Integrated Gradients and SHAP kept Deletion AUC under 0.43 on all classifiers; LIME collapsed.

HiLEx: Image-Based Hierarchical Layout Extraction from Question Papers **ICDAR 2025** *(Springer LNCS)*
- Layout benchmark of 1,965 exam-paper pages from 8 exams, with 18,152 boxes in 6 hierarchical classes.
- Detectron2 baseline reached 94.0% mAP@50, ahead of YOLOv8 (84.8%) and zero-shot PaliGemma2.

RESEARCH EXPERIENCE

Multi-agent driving without traffic signals Oct 2026
Supervised research, Institute of Engineering & Management; Vega HPC cluster *Kolkata*
- Built a 41-junction MetaDrive city and an independent per-agent PPO-Lagrangian trainer.
- Ran two pre-registered studies via Slurm and Apptainer: 10 PPO variants, 7 junction scenes, 350 runs.
- MAPPO-Lagrangian reached 0.906 mean arrival vs 0.705 for independent PPO, which froze in 78 of 105.
- Safety budgets cut first-come-first-served accuracy at an isolated crossing from 0.94 to 0.83–0.87.
- Fixed a 33 MB-per-reset memory leak and a ray-cast seam crash that killed about 1 in 300 episode resets.

Text-to-image bias and reward-model pilots Oct 2026
Self-directed, with a small team *Kolkata*
- Designed and ran bias pilots on 4 open text-to-image models and GPT-Image-2.5 with permutation tests.
- Qwen-Image drew a woman for 14.6% of single-person prompts at 1:1 but 27.1% at 9:16 ($p = 0.0005$).
- CLIP and PickScore favoured images with the caption's noun written in over a nonword (92%, 90%).
- Falsified two further hypotheses in the same round, at a total cost of about $7.40.

Long-audio evaluation of audio-language models Sep 2026
Research collaboration with CNH Industrial India and ISI Kolkata *Kolkata*
- Built the evaluation harness for 21 model configurations on AMI meeting audio and scored 181,745 results.
- Covered 13 open audio-language models from 7 families, 4 Whisper cascades, Gemini and GPT-audio.
- Ran the 17 local configurations as resumable RunPod GPU job chains; flagged 3 models hearing only 30 s.
- All 20 systems lost accuracy as audio grew; in 17, errors shifted to the most-repeated competing mention.
- Qwen2.5-Omni-7B beat its Whisper text cascade by 23.3 points on full 5-minute recordings.

Adversarial audit of remote-sensing VLMs Aug 2026
With a senior collaborator *Kolkata*

- Ported a PGD attack to 5 remote-sensing VLMs, from GeoChat and RS-LLaVA to LHRS-Bot-Nova.
- Detection-crafted noise flipped 92.0% of LHRS-Bot-Nova's EarthVQA answers vs 0.9% for random noise.
- Same transfer on RS-LLaVA: 91.7% of answers flipped against 3.7% for size-matched random noise ($n = 375$).
- Removed GeoChat's vision-tower no-grad wrapper so attack gradients reach the input image.
- Swapped RS-LLaVA's broken cached generation for uncached greedy decoding; added gradient preflights.

JEPA for vision transformer hashing Aug 2026
Self-directed; extends the Vision Transformer Hashing codebase *Kolkata*

- Added I-JEPA masking, a narrow ViT predictor and an EMA target encoder to the hashing codebase.
- Wrote one trainer over 6 hashing losses (DSH, HashNet, GreedyHash, IDHN, CSQ, DPN) with 3 JEPA modes.
- Frozen I-JEPA ViT-H/14 beat a same-size supervised ViT-H/14 in 18 of 18 MS-COCO settings (+0.078 mAP).
- Peaked at 0.841 mAP@5000 on MS-COCO (CSQ, 64-bit); I-JEPA also won 15 of 18 settings on CIFAR-10.
- Traced a DSH artefact to unnormalised features; the fix made DSH the largest win (+0.122 mAP).

Geospatial foundation-model embeddings Jun 2026 – Jul 2026
Research collaboration on geospatial foundation models *huggingface.co/DeepanSadhukhan*

- Published frozen 768-D AnySat and Prithvi-EO-2.0 embeddings as two public Hugging Face datasets (zarr).
- Covered 66,356 samples across EuroSAT, RESISC45, LoveDA and OSCD for both foundation models.
- Extracted them with Kaggle notebook pipelines and tracked completion per model and dataset.

Data Science Research Intern Jul 2025 – Jun 2026
Centre of Excellence for Data Science, Institute of Engineering & Management *Kolkata (hybrid)*

- Co-authored HiLEx (ICDAR 2025, Springer LNCS), listed among the centre's publications.
- Joined the TradeSim build, a paper-trading platform commissioned by CEDS, IEDC and IEMLabs.
- Released the HiLEx dataset in COCO and YOLO formats in Jun 2025: 1,378 train, 388 valid and 199 test pages.
- Updated the project site after acceptance with the Springer chapter link, author table and citation.

Student Researcher Sep 2023 – Nov 2023
IEDC, Institute of Engineering & Management *Kolkata*

- Started a MERN portal that matches students to faculty research projects, as a first-year project.
- Planned its two roles: faculty post projects with co-faculty, and students apply to join them.
- Carried it into the 2024 CEDS portal, with a 34-route Express and MongoDB backend.

INDUSTRY EXPERIENCE

Product Demo Specialist Intern Aug 2026
Tech for Social Good *Remote*

- Presented the product in 2 Zoom seminars to about 20 attendees.
- Ran a hands-on live demo for a client NGO, attended by 10 of its employees.

Product Development Intern Mar 2026 – Jul 2026
Deep Duo Foundation *Kolkata (hybrid)*

- Designed and built MarketOS: a LangGraph supervisor splits one campaign brief across 17 agents.
- Connected agents over Kafka with trace IDs and a dead-letter queue; ClickHouse holds analytics.
- Served it through FastAPI with streamed runs; 176 pytest tests, some on live Kafka and Postgres.
- Bridged Twilio calls to Gemini Live: a WebSocket daemon converts 8 kHz mu-law to 16 kHz PCM and back.
- Wrote a Bayesian A/B agent that stops a test early once a variant's chance of being best reaches 0.95.

Machine Learning Intern Dec 2025 – Feb 2026
IEMA Research & Development Pvt. Ltd. (IEMLabs) *Kolkata (on-site)*

- Co-built the FastAPI stock-analysis service behind TradeSim, a paper-trading platform on live NSE prices.
- Pulled 5 years of weekly Upstox candles and computed TA-Lib indicators and ATR-based risk levels.
- Combined the signals with news headlines into a Gemini 2.5 Flash report fitted to each investor's profile.
- Backfilled daily NSE prices from 2010 (about 335 MB) with a multithreaded, rate-limited downloader.
- Coverage check found 43 symbols with no Upstox history; 5 expired rights entitlements were dropped.

Full Stack Software Developer Intern Mar 2025 – Dec 2025
VitaniumX *Remote*

- Built and shipped VoicePod, the Next.js operator console for an AI voice-calling agent, as its sole code author.
- Authored 242 of the repository's 255 commits, released through 211 production deployments on Vercel.
- Wrote React Flow editors for multi-prompt call flows and DTMF phone menus (IVR).
- Built a call-log console that streams each call's recording and transcript from Azure Blob Storage.
- Added CSV contact import, scheduled campaign starts, an ad-hoc dial-pad and an IVR audio library.

Software Developer Intern Jan 2024 – Apr 2024
NexaWings International Software Solutions *Kolkata (hybrid)*
- Wrote the API and RAG pipeline that lets a German client query its German-language books.
- Built a virtual try-on pipeline: from a garment photo and a model photo, it renders the model wearing it.
- Built Flask microservices with CRUD REST endpoints for the agency's client projects.
- Tested the APIs in Postman before each release.
- Scraped and validated sales leads with BeautifulSoup for the sales pipeline.

Student Intern Sep 2023 – Nov 2023
Blockchain Federation *Kolkata (hybrid)*
- Scraped about 5,000 sales leads for cold-email outreach on the company's product.
- Trained in Solidity and wrote basic smart contracts as practice.

STARTUP AND LEADERSHIP

Founding Team Member 2025 – 2026
TradeSim, IEMLabs (faculty-founded) *Kolkata*
- Paper-trading competition platform on live NSE prices; teammates built the trading engine and interface.
- IEMLabs funded the platform and supplied about 100 student beta testers; usage grew to about 1,000.
- Co-wrote the IIM Calcutta Seva First Innovation Challenge pitch (2026) on retail F&O losses.
- Added the revenue model: tiered college licences from Rs 50,000 to Rs 2 lakh a year.
- Wrote a timed two-speaker pitch script with prepared Q&A, plus a demo page for the walkthrough video.

Co-founder Jun 2025 – Mar 2026
Solyrix, a student startup *Kolkata*
- AI calling agents for banking and insurance firms; a fellow co-founder built the voice agent and call backend.
- Built the v1 operator dashboard in Next.js 15 from a v0 scaffold: campaigns, leads, call logs and analytics.
- Wired the public live-call demo: a form places an outbound AI call, then polls for the post-call transcript.
- Wrote a Node.js relay that verifies HMAC-SHA256 webhooks and pushes live call state over WebSockets.
- Rebuilt the batch-call modal and call-logs page in v2, adding transcript, report and audio playback tabs.

PROJECTS

Entity resolution, Amazon ML Challenge 2026 Sep 2026 – Oct 2026
Team of 3
- Matched 1.73M businesses across the US, India and France; public macro F0.5 rose from 0.930 to 0.981.
- TF-IDF and exact-key blocking proposed candidates; a LightGBM ranker kept 25 per business.
- Scored 43.3M candidate pairs on about 80 name, address and house-number features.
- A soft branch rule lifted F0.5 to 0.955; stacking a fine-tuned bge-reranker cross-encoder took it to 0.977.
- Isotonic-calibrated scores fed exact expected-F0.5 set decoding, run end to end on a RunPod A40.

GlycoCart Apr 2026 – Oct 2026
Glucose-aware food-ordering agent (personal project) *glycocart.deepansadhukhan.com*
- Next.js agent that builds carts through Swiggy's Food, Instamart and Dineout MCP servers.
- Re-ranks dishes by a personal post-meal glucose estimate: glycemic load adjusted for fibre, protein and fat.
- Ordering and payment tools stay out of the agent's reach, and a regression test enforces it.
- Swiggy OAuth tokens sit in AES-256-GCM cookies; profiles, chats and carb logs persist in Neon Postgres.
- Built with Claude as coding agent: owned scope and safety boundary, tested on a live account, 15 test suites.

Egg and poultry trade desk Aug 2026 – Sep 2026
Agri-commodity data product, team project *egg-monitor-lilac.vercel.app*
- Shipped a Next.js 16 trade desk for egg and broiler prices across 37 mandis on a teammate's forecast API.
- Built price ledgers, P10–P90 forecast bands and a Google Maps view of the trade network.
- Modelled net profit per truckload for every mandi pair from 10 truck tiers, freight, handling and breakage.
- Walk-forward backtest (10 folds, 118,106 predictions): 3.49% WAPE but near-chance direction (51.6%).

Shrimp-farm satellite mapping Aug 2026
Aquaculture-tech venture; sole author of the pipeline *Andhra Pradesh coast*
- Mapped 11,531 water bodies (about 4,845 ha) in 3 districts from 0.29 m/pixel satellite imagery.
- Fine-tuned YOLO26s-seg on Kaggle GPUs for ponds and canals; merged ponds cut by tile edges in UTM space.
- Rule-based aerator and water-colour checks label ponds active, inactive or dry; flagged 42,148 aerator points.
- Kept two frozen holdout blocks; found a 2× train/inference scale shift and a bug that dropped canal labels.
- Wrote two label-review tools: a SAM-assisted tile editor and a Leaflet-Geoman map editor for the review team.

Pond Patrol camera planning and edge bird detection May 2026 – Jul 2026
Bird-deterrence venture, team project *Live planner*
- Three.js camera planner for fish ponds drawn on Google Maps or imported from CSV, live on GitHub Pages.
- Scores each camera pose by field of view, range, tilt, line of sight and pixels on target.
- Greedy placement adds cameras until coverage hits 98%, the budget runs out or gains fall below 4.5%.
- Raspberry Pi 4 bird detector: YOLO26n on NCNN, threaded capture and MJPEG streaming, optional ByteTrack.

AstraLink Jan 2026 – Apr 2026
ZK-KYC for tokenised assets; Stellar testnet prototype *astralink.deepansadhukhan.com*
- Wrote the Soroban (Rust) soulbound identity contract that a teammate's asset token checks per transfer.
- Built a Next.js relayer that verifies Anon Aadhaar zero-knowledge proofs (test mode) and pays transaction fees.
- Wrote 8 of the workspace's 36 contract tests, including 3 inter-contract tests against a mock identity contract.
- Set up GitHub Actions CI for cargo test, the wasm release build, lint and the Next.js build.

Machli logistics portals Jan 2026
Machli fish-distribution network
- Built 3 role-based Next.js portals (main hub, intermediate hub, driver PWA) on a teammate's Express API.
- Added email-OTP login, httpOnly session cookies and an API-route proxy over 16 hub endpoints.
- Drag-and-drop dispatch board stages orders onto trucks against capacity and assigns driver managers.

Aexlrt admin analytics console Jun 2025 – Aug 2025
Aexlrt fitness app
- Built the Next.js 14 and TypeScript admin console for the Aexlrt fitness app, deployed on Vercel.
- Computed unique-user DAU, WAU and MAU from raw app-usage sessions, with custom date ranges.
- Added per-user health and workout drill-downs and a scheduled push-notification manager.

Research-lab project-management portal (backend) Jun 2024 – Aug 2024
Centre of Excellence for Data Science, Institute of Engineering & Management
- Wrote 34 REST routes in Express and MongoDB (70 of 72 commits) for the centre's research-project portal.
- Faculty post projects with co-faculty, and students apply through a teammate's React frontend.
- Sign-up checked against enrolment and staff rosters, with SMS (AWS SNS) and email OTP and JWT auth.

HACKATHONS

Google hackathon (Food and Health vertical), NutriSense AI Apr 2026
- Sole code author of a meal-photo nutrition app: React on Firebase Hosting, with Firebase Auth.
- FastAPI backend on Cloud Run turns meal photos into calorie, macro and allergen JSON via Gemini.

Build With Aptos 2025, Solyrix Arena Jul 2025
- Wrote both Aptos Move modules (about 500 lines) behind an AI-agent competition dApp.
- Competition rooms, agent registration with entry fees, and on-chain winner declaration with events.

COMSYS 2025 Hackathon, Team Solyrix, Task A Jun 2025 – Jul 2025
- 94.08% accuracy and 0.90 macro F1 on face gender classification (422 validation images, 81% male).
- Sole code author: fine-tuned ConvNeXt-Base in PyTorch Ignite with class-weighted loss, EMA and AMP.

Also took part in: GDG on Campus Solution Challenge 2025 (Google); Build With India (team placed in the top 5,000 of 25,000); Diversion 2K24 and 2K25 (MLH); AMD Slingshot Ideathon 2026

SKILLS

Programming: Python, TypeScript, JavaScript, SQL, Bash; contracts in Rust (Soroban) and Move (Aptos)
Machine learning: PyTorch, Hugging Face Transformers, scikit-learn, LightGBM, pandas, NumPy
Vision, audio and geospatial: VLMs, audio-language models, SAM2, YOLO, OpenCV, GeoPandas, Shapely
Research methods: INT8/NF4 quantization, PGD attacks, PPO-Lagrangian, pre-registration, statistical tests
LLMs and agents: LangGraph, LangChain, MCP, Vercel AI SDK, Gemini Live, Claude, OpenAI, OpenRouter, pgvector
Backend and data: FastAPI, PostgreSQL, Redis, Kafka, ClickHouse, Node.js, Express, MongoDB, Flask, pytest
Cloud, HPC and DevOps: Docker, Slurm/Apptainer, RunPod, HF Hub, GitHub Actions, Vercel, Cloud Run, Azure
Web and tools: React, Next.js, Tailwind CSS, React Flow, Three.js, Git, LaTeX, Claude Code

MEMBERSHIPS, CERTIFICATIONS AND LANGUAGES

Memberships: IEEE (Kolkata Section); INSTICC (2026)
Certifications: Kaggle 5-Day Gen AI Intensive (2025); Information Theory, CUHK (Coursera, 2025); Google Cloud Gen AI Academy (2025); Anthropic Claude Code in Action (2026); OSCG 2026 contributor
Languages: Bengali (native), English (professional working proficiency), Hindi (limited working proficiency)