

# DEEPAK KARKALA

Senior ML Engineer

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## SUMMARY

Senior ML Engineer with 6+ years of experience in ML/AI (2018-present), shipping production ML systems delivering measurable business impact across e-commerce and IoT (12% higher marketing ROI, 5% conversion uplift, 4% search-to-purchase improvement, 20% reduction in maintenance callouts). Experience across the full ML lifecycle - problem framing, feature engineering, training, pipelines, evaluation, deployment and monitoring. Specialized in cost-effective, moderate-scale MLOps with minimal infrastructure footprint. Hands-on work in GenAI, Agentic AI, and multi-agent systems. Holder of 1 granted US patent and 1 pending US patent application.

## SKILLS

**ML/AI:** Machine Learning, MLOps, Computer Vision, Time Series Forecasting, LLMs, RAG, Fine-tuning, Anomaly Detection  
**Frameworks:** Python, PyTorch, XGBoost, scikit-learn, LangGraph, LangChain, FastAPI  
**Cloud/Infra:** AWS (SageMaker, Glue, EMR, Lambda, Kinesis, Step Functions), CI/CD, A/B Testing, Terraform, Docker  
**Data/Tools:** SQL, Redis, Feast, Pinecone, Spark, OpenAI API, Claude Code, vLLM, Git  
**MLOps:** Monitoring, Data Pipelines, Drift Detection, Calibration, Model Serving, Evaluation, Feature Engineering, SLOs

## WORK EXPERIENCE

**Senior ML Engineer (Contract)** Aug 2022 - Nov 2025  
Confidential Client - Mid-sized European E-commerce Marketplace (75K SKUs, 50K DAU, 2.5K orders/day) Remote

- Led end-to-end delivery of **4 production ML systems** driving **12% higher marketing ROI, +5% conversion uplift**, and **+4% search-to-purchase** across millions of sessions; owned cost-bounded, minimal-footprint AWS MLOps.
- **RAG Search (Hybrid Retrieval, Ranking):** Led design of **BM25 + dense vectors** with re-ranking to define latency/error SLOs and cost targets upfront. Built evaluation framework (offline metrics, CI/CD regression tests, load envelopes) including scalable LLM-driven approach to create **golden dataset** for ranking evaluation. Architected for scale (**3M queries/month**) and delivered **p99 latency under 500 ms at EUR 0.001 per query**, improving **search-to-purchase by 4%**.
- **Review Summarization (LoRA, vLLM):** Fine-tuned **Mistral-7B** on **100K+ reviews**; cut LLM cost **60% vs GPT-4 baseline** while maintaining quality. Partnered with product and legal to define governance standards (model cards, versioning, bias-aware retrieval, PII redaction); productionized batch RAG with automated quality checks (hallucination/toxicity/relevance).
- **CLV Prediction (Batch MLOps, XGBoost):** Built segmented CLV models (early-stage vs established); improved **RMSE by 15-20%, Gini 0.47 to 0.62** for budget-constrained CRM, enabling **12% higher marketing ROI**. Diagnosed feedback loop where top-decile targeting reinforced bias; led cross-functional exploration budget experiment (10% random allocation), retrained on less-biased data for better high-potential discovery. Shipped weekly pipeline scoring **300K+ profiles** with segment monitoring.
- **Real-Time Purchase Intent (Low-latency, Streaming):** Deployed sub-second scoring for **60K+ daily predictions** (Feast + ElastiCache) with **Spark Structured Streaming** features (**50K+ events/hour**) and class-weighted LightGBM (20:1 imbalance); optimized feature fetch to achieve **40% p99 latency reduction**. Resolved production calibration breakdown eroding marketing trust; added segment-wise reliability analysis + post-hoc calibration, restoring confidence. Designed end-to-end A/B testing strategy delivering **+5% conversion uplift**.

**Co-Founder - Social Impact Ventures**  
Spiticart, Rumi Schools

**Jan 2021 - Jul 2022**  
Bangalore, India

- Built and piloted two social-impact ventures - an artisan-first D2C handicrafts marketplace (spiticart.com) and a digital-first rural education model (rumischools.org) - then transitioned back to ML engineering.

**ML Engineer**  
eSMART Technologies

**Jun 2018 - Dec 2020**  
Renens, Switzerland | Remote

- Owned end-to-end IoT ML systems for smart-building operations across 3000 apartments, spanning data quality checks, evaluation, monitoring, and scheduled retraining.
- **Predictive Maintenance (Anomaly Detection + HITL):** Deployed anomaly detection + alert triage for heating systems; reduced emergency maintenance callouts by **20%**. Diagnosed production alert-fatigue issue causing low adoption; partnered with maintenance teams and leadership to redesign system as a prioritization tool vs. fully automated detector. Evolved approach from

unsupervised (residuals + LOF) to supervised as labels grew via technician human-in-the-loop validation; achieved 75% **Precision@50** for high-priority alerts and restored stakeholder trust.

- **Energy Forecasting (Smart Energy Advisor)**: Delivered 24-hour ahead energy demand forecasting (XGBoost + weather, lag, rolling windows, holiday features) powering resident-facing recommendations; achieved **under 10% MAPE** and **10 percentage points** increase in solar self-consumption. Partnered with domain experts to design tiered cold-start strategy for newly commissioned buildings (physics-informed heuristics -> archetype models -> individualized forecasts). Implemented walk-forward validation, baselines (ARIMA/Prophet), and drift monitoring.

### ML Research Intern NEC Labs America

**Feb 2017 - Jul 2017**  
*Princeton, NJ, USA*

- **Traffic Surveillance Object Detection**: Fine-tuned YOLOv2 for tandem-motorbike detection in traffic surveillance video; tuned anchor boxes/heads + targeted augmentation to surface candidate "tandem near pedestrian" incident windows for human review.
- **Scene Understanding (Visual Relationship Detection)**: Built a PyTorch subject-predicate-object relationship detector with scene-graph outputs; engineered spatial features and explored graph/message-passing + translation-embedding formulations to improve predicate classification robustness for downstream incident reasoning.

### Signal Processing Engineer Signalchip Innovations

**Feb 2012 - May 2015**  
*Bangalore, India*

- Developed and validated WCDMA uplink receiver algorithms (Path Searcher, RAKE, Multiuser detection) to meet 3GPP NodeB receiver conformance BER under 0.001 across multipath/interference channel conditions via link-level simulations and optimization.

### Junior Research Fellow Indian Institute of Science (IISc)

**Jun 2011 - Jan 2012**  
*Bangalore, India*

- Published first-author paper in **Medical Physics** on DOT measurement-selection optimization; cut data acquisition time by 46% with under 1% reconstruction quality loss, and identified 20% more independent measurements vs. prior singular-value methods.

## PROJECTS

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### Agentic MLOps Platform

- LangGraph-orchestrated multi-agent workflow that generates deployable MLOps repos from natural language specifications; includes real-time streaming of model reasoning (SSE) for transparency, database-backed job queue for persistence, human-in-the-loop checkpoints for approvals and clarifications. Built using spec-driven agentic coding (BMAD-method).

### AI Feynman Kannada Physics Tutor

- Created a novel Kannada physics reasoning dataset and fine-tuned Gemma-3 1B via staged SFT (Kannada fluency to physics reasoning) to deliver Feynman-style, concept-first explanations for local-language learning. Built an evaluation harness using LLM-as-judge scoring and integrated RAG grounding for more reliable answers. Published dataset and models on Hugging Face.

### AI Scriptwriter (The Office)

- Fine-tuned Gemma 1B for **The Office**-style screenplay generation using SFT, RFT. Published dataset and models on Hugging Face. Developed a structured "reasoning trace to screenplay" format to improve multi-step comedic setup/payoff. Used LLM-as-judge as model grader, and used reward curves + score distributions to track improvements from Base Model to SFT to RFT.

## EDUCATION

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### MS Communication Systems Ecole Polytechnique Federale de Lausanne (EPFL)

**Aug 2015 - May 2018**  
*Lausanne, Switzerland* | GPA: 5.25/6.0

- Thesis: Data Analysis and Anomaly Detection in Buildings Using IoT Sensor Data

### BE Electronics & Communication Engineering RV College of Engineering

**Aug 2007 - Jun 2011**  
*Bangalore, India* | GPA: 9.23/10.0

## PUBLICATIONS, PATENTS

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### Patents:

- US9602240 (granted patent): Method and System for Symbol Level Interference Cancellation for Multiuser Detection (2017)
- US20160365991 (application publication): Method and System for Performing Optimized Channel Estimation (2016)

### Publication:

- First-author, Medical Physics Journal (2012): Data-resolution matrix optimization for diffuse optical tomography