

Bharat K. Patil

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ML engineer specialising in Deep Learning, Reinforcement Learning, and scalable data pipelines. Experienced across the full model lifecycle - from simulation and training to containerised deployment - with 4+ years building production-ready systems.

Deep Learning | Reinforcement Learning | Data Pipelines | Model Deployment

Technical Skills

Programming	Python, C#, MATLAB, Bash
ML & AI	Deep Learning, Reinforcement Learning, Statistical Learning
Frameworks	TensorFlow, PyTorch, Scikit-learn, HuggingFace Transformers, Brian2
MLOps & Serving	FastAPI, Docker, Streamlit, MLflow, GitHub Actions
Data & Storage	NumPy, SciPy, Pandas, SQL (LeetCode 50), Signal Processing, ChromaDB
Tools	Git, Linux, Unity3D, Jupyter, SpikeInterface
Core Topics	Probability Theory, Linear Algebra • Nonlinear Dynamics
Languages	English (C2), German (A2), Hindi (Native), Marathi (Native)

Professional Experience

Research Engineer — *Csicsvari Group, IST Austria* *Sept. 2023 – Sept 2025*

- **Automated** end-to-end data ingestion, signal processing, and quality-control steps for **11 TB** of time-series data across 11 sessions and replaced a largely manual workflow with a fully scripted, reproducible pipeline.
- Reduced analysis latency from $\sim 3\text{--}4$ months to **~ 30 minutes**, cutting iteration cycles by **$> 97\%$** and enabling near-real-time feedback.


Research Engineer — *Computational Neuroscience Lab, IIT Madras* *Oct 2020 – Jun 2023*

- Developed and trained **deep learning** and **RL models** (TensorFlow, PyTorch) on 1M+ simulated trajectory points across multiple navigation tasks with full pipeline from data generation to model evaluation.
- Built **Unity3D synthetic data pipeline** generating labelled agent-POV datasets across 35 navigation trajectories; supported 5 concurrent research projects over 3 years.


Teaching Assistant — *Dept. of Aerospace Engineering, IIT Madras* *Aug 2019 – Jun 2020*
Fluid Dynamics; Overview of Defence Technologies

Summer Intern — *CSIR National Aerospace Laboratories* *May 2018 – Jul 2018*
Imaging techniques and flow analysis

Projects

3D Spatial Representation Learning | *TensorFlow • FastAPI • Docker • Streamlit*  *Sep 2021 – Present*

- Built **deep autoencoder** (TensorFlow, **50-dim bottleneck**) learning compact spatial representations from $\sim 250\text{k}$ 3D trajectory samples across 5 environments, served via **FastAPI** REST endpoint (3 routes), containerised with **Docker** and deployed with an interactive **Streamlit demo** on HuggingFace Spaces.
- Task-relevant **representational structure emerged without explicit supervision**, validated across 2 experimental paradigms, published in *Nature Scientific Reports* (2024, 2655 accesses).

Unified Spatial Representation Learning | *TensorFlow • CNN • GNN • Unity3D*  *Jan 2021 – Present*


- Built and trained a **multi-task CNN–GNN** (TensorFlow) on 1M+ synthetic trajectory points generated via a custom **Unity3D** simulation pipeline, with a **live interactive demo** on HuggingFace Spaces.
- Ran **7-config ablation** on prediction targets (position, heading, reward); training objective alone drove **$5\times$ variation** in learned feature selectivity across 320 hidden units.
- Implemented **continual learning** with EWC regularisation across 7 sequential retraining sessions, under review at *Nature Scientific Reports*.

RL Navigation Agent | TensorFlow • TD Learning • Embeddings • Autoencoders Mar 2019 – Jun 2020

- Built **end-to-end RL pipeline** from scratch with custom **49-neuron state encoder** validated at >90% position reconstruction accuracy, TD-trained **value network** (200 hidden units), and hill-climbing inference for test-time trajectory generation.
- Agent reliably reached reward locations across **2 environments** (box, plus-maze) and **2 trajectory regimes** (free exploration vs. boundary-constrained) without explicit path planning.

Additional Projects

2018 – 2023

- **Personal Portfolio with RAG Chat API** *FastAPI* • *ChromaDB* • *Claude API* • *ElevenLabs* 
RAG-powered chat over personal corpus (papers, CV, READMEs, presentation transcripts etc.) using ChromaDB and Claude API, with ElevenLabs voice synthesis, deployed on HuggingFace Spaces.
- **Self-Stabilizing Drone** | *Pixhawk* • *Python* • *Control Systems* ([video demo](#)).
Designed **PID flight controller** enabling stable hovering and autonomous path tracking on real hardware.
- **Spatiotemporal Sequence Modelling** | *Python* • *NumPy* • *Signal Processing*
Built oscillatory network with **stacked autoencoder** for 1D sequence modelling; validated via **Power Spectral Density** and Hilbert transform analysis, presented at CNS 2021.
- **Research Reproduction - SNN** | *Brian2* • *Python*
Reproduced balanced **spiking network** (10k neurons, STDP plasticity) from published literature; validated spike statistics against reported results.

Selected Publications

- **Modeling hippocampal spatial cells in rodents navigating in 3D environments** 2024
Nature Scientific Reports | DOI: [10.1038/s41598-024-66755-x](https://doi.org/10.1038/s41598-024-66755-x)
- **A unified model of hippocampal spatial and object cells with bidirectionally coupled layers** 2024
Nature Scientific Reports (under review) | DOI: [10.1101/2024.09.09.612040](https://doi.org/10.1101/2024.09.09.612040)

Conference Presentations

- **Deep learning model for spatial and non-spatial representation** Jun 2024
14th FENS Forum of Neuroscience, Vienna (PS01-26AM-019)
- **Deep oscillatory neural network with graph convolution for spatial cells** Mar 2023
15th Göttingen Meeting of the German Neuroscience Society (T26-1A)
- **Oscillatory network model for theta-sequences in one-dimensional motion** Jul 2021
30th Annual Computational Neuroscience Meeting, Online
- **Anti-Hebbian oscillatory network model for object vector cells** Dec 2019
Annual Conference of Cognitive Science, BITS Pilani, Goa, India.

Education

- Indian Institute of Technology Madras** 2015 – 2020
B.Tech & M.Tech (Dual Degree), Aerospace Engineering CGPA: 7.49
Minor in Biotechnology | [Thesis](#) CGPA: 8.73
- CBSE Senior School Certificate (XII)** — Score: 87% 2014
- CBSE Secondary School Examination (X)** — GPA: 10/10 2012

Leadership & Initiatives

- **CAVAL – Mobile Bicycle Servicing Platform (Co-founder)** ([link](#)) Mar 2016 – Jul 2017
Built campus startup at IIT Madras used by **5k+ students**; managed product, operations, and a small team from scratch.
- **Video Editing & Film Making** ([portfolio](#)); 2M+ views; 10× subscribers; Apr 2016 – Apr 2019