Aditya Anil Kapile

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PROFILE

Robotics and AI MSc student at Nottingham Trent University with MBA in Business Analytics and mechanical engineering background. Experienced in machine learning, perception, and optimisation for autonomous systems, including development of a PSO-based drone coordination model improving stability and efficiency in multi-agent robotics. Seeking a graduate robotics/AI role applying intelligent systems to real-world challenges.

TECHNICAL SKILLS

- Programming: Python (3 years); scientific computing, ML pipelines, and optimisation algorithms
- Machine Learning & AI: scikit-learn, TensorFlow, PyTorch, Keras (2+ years); classification, regression, clustering, neural networks
- Data Science: Pandas, NumPy, SciPy (2+ years); preprocessing, feature engineering, statistical analysis
- Computer Vision & Perception: OpenCV, human activity recognition, sensor data processing, autonomous perception
- Optimisation & Learning Algorithms: Particle Swarm Optimisation (PSO), Genetic Algorithms (GA), Evolutionary Strategies (ES), reinforcement learning
- Visualisation: Matplotlib, Seaborn, Plotly
- Tools & Development: Git, GitHub, Jupyter, Anaconda, Tkinter/PyQt, MS Excel
- APIs & Integration: REST APIs
- Containerisation: Docker, Docker Compose
- Generative AI: Local deployment of language models

SOFT SKILLS

- Team collaboration -co-developed a pipe inspection robot in a 4-member engineering team and coordinated college fest and sports groups
- Communication -presented technical projects and created educational content explaining complex concepts to varied audiences
- Project management -delivered concurrent engineering and MBA projects while organising college events within deadlines
- Leadership -served as School Head Boy and cricket captain, guiding teams toward collective goals
- Adaptability -transitioned from mechanical engineering to AI/robotics through self-directed learning and new domain exploration

PROJECTS

Drone Swarm Optimisation (PSO)

- Addressed instability and inefficient coordination in multi-drone swarms caused by poorly tuned behavioural parameters
- Applied **Particle Swarm Optimisation** to tune swarm coefficients and improve formation cohesion and coverage behaviour
- Achieved stable fitness convergence within 60–80 iterations across runs, reducing swarm dispersion and improving trajectory consistency
- Validated optimisation performance through convergence curves and swarm trajectory visualisation

Breast Cancer Classification Pipeline

- Tackled unreliable and non-interpretable breast cancer prediction from clinical features in diagnostic datasets
- Developed multi-model ML pipeline (Logistic Regression, SVM-RBF, Random Forest, MLP) with preprocessing and feature analysis for accurate, explainable classification
- Achieved **98.25% accuracy (Logistic Regression, SVM)**, **96.49% (MLP)**, **95.61% (Random Forest)** on Wisconsin dataset, demonstrating high diagnostic reliability
- Analysed feature importance and model behaviour to identify clinically influential predictors supporting trustworthy decision-support use

Real-Time Traffic Sign Recognition

- Addressed unreliable traffic sign detection in autonomous driving caused by lighting and scale variation
- Developed CNN-based recognition pipeline with preprocessing and augmentation for robust perception
- Achieved **99.36% peak validation accuracy (99.34% final)** on multi-class traffic sign dataset
- Demonstrated near real-time inference (~16-20 ms per image) suitable for ADAS perception tasks

Multimodal Human Activity Recognition

- Addressed high misclassification in human activity recognition when using single wearable sensors (accelerometer or gyroscope alone)
- Designed multimodal HAR pipeline using UCI HAR dataset with 500+ engineered statistical features from accelerometer and gyroscope signals
- Implemented and compared SVM, XGBoost, and deep neural network fusion models with independent sensor scaling and feature-level fusion
- Achieved **95.4% accuracy** with tuned multimodal SVM, outperforming gyroscope (**80.3%**) and accelerometer (**91.3%**) single-sensor baselines
- Verified statistically significant error reduction from sensor fusion using McNemar's test ($p < 0.05$)

Salary Prediction & Income Tier Classification

- Addressed unreliable individual salary estimation from demographic and employment features in labour-market data
- Developed Random Forest regression and salary band classification models with preprocessing and feature engineering
- Achieved **R^2 = 0.45**, **MAE = £40.9k**, **RMSE = £212k**, explaining 45% of salary variance despite extreme income outliers
- Demonstrated that salary band classification outperforms exact salary regression, indicating higher reliability for income range prediction
- Analysed feature influence and model behaviour to interpret labour-market salary drivers

SIPRI Military Expenditure Data Science & GUI

- Addressed difficulty in analysing long-term global arms transfer and military expenditure trends across countries and decades
- Processed SIPRI arms transfer dataset (1950-2024) and engineered analytical features for country-level and temporal analysis
- Identified strong relationships between orders and deliveries (**$r \approx 0.92$**) and between total and delivered TIV (**$r \approx 0.94$**), revealing consistent transfer dynamics
- Revealed highly skewed distribution with extreme outliers and concentration of transfers among top recipient nations
- Built interactive visual analytics interface enabling exploration of trends, country shares, and temporal patterns

Additional Engineering Projects

Autonomous Pipe Inspection Robot

- Designed and built mobile pipe-inspection robot with onboard sensing and remote operation, enabling safe inspection of confined pipelines without human entry.

Object Detection Aid for Visually Impaired Users

- Developed real-time computer vision aid detecting obstacles and objects for visually impaired users, providing audio feedback for navigation assistance.

House Price Prediction (Machine Learning)

- Built regression model with feature engineering to predict house prices from structural and location features

EDUCATION

Nottingham Trent University -MSc Robotics and Intelligent Systems | 2025–Present
Modules: Foundations of AI, Computational Intelligence, Artificial Perception, Cognitive Robotics, Intro to Software Programming, Research Methods
Building expertise in AI-driven perception and intelligent control for autonomous robotic systems

Savitribai Phule Pune University -MBA Business Analytics | 2024–2025 | **First Class**
Modules: Business Analytics & Statistical Methods (R), Data Mining, Machine Learning & Deep Learning, Business Intelligence, Risk Analytics
Applied machine learning and statistical modelling to data-driven business decision making

Savitribai Phule Pune University -B.E. Mechanical Engineering | 2020–2024 | **First Class**
Core Areas: Mechanics, Thermofluids, CAD/CAE, Manufacturing, Mechatronics, Robotics, FEM
Engineering foundation for designing and analysing mechanical and robotic systems

Maharashtra State Board -Higher Secondary (Science) | 2018–2020 | **First Class**

Maharashtra State Board -Secondary School | 2017–2018 | **Distinction**

EXTRA CURRICULAR

- Cricket Team Captain (Nepal U-14) - led team strategy and on-field coordination, demonstrating leadership, clear communication, and goal-driven performance
- School Head Boy - represented student body and organised school initiatives, showing initiative, responsibility, and attention to detail
- National-Level Volleyball (U-17) - selected for competitive squad, reflecting self-motivation, teamwork, and adaptability in high-performance environments