NAWARAJ RAI

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Summary

A highly motivated and meticulous AI and Information Technology graduate student with a proven ability to architect and deploy complex systems, with expertise in **LLM-powered applications**, automated **data integration workflows**, and full-stack development. Combining over a year of professional experience in developing scalable backend systems and data pipelines with advanced academic training in Computer Vision, NLP, and Deep Learning from Macquarie University. Eager to apply skills in generative AI, prompt engineering, and data science to build intelligent automation solutions.

Education

Macquarie University, Sydney, NSW   Feb 2024 - Current
Master of Information Technology in Artificial Intelligence   **Current WAM: 82.083**

Relevant Courses: Advanced Computer Vision and Action; Advanced Natural Language Processing; Artificial Intelligence for Text and Vision; Advanced Machine Learning; Advanced Topics in Artificial Intelligence; Data Science; Intelligent Machines, Ethics and Law; Rights, Responsibilities and AI

Kathmandu University – School of Engineering, Dhulikhel, Nepal   Aug 2017 - Mar 2022
Bachelor of Computer Engineering   **CGPA: 3.79/4.00**

Relevant Courses: Artificial Intelligence; Machine Learning; Speech and Language Processing; Algorithms; Data Structures; Database System Management; System Analysis and Design; Software Engineering

Skills

- **Languages:** Python, Java, SQL (Oracle PL/SQL, Microsoft T-SQL), JavaScript
- **AI/ML Frameworks:** PyTorch, TensorFlow, Keras, Hugging Face Transformers, PyG, YOLO, Scikit-learn, Pandas, NumPy, Matplotlib, Seaborn, OpenCV, Stable Baselines 3
- **AI/ML Concepts:** Deep Learning, Computer Vision (Classification, Segmentation), NLP (Transformers, Siamese Networks, RAG, LLM Fine-tuning), Reinforcement Learning (DQN, PPO), Graph Neural Network, Transfer Learning, GANs, Deep Dream, Hyperparameter Tuning
- **Technologies:** Flask, FastAPI, Django, Spring Boot, ROS2, Docker, Git, GitHub, Bitbucket, JIRA, Confluence
- **Databases:** Oracle, MySQL, Microsoft SQL Server, PostgreSQL
- **ETL Tool:** Oracle Data Integrator (ODI), Microsoft SQL Server Integration Services (SSIS)

AI & Machine Learning Projects

Empathetic AI Companion (Kumora)   Full Stack Generative AI System
PyTorch, Transformer, DistilBERT, LLMs (Gemini 1.5, gpt-4.1-mini), Flask, Prompt Engineering

- Architected full-stack AI system with **emotion detection**, **context management**, and **dynamic response generation** for mental health support.
- Fine-tuned **DistilBERT** for 27-class emotion classification.
- Designed **dynamic prompt engineering system** adapting to emotional context and user history.

LLM-Powered Travel Assistant with RAG   Generative AI
LLMs (Llama, Mistral, Qwen), LangChain, HuggingFace, Ollama, FastAPI

- Developed a personalized travel assistant chatbot after comparing locally hosted (**HuggingFace**, **Ollama**) LLMs (Llama-3.2, Mistral-7B, Qwen2.5).
- Implemented a **Retrieval-Augmented Generation (RAG)** pipeline with **LangChain** and **ChromaDB** to ground LLM responses in a factual knowledge base, significantly reducing hallucinations.
- Built multilingual web application with language detection and dynamic prompt engineering.

DDIM Image Generation   Generative AI | Computer Vision
PyTorch, Diffusion Models, DDIM, Generative Modeling

- Implemented **Denoising Diffusion Implicit Models (DDIM)** for high-quality image generation, enabling faster sampling rates compared to standard **Denoising Diffusion Probabilistic Models (DDPMs)**.
- Trained the model on the **CIFAR-10** dataset, demonstrating strong capabilities in generative modeling and latent

space manipulation.
- Optimized the reverse diffusion process to accelerate image synthesis without compromising visual quality.

ChemSAGE: HIV Inhibition Prediction
Advanced Deep Learning | Graph Neural Networks
PyTorch, PyG, NetworkX, RDKit, ogb
- Developed a novel chemistry-aware **Graph Neural Network (ChemSAGE)** with **edge-aware aggregation** and **global context injection** for **molecular property prediction**.
- Achieved superior performance in predicting HIV inhibition properties compared to baseline models, demonstrating the effectiveness of incorporating chemical domain knowledge into GNN architectures.
- Implemented the model using PyTorch Geometric, optimizing for efficient processing of molecular graphs.

Human vs. AI Text Detection
Advanced NLP | Fraud Detection
Transformer (BERT, DistilBERT, RoBERTa), Feature Engineering (Bag-of-Words, TF-IDF), Classical ML models
- Built classifier to distinguish human-written vs AI-generated text.
- Curated diverse 20,000-sample dataset from multiple sources and LLMs (GPT-4, Claude, Llama)
- Fine-tuned a **DistilBERT** model to achieve a test accuracy of 91.93%, significantly outperforming classical ML baselines and demonstrating strong NLP fundamentals.

Spill Identification & Autonomous Robot Reaction
Advanced Computer Vision and Action
PyTorch, CNN, ResNet50, OpenCV, Transfer Learning, Fine-tuning, ROS2
- Architected and deployed an end-to-end computer vision system on a physical robot to **identify 21 types of domestic spills** and execute autonomous motor commands in real-time.
- **Fine-tuned** a pre-trained **ResNet50** model using **layer-wise learning rates** and specialized it for the deployment environment via transfer learning, achieving 100% accuracy on lab-condition test images.
- Engineered a **ROS2 node** to process real-time camera feeds, run inference with the trained PyTorch model, and publish messages to control the robot's actions.

Fine-grained Image Classification & Analysis
Advanced Computer Vision
PyTorch, CNN, OpenCV, Transfer Learning, Fine-tuning, GANs, DeepDream
- Implemented a **self-designed CNN** and pre-trained **ResNet50** models on the **102-class FGVC-Aircraft dataset**, achieving a 66.04% validation accuracy by **fine-tuning ResNet50** architecture.
- Systematically evaluated these deep learning models along with fine-tuning, transfer learning, and data augmentation.
- Explored advanced techniques by implementing a **DCGAN** for synthetic data generation and using **DeepDream** for model interpretability.

Medical Question & Answer Semantic Similarity
Advanced NLP
Tensorflow, Keras, Transformer (BERT), Multi-Head Attention, Positional Embeddings, Siamese Network
- Implemented Siamese network and custom Transformer encoder from scratch and compared the performance for determining the semantic relevance between medical questions and answers.
- Developed contrastive loss function for semantic similarity in medical domain and conducted thorough text preprocessing, including a detailed analysis to select optimal vocabulary size and sequence length for the input.

Professional Experience

truuth
Sydney, Australia
AI Research Intern | Document Fraud Detection
Aug 2025 – Oct 2025
- Evaluated **State-of-the-Art (SOTA) Synthetic Image Detection (SID)** models on a diverse range of datasets containing both real images and synthetic images generated from modern AI generative models **(Stable Diffusion, DALL·E, Midjourney, Ideogram, Adobe Firefly)**.
- Conducted in-depth analysis including misclassification and threshold level optimization, and fine-tuned SOTA model for real document data.
- Improved model performance by implementing different evaluation pipelines for preprocessing.
- Evaluated SOTA model on various forgery datasets, testing robustness against splicing and inpainting techniques.
- Compared our SOTA model to a range of similar SID models recently released claiming to have SOTA performance on similar AI generated image datasets on which we evaluated our SOTA model.

COTIVITI Nepal
Kathmandu, Nepal
Software Engineer I – Intl Ops-R+D Leadership
Sep 2022 – Jan 2024
- Executed **data migration operations** and wrote **Oracle PL/SQL scripts** for validating an internal application

within the organization.

- Designed PL/SQL scripts to automate the migration from **Oracle Data Integrator (ODI)** mappings of the clients to the mapping application and execute the queries for seamless data transformation and load.
- Gained expertise in enterprise ETL by configuring, executing, and monitoring **Microsoft SQL Server Integration Services (SSIS)** packages for seamless data integration and transformation.
- Involved in a new project aimed at designing a consolidated **Single-page Application (SPA)** to streamline various applications used by the data operations teams, enhancing efficiency and usability, using **Java Spring Boot** for backend services, **Angular** for the frontend, **Okta** for **Single Sign-On** authentication, and **Role-Based Access Control (RBAC)** with **OAuth 2.0** for authorization.

COTIVITI Nepal
Software Engineer Trainee

Kathmandu, Nepal
Jul 2022 – Sept 2022

- Completed an intensive 5-week training program focusing on enterprise software development (**Java**, **Shell Scripting**), database management (**Oracle SQL**, **PL/SQL**), Quality Assurance, and data integration (**SSIS**).
- Gained domain knowledge in the **US Healthcare System**, and its **Data Analytics** processes, including claims processing, insurance concepts, and regulatory compliance (**HIPAA**, **Medicare/Medicaid**).

QUICKFOX Consulting
Software Engineer Intern

Kathmandu, Nepal
Feb 2022 – Jun 2022

- Gained proficiency in **Python programming** through practical experience.
- Developed automation scripts using **Python** and **Robotic Process Automation (RPA) framework**.
- Specialized in an **Optical Character Recognition (OCR)** project, gaining hands-on experience in text extraction from images.

Leapfrog Technology Nepal
Software Engineer Intern

Kathmandu, Nepal
Dec 2021 – Jan 2022

- Developed **responsive websites** and **games** from image templates using **Figma, HTML, CSS, and vanilla JavaScript, Canvas**.