NASIM MAHMUD NAYAN

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SUMMARY

ML Engineer specializing in trustworthy healthcare AI with expertise in bias mitigation, multimodal diagnostics, and LLM systems for clinical decision support. Built ExplainRAG-based decision support systems and the open-source M-TRUST fairness toolkit, with a proven ability to deliver end-to-end ML pipelines and collaborate effectively across academic and industry teams.

EDUCATION

- **Bachelor of Science in Computer Science and Engineering**
  University of Information Technology and Sciences (UITS) | Dhaka, Bangladesh | (Jan 2019 – Feb 2023)
  - **CGPA:** 3.62/4.00 (Ranked 6th in department)
  - **Thesis:** A Multi-Disease Prediction Framework: Leveraging Machine Learning and Real-Time Applications for Improved Health Outcomes

RESEARCH EXPERIENCE

- **Research Assistant,** Medical Cyber-Physical Systems
  Shanto-Mariam University of Creative Technology | Jul 2022 – Present
  Advisors: Prof. Mohammad Mobarak Hossain, Dr Jasim Uddin
  - Architected an ensemble learning framework for maternal health risk stratification, achieving 99% prediction accuracy and reducing algorithmic bias by 34% across 5,000+ patient records.
  - Implemented homomorphic encryption on IoT devices to ensure secure, private, and compliant transmission of pregnancy data.
  - Contributed to 3 co-authored papers in high-impact venues (combined 50+ citations), establishing new benchmarks in maternal health AI

- **Research Assistant,** Healthcare AI & IoT Systems
  Rising Research Lab | Aug 2022 – Mar 2023
  Advisors: Md Monirul Islam , Dr Jia Uddin
  - Developed and deployed a multi-disease prediction system (Diabetes, Parkinson's, etc.) with 92% average accuracy and an IoT air quality monitoring network across 5 locations.
  - Engineered a full data pipeline, from IoT device data capture to real-time inference.
  - Implemented an AutoML pipeline that reduced model development time by 60% while maintaining performance.

- **Research Assistant,** Computer Vision in Medicine
  EMPATHY LAB, Independent University Bangladesh | Jan 2023 – Dec 2024
  Advisors: Dr. Ashraful Islam , Dr Muhammd Usama Islam
  - Conducted a systematic review of 125+ papers on healthcare computer vision applications, identifying key research gaps and opportunities.
  - Analyzed leading deep learning architectures, such as CNNs and Vision Transformers, for medical imaging and predictive analytics.
  - Synthesized findings to inform the lab's research direction in surgical assistance and remote disease monitoring.

PUBLICATIONS

Publication Metrics: 10+ publications | 100+ citations | h-index: 5 | Google Scholar Profile | Full list on Google Scholar.

Selected Peer-Reviewed Journal Articles

- **Nayan NM,** et al (2025) "An interpretable and balanced machine learning framework for Parkinson's disease prediction using feature engineering and explainable AI ". PLoS One 20(10): e0333418. DOI: 10.1371/journal.pone.0333418
- Hossain, M.M., Kashem, M.A., **Nayan, N.M**., et al. (2024). "A Medical Cyber-Physical System for Predicting Maternal Health in Developing Countries Using Machine Learning." Healthcare Analytics, 5, 100285. DOI.: 10.1016/j.health.2023.100285
- Alam, M., Islam, M.M., **Nayan, N.M**., et al. (2024). An IoT Based Real-Time Environmental Monitoring System for Developing Areas. Journal of Advanced Research in Applied Sciences and Engineering Technology, 52(1), 106 121.
  DOI: 10.37934/araset.52.1.106121

Conference Proceedings (Presented- Oral presentation)

- **Nayan, N.M.**,et al. (2023). "SMOTE Oversampling and Near Miss Undersampling Based Diabetes Diagnosis from Imbalanced Dataset with XAI Visualization." IEEE Symposium on Computers and Communications (ISCC), pp. 1–6. DOI: 10.1109/ISCC58397.2023.10218281
- M. M. Hosaain, M. A. Kashem and **N. M. Nayan**,(2024) "Artificial Intelligence-Driven Approach for Predicting Maternal Health Risk Factors," 2024 9th SEEDA-CECNSM, Athens, Greece, 2024, pp. 153-158, DOI: 10.1109/SEEDA-CECNSM63478.2024.00035.

Under Review

- **Nayan, N.M.,** et al. "A Multi-Disease Prediction Framework: Leveraging Machine Learning and Real-Time Applications for Improved Health Outcomes." BMC Medical Informatics and Decision Making. [Under review]
- Hossain, M.M, **Nayan, N.M.,** et al. "A comprehensive maternal health risk prediction dataset from IoT-enabled medical cyber-physical systems in developing countries: Supporting deep learning applications for clinical decision support" BMC Medical Informatics and Decision Making. [Under review]

KEY RESEARCH PROJECTS

M-TRUST: Open-Source Fairness Toolkit for Medical AI | PyPI | GitHub

- Built a plug-in Python toolkit to detect and mitigate demographic, quality, annotation, and amplification bias in clinical AI.
- Provided a one-line wrapper API with docs and examples for reproducible adoption across models.
- Reduced demographic bias by 30.8% on benchmark datasets while maintaining 98% accuracy.

Technologies: Python, PyTorch, Scikit-learn, Pandas, Matplotlib

ExplainRAG-FC-AS: Clinical Decision Support via RAG & LLMs | GitHub | Demo

- Structured guideline evidence with thematic clustering and NLI fact-checking before generation.
- Reached sub-10s queries, mean evidence confidence 0.85; 90% clinician preference vs ranked retrieval.
- Enabled source-level attribution for traceable, transparent recommendations.

Technologies: Python, PyTorch, FAISS, K-means Clustering, RoBERTa-large-MNLI, GPT-4, Streamlit.

Multimodal Chest X-ray Diagnosis System with Bias Analysis | GitHub | Demo

- Combined CheXNet image features with BioBERT clinical text to classify 14 thoracic diseases.
- Diagnosed 4.3× cross-modal bias amplification; applied constraints to cut disparities from 7.6% to 4.5%.
- Added Grad-CAM explanations to improve clinician trust and interpretability.

Technologies: Python, TorchVision, Transformers (BioBERT), Streamlit, Grad-CAM, Docker

Trustworthy ECG Analysis Platform | GitHub | Demo

- Delivered real-time/offline ECG analysis with fairness-aware training and uncertainty estimation.
- Achieved fairness score >0.9 and 95% accuracy; optimized to <30MB model and <100ms inference for edge.
- Supported live sensor streams and digitized paper ECGs with natural-language explanations.

Technologies: Python, PyTorch, ResNet (transfer), SciPy (signal), Streamlit

AWARDS & HONORS

- **Employee of the Month |** Primacy Infotech LTD | August 2023
- **2nd Place |** Inter-university Programming Contest (45 teams) | UITS 2022
- **Fastest Problem Solver |** UITS Victory Day Programming Contest | 2021
- **1st Place |** Inter-university PowerPoint Presentation Competition | UITS 2020

ACADEMIC SERVICE & LEADERSHIP

Peer Review Experience

- Peer Reviewer, Informatics and Health (Elsevier), Aug 2025–Present
- Peer Reviewer, International Journal of Human-Computer Interaction (Taylor & Francis, Q1), Sept 2025–Present

Teaching & Mentoring

- **AI Trainer,** Enhancing Digital Government Economy (EDGE) Project, May 2023 - Nov 2023.
  - Trained 50+ students in ML/AI through hands-on projects, developing a curriculum covering supervised learning, clustering, regression techniques, and model evaluation metrics
  - Created educational materials with clear explanations of complex ML concepts, demonstrating strong communication skills
  - Evaluated student ML models, providing detailed feedback on error modes and improvement strategies

- **Research Mentor,** UITS Summer Research Program, 2023 & 2024
  - Mentored 2 research groups (total 7 students) on machine learning and IoT projects
  - Guided in a complete research pipeline from literature review to publication
  - Outcomes: 1 paper accepted (Scopus-indexed), 1 under review

University & Community Leadership

- Conference Organizing: Poster Presentation Coordinator, UITS Zero One Fest, 2022
- Leadership: Senior Executive, Research Hub Wings, UITS Computer Club, 2022-2023

PROFESSIONAL EXPERIENCE

Machine Learning Engineer (Remote), Programming Hero | Dec 2023 – Present

Zenyora AI Wellness Platform

- Architected and deployed a production-level AI wellness platform serving 100+ active users (available on Microsoft Store).
- Engineered computer vision system for real-time posture detection achieving 95% accuracy, reducing user eye strain by 40%
- Developed context-aware productivity coaching using behavioral analytics and real-time interventions, distinguishing focused work from distractions

Technologies: PyTorch, OpenCV, MediaPipe, OCR, LLM, FastAPI, Docker, Git

Automated Real Estate Sales Agent

- Developed voice-based virtual salesperson using RAG architecture and LangChain, integrating GPT-4 and Whisper for natural conversation handling
- Achieved 95% query relevance with Pinecone vector database, reducing response time from hours to seconds and increasing lead engagement by 3×

Technologies: LangChain, RAG, Pinecone, OpenAI GPT-4, Whisper, ElevenLabs, FastAPI, Docker

AI Engineer, Primacy Infotech Ltd | Jul 2023 – Nov 2023

- Led AI tour planner development for 6 UNESCO sites, reducing itinerary creation time from 2 hours to 5 minutes
- Performed data mining and preprocessing on visitor preference surveys to extract actionable insights for personalized route generation
- Increased tourist satisfaction scores by 35% through personalized route generation using visitor preference analysis

Technologies: LLM, FastAPI, PostgreSQL, Docker, Streamlit

TECHNICAL SKILLS

- Programming Languages: Python (Expert), C/C++ | 300+ problems solved
- Machine Learning & AI: Supervised/Unsupervised Learning, Deep Learning, Generative AI (LLMs, RAG), Multimodal AI, Explainable AI (XAI), Fairness in ML
- Frameworks & Libraries: PyTorch, TensorFlow, Scikit-learn, OpenCV, Hugging Face, LangChain
- MLOps & Production: Docker, FastAPI, CI/CD, MLflow, Vector Databases
- Research Methods: Experimental Design, Statistical Analysis, Systematic Reviews, Hypothesis Formulation, Scientific & Technical Writing

STANDARDIZED TESTS

- TOEFL: 98/120
- IELTS: 6.5/9.0
- GRE: 307/340 (Q:153, V:154, AWA: 3.0)

References available upon request