

# ANSHUL KUMAR

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## Education

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<b>Birla Institute of Technology and Science (BITS) Pilani, Goa Campus</b> <i>B.E. (Hons.) Electronics and Communication Engineering — 6.71 CGPA</i>	<b>2023 – 2027</b>
<b>Joint Entrance Examination (JEE) Main 2023</b>	<i>99 Percentile</i>
<b>Joint Entrance Examination (JEE) Advanced 2023</b>	<i>AIR 21194</i>
<b>Birla Institute of Technology and Science Admission Test (BITSAT) 2023</b>	<i>Score: 280</i>

## Experience

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**MarketWire** — Founder Feb 2025 – Present  
*marketwire.ai*

- Architected an event-driven, containerized microservices platform (9 Docker services) for real-time scraping, classification, and delivery of NSE/BSE announcements using **Python, Redis, and Supabase**.
- Designed a **priority-based Redis multi-queue system** with delayed job scheduling and adaptive rate control (30s idle / 120s under load), reducing API quota exhaustion by **85%** while maintaining burst resilience.
- Implemented **horizontal worker scaling with ephemeral containers** to ensure exactly-once processing and high-throughput ingestion of stock exchange filings.
- Built **SHA-256 content-addressable storage**, achieving **100% duplicate detection** across 100K+ historical filings.
- Developed a real-time notification pipeline using **WebSockets (Flask-SocketIO)** and Telegram bot integrations to push categorized announcements and personalized watchlist alerts to subscribers.
- Deployed production infrastructure using **Docker Compose, health checks, and Sentry-based observability** to monitor system reliability and service-level failures.

**Mailwave Technologies Pvt. Ltd.** — Intern May 2025 – July 2025

- Built an automated website-to-email generation pipeline using **Puppeteer** to extract screenshots, HTML, CSS, and design metadata, transforming live websites into structured inputs for LLM processing.
- Integrated the **Gemini API** to generate production-ready, brand-aligned HTML email templates that replicated website design systems, enabling customized outbound branding workflows.
- Engineered AI-powered **Supabase agents** with secure database access, allowing users to execute structured queries and actions via natural language prompts.
- Contributed to backend architecture and automation flows, improving reliability and reducing manual template creation effort.

## Projects

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**Cardiovascular Signal Prediction (rPPG)** Jan 2025 – Present

- Developed deep learning models for extracting physiological signals from RGB video using **remote photoplethysmography (rPPG)** with PyTorch and OpenCV.
- Designed a custom **hybrid spectral loss function** combining FFT and Continuous Wavelet Transform (CWT) components with adaptive weighting, achieving a **45% reduction in prediction error** and **2x improvement in signal-to-noise ratio (SNR)**.
- Integrated the hybrid loss with a **DiffMamba-based temporal architecture**, improving robustness to motion artifacts and illumination variability in real-world scenarios.
- Performed signal preprocessing, temporal modeling, and frequency-domain supervision to enforce physiological consistency of predicted waveforms.

**Federated Learning Research** Aug 2024 – Jan 2025

- Researched communication-efficient **federated learning optimization** under non-IID data distributions using PyTorch and Flower.

- Implemented **mutual information–based client adaptation**, periodically measuring similarity between global and local model parameters to dynamically pause redundant client training, reducing unnecessary compute and communication overhead.
- Applied **Dirichlet-based data partitioning** and trained deep models (ResNet-50) on MNIST, CIFAR-10, and CIFAR-100 to evaluate convergence under heterogeneous settings.
- Integrated **differential privacy (Opacus)** and knowledge distillation to analyze privacy–utility and efficiency trade-offs in distributed training environments.

## Skills

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**Technical:** Artificial Intelligence, Machine Learning, Computer Vision, Web Development (Front-End & Back-End)

**Programming:** Python, C/C++, Javascript

**Tools & Frameworks:** PyTorch, OpenCV, NumPy, Redis, Flower, Docker, Git, Github

**Languages:** Hindi, English

## Extra-Curricular Activities

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**Music:** Piano, Music Production