Terasate :- AI-Based Satellite Image Land Use & Terrain Classification System

Team name :- CodeSib

Domain : AIML

Problem Statement

- Manual analysis of satellite imagery is slow and error-prone at scale

- No real-time tool to classify terrain types (Urban, Forest, Water, Agricultural, Barren)

- Lack of change-detection to track urban expansion or deforestation over time

- Researchers lack a unified platform for model comparison and augmentation preview

Our Solution

- AI-powered ResNet50 model trained on ISRO satellite patch dataset - 94.7% accuracy

- Instant terrain classification from any uploaded satellite image in milliseconds

- Change-detection engine compares two time-period images and computes area shift (km²)

- Model leaderboard + augmentation preview for scientific reproducibility

Features Implementation

- Single Image Classification - Upload a satellite patch → get terrain label + confidence score + per-class probability breakdown

- Batch Processing - Upload multiple patches at once; receive aggregated terrain distribution stats

- Change Detection - Upload Year-1 & Year-2 images → calculates area shift in km² and % change per terrain class

- Augmentation Preview - Preview 3 data-augmentation variants: 90° Rotation, Horizontal Flip, Brightness boost

- PDF Reporting - Users can export processed results and visualizations as PDF reports for offline access and documentation.

- Analytics Dashboard - Training loss curve, confusion matrix (5 classes), model reliability (96.7%), system performance metrics

System Architecture
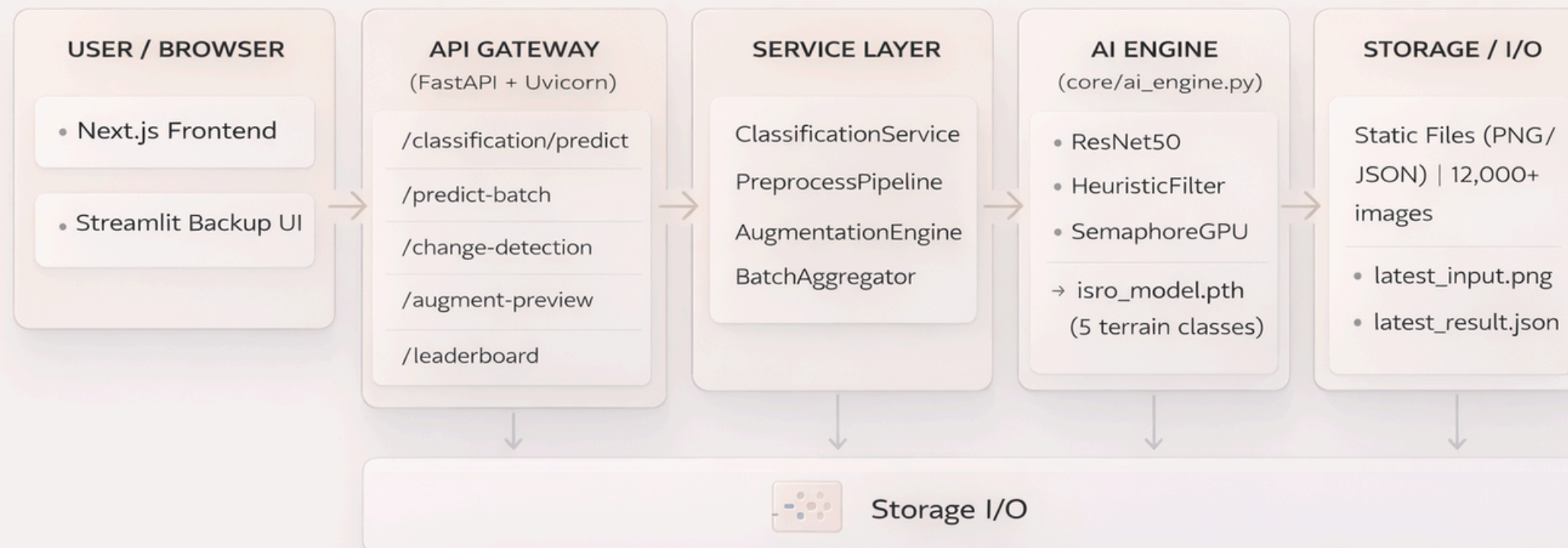
Technology Stack

Backend Layer

- FastAPI — High-performance async REST API
- Python 3.x — Core backend language
- PyTorch + TorchVision — Deep learning model inference
- Pillow / NumPy — Image preprocessing & array operations
- Uvicorn — ASGI production web server

Frontend layer

- Next.js 14 — React framework with App Router
- TypeScript — Typed component development
- Tailwind CSS — Utility-first styling
- Framer Motion — Animations & transitions
- Recharts — Data visualization (loss curve, dashboards)
- Lucide Icons — Consistent iconography

AI / ML Engine

- ResNet50 — Base classification model architecture
- isro_model.pth (~94 MB) — Trained ISRO terrain classifier
- Heuristic Filter — Pixel-math override for shadow/water edge cases
- GPU Semaphore — Parallel inference throttle (max 2 concurrent)
- Softmax output — Per-class confidence probabilities
- Data Augmentation — Rotation, flip, brightness pipeline