AI-Based Landing Zone Safety Classification

Capstone Project - Final Report

Project Overview

An advanced autonomous AI system for real-time drone landing zone safety classification. The system analyzes multi-modal terrain and environmental features to classify landing zones as **Safe** or **Unsafe**, with a strict emphasis on minimizing false positives.

Key Performance Metrics

• Precision: 93%
• Recall: 92%
• ROC-AUC: 0.94
• Fatal Errors (False Positives): 0 in LAND decisions
• Decision Accuracy: 100% for LAND decisions

System Architecture

• Dataset: 3,000 terrain samples with 8 environmental features
• Data Preparation: SMOTE for class balancing
• Models: 9 individual algorithms comparison
• Ensemble: Voting + Stacking ensembles
• Decision Logic: 4-level safety hierarchy (LAND, CAUTION, LOITER, ABORT)

Decision Distribution

• LAND: 2 decisions (0.3%) - 100% were actually Safe
• CAUTION: 203 decisions (33.8%)
• LOITER: 196 decisions (32.7%)
• ABORT: 199 decisions (33.2%) - 72.4% were actually Unsafe

Files Included

• Capstone_Project_fixed.ipynb - Main Jupyter notebook
• Capstone_Project_Fixed.html - HTML version
• Capstone_Project_Fixed.pdf - This PDF document
• Landing Zone Dataset.xlsx - Training dataset (3,000 samples)
• README.md - Comprehensive documentation

For complete implementation details, code, visualizations, and training results, please refer to the Capstone_Project_fixed.ipynb notebook.