Project Portfolio Summary

My technical work demonstrates a strong command of applied deep learning across diverse domains, ranging from assistive technology to astrophysics. As a WAICY 2024 finalist, I developed a specialized neural network for American Sign Language (ASL) recognition, engineering a computer vision system capable of interpreting dynamic hand gestures to facilitate accessible communication. Building on this expertise in neural architectures, I approached the NASA Development Challenge by designing a model to process vast open datasets, successfully automating the detection of exoplanet signatures through advanced pattern recognition in astronomical data.

Technical Implementation & Source Code

SignSpeak (ASL Recognition)

Repository: https://github.com/ethanli1337/SignSpeak

A bidirectional ASL translation system using LSTM-based neural networks and Google MediaPipe for pose estimation. Achieved WAICY 2024 Finalist recognition for combining accessibility-focused design with production-grade deep learning.

Key Technologies:

- PyTorch with custom LSTM architectures (3 LSTM + 2 Dense layers)
- Google MediaPipe for real-time pose estimation
- Flask web framework with Docker containerization
- End-to-end pipeline: video capture → keypoint extraction → classification → text/speech output

NASA Exoplanet Challenge

Repository: https://github.com/ethanli1337/Exoplanet-Challenge-2025

An automated classification system for NASA's exoplanet candidates using ResNet18 architecture. Achieved 70% accuracy on test set.

Key Technologies:

- PyTorch ResNet18 adapted for time-series analysis
- Data preprocessing pipeline handling class imbalance and missing values
- CLI and Flask web interface for interactive predictions
- Integration with NASA's Kepler, K2, and TESS public archives

Domain Expertise

- **Deep Learning Frameworks:** PyTorch, TensorFlow

- **Computer Vision:** MediaPipe, OpenCV, real-time pose estimation
- **Sequence Modeling:** LSTM networks, temporal pattern recognition
- **Data Engineering:** Preprocessing pipelines, class balancing, feature normalization
- **Web Development:** Flask, Python

Impact & Recognition

- **WAICY 2024 Finalist** for accessibility-focused AI system
- **NASA Development Challenge Participant** with high-accuracy classification model
- Open-source implementations enabling reproducible research and community contribution