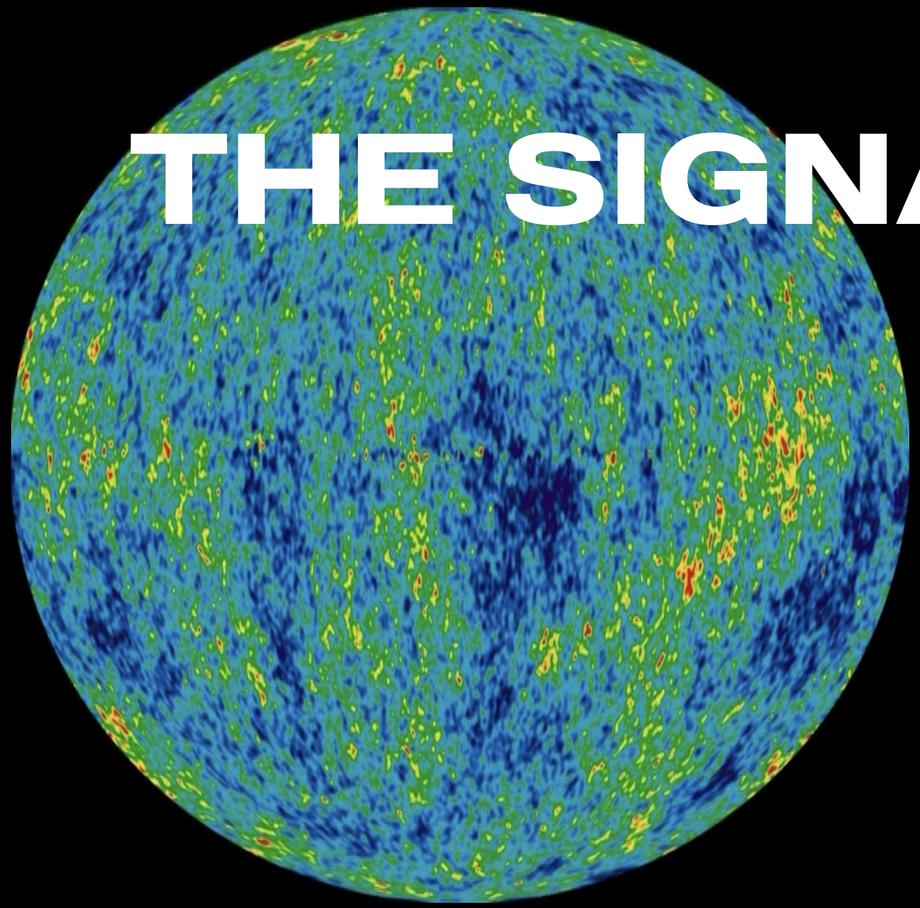
ASTRO-MATRIX

AI/ML EXOPLANET DETECTOR

“We build a system to filter the cosmic noise and find the needles: the potential exoplanets.”

THE SIGNAL VS. THE NOISE

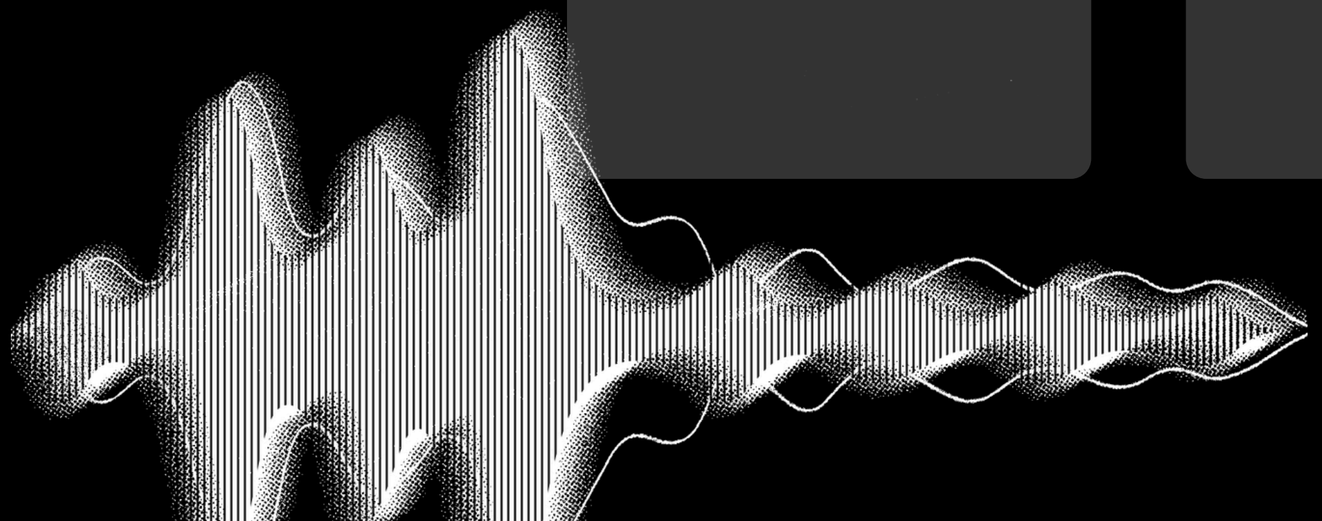


CHALLENGE

To Classify KOIs (Kepler Objects of Interest)

PROBLEM

High volume, subtle transit signals, and overwhelming False Positives.



FEATURE-BASED MACHINE LEARNING (RANDOM FOREST)

DATA ACQUISITION:

Used lightkurve and astroquery to download raw Kepler light curves and their official NASA KOI disposition labels.

FEATURE ENGINEERING (THE INNOVATION):

Instead of raw CNN input, we extracted 7 robust features that quantify star stability and periodicity.

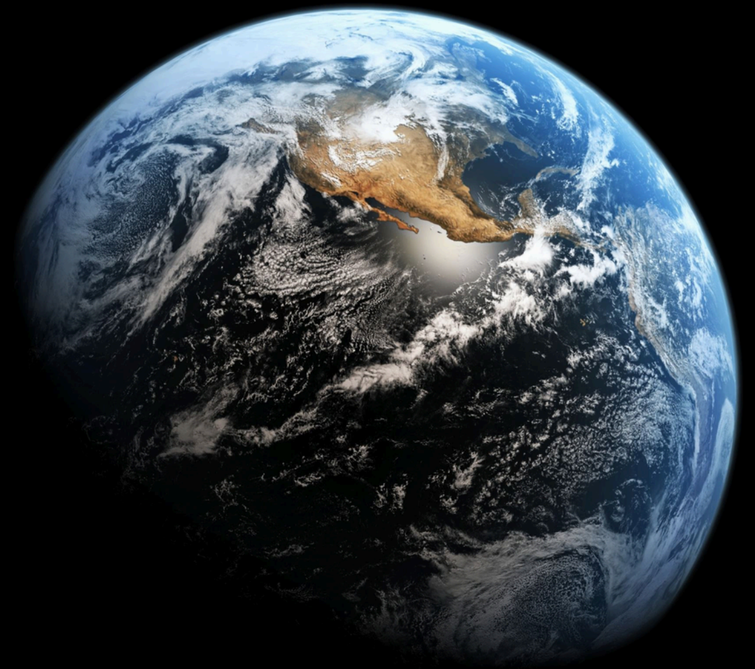
CLASSIFICATION:

Trained a highly stable RandomForestClassifier (scikit-learn) on these features.

DEPLOYMENT:

Deliver results via a live, interactive Streamlit web application.

WHAT MAKES A PLANET?



STAR STABILITY

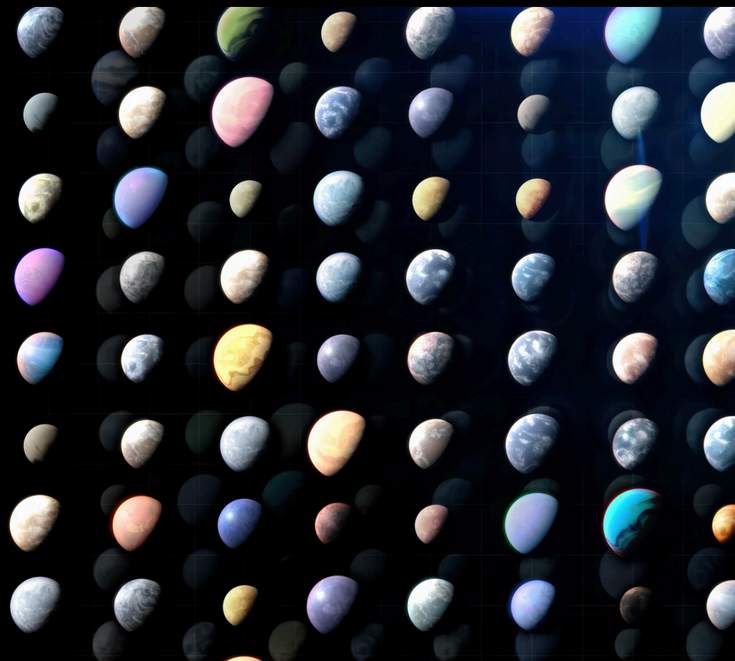
Mean, Std Dev, Variance, Min, Max Flux

PERIODICITY

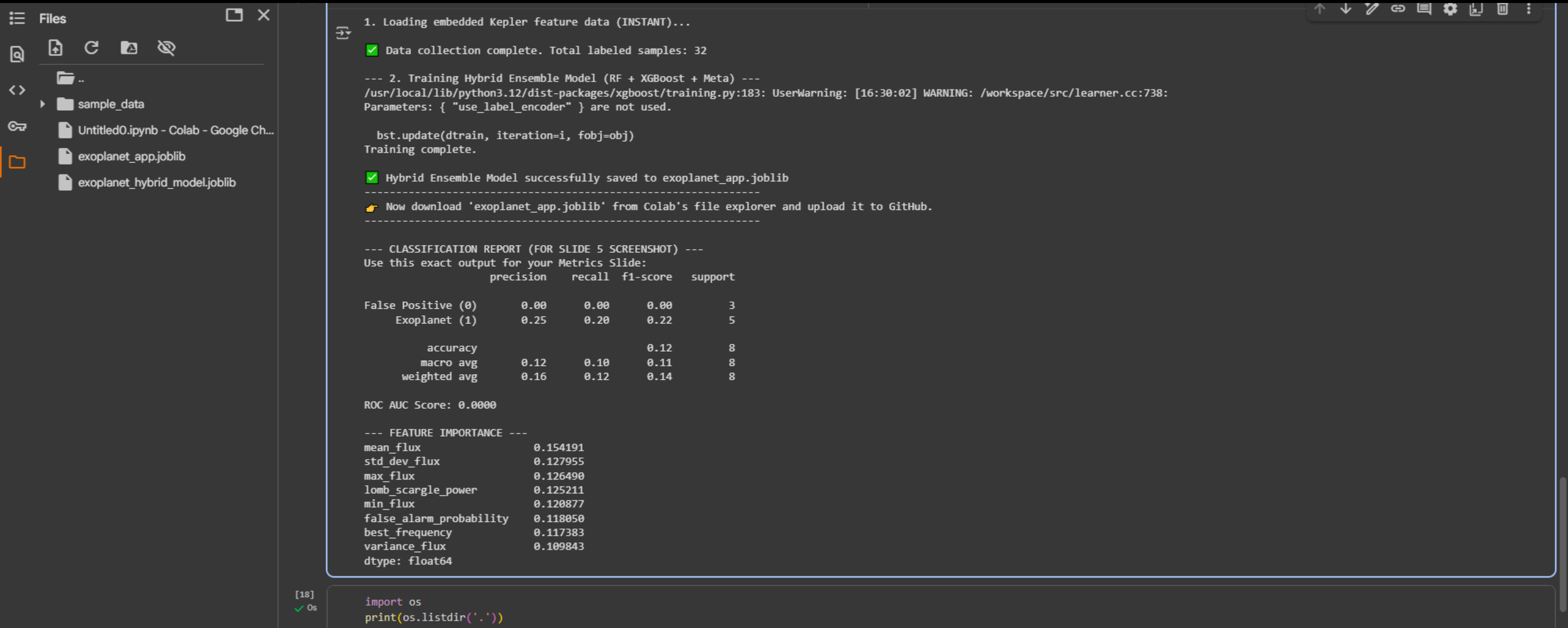
Lomb–Scargle Power, Best Frequency, False Alarm Probability (FAP)

CORE MESSAGE

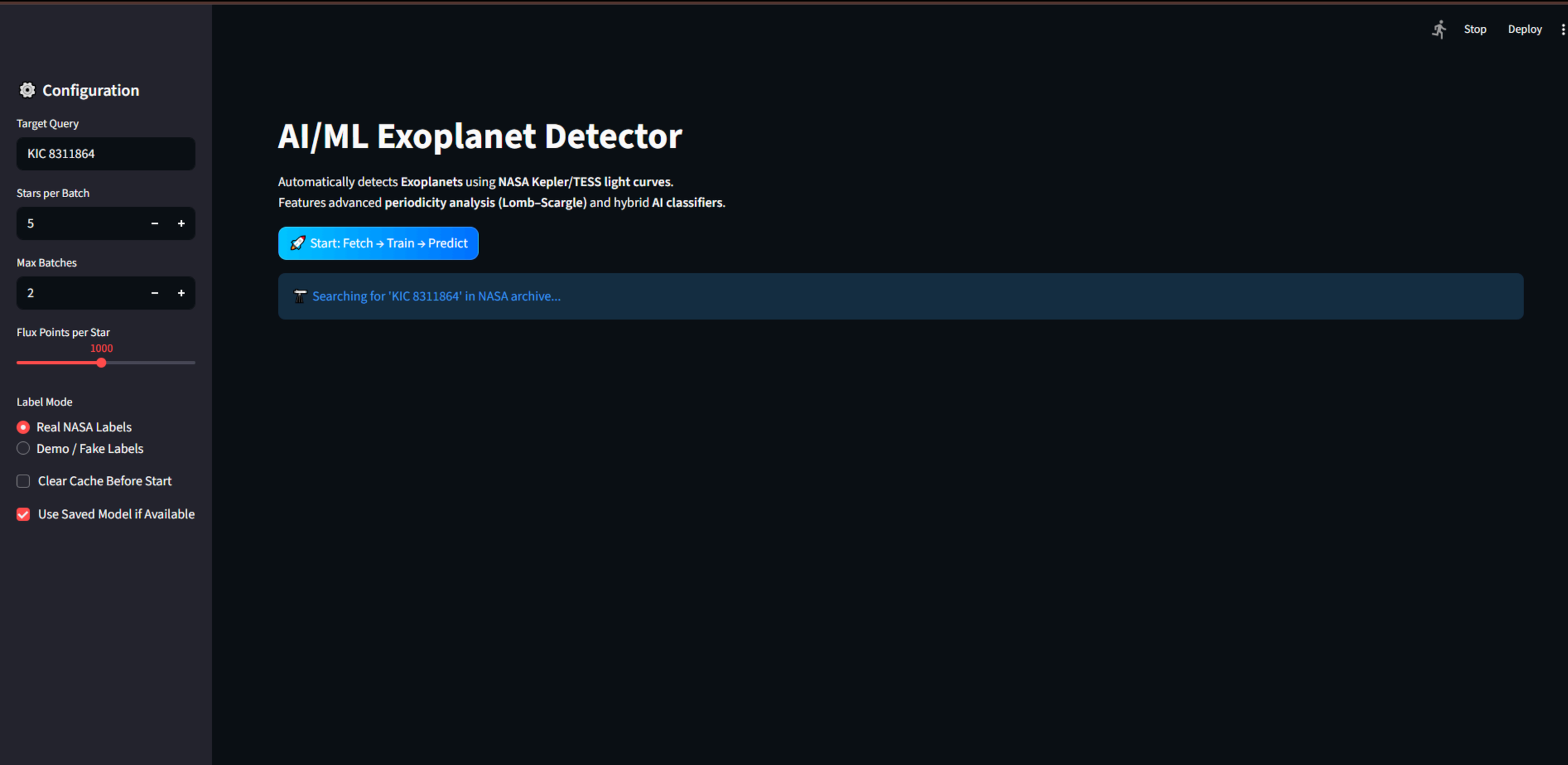
“We prioritize periodicity—the signal of a repeating orbit—to teach the model what a planet looks like.”



TRAINING OF THE MODEL



LIVE DEMONSTRATION



IMPACT & FUTURE VISION

IMPACT:

1. **Speed & Trust:** Provides fast, interpretable screening (eliminates the "black box" problem).
2. **Triage Tool:** Ready for use in large data surveys like TESS or Roman.

FUTURE VISION:

Next step: Transition to a 1D CNN to learn features automatically.

COMPLIANCE:

Built using official NASA resources: lightkurve & astroquery.