Exoplanetary surface composition prediction using ML

Dataset (source):

zenodo

USGS science for a changing world

NASA Planetary Spectrum Generator

PICAS

References:

https://arxiv.org/abs/2203.04201 :Follow the Water: Finding Water, Snow and Clouds on Terrestrial Exoplanets with Photometry and Machine Learning

https://ui.adsabs.harvard.edu/abs/2021MNRAS.504.6106P/abstract :Color classification of Earth-like planets with Machine Learning

TEAM MEMBERS:

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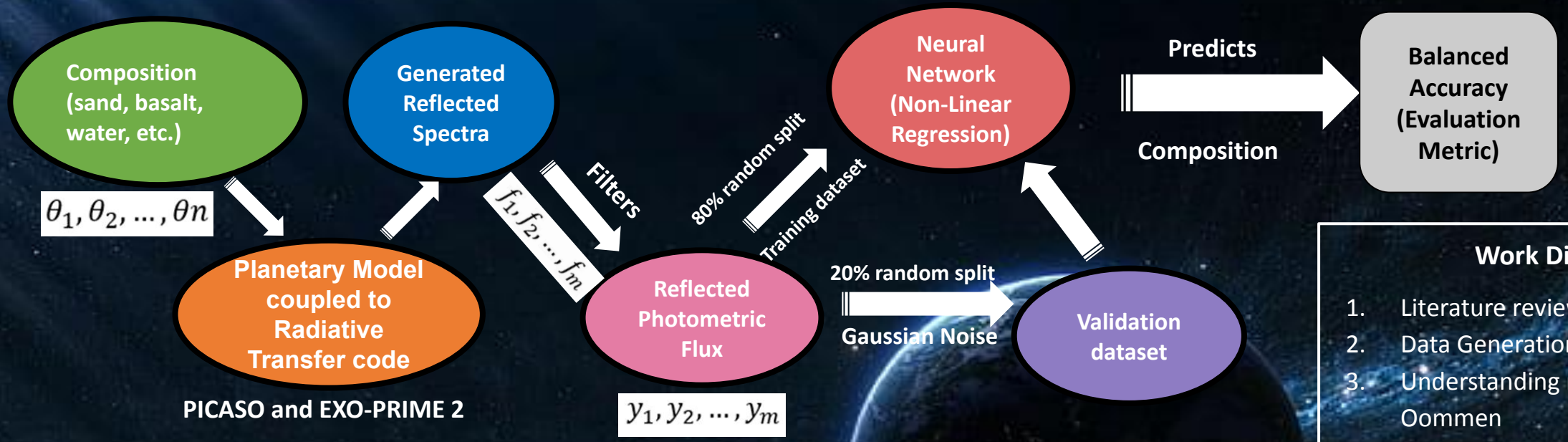
IDEA: To identify the presence of minerals on the surface of exoplanets (mainly terrestrial) by implementing Machine Learning on the reflection photometric flux from spectra generated using planetary models (PICASO, Exo-Prime2) and spectral library (USGS and PSG).
This can help characterize future telescopes for predicting composition using photometric flux and follow up in time-intensive spectroscopic data.



Midway Plans

1. Literature Review
2. To complete generating dataset and labeling
3. Learning Neural Network
4. Augmenting data with Noise
5. Implementing some preliminary models for non-linear regression (SVM and Random Forest)

Post Mid-term Plans

1. Analyzing ML performance
2. Adding more parameter space for data generation (if needed)
3. Implementing a Neural Network to predict the surface composition of Exoplanet
4. Increasing the number of filters to compare the accuracy
5. Find a set of optimal filters (by feature ranking) for characterization of future telescopes

Work Division

1. Literature review: Dibya
2. Data Generation: Both
3. Understanding neural network : Oommen
4. Implement SVM and Random forest: Dibya
5. Analyze the results: Oommen
6. Coding and building: Both
7. Documentation: Dibya
8. Report Preparation : Both

Expected Results

To successfully predict the surface composition(with %) and improve the performance using neural network.