

Automating Verification and Validation in the EXCALIBUR Pipeline for the Atmospheric Analysis of Exoplanets

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EXCALIBUR is an exoplanet atmospheric analysis pipeline that transforms raw telescopic data into useful data products on exoplanets, such as light curves and spectra, and then conducts analysis to infer the chemical composition of the exoplanets' atmospheres. Each time an exoplanet is processed, the data product is currently manually analyzed to ensure the processing did not distort the raw data into a scientifically implausible form. However, sorting through data products manually is not practical in the limit of having hundreds or thousands of exoplanets to analyze. The goal of this project was to automate the verification and validation (VV) process so the EXCALIBUR pipeline will become more robust and completely hands-off, allowing it a much broader application. This automation took the form of a machine learning pipeline that takes in data products and predicts their scientific plausibility. Constructing this machine learning pipeline involved simulating synthetic exoplanet data, analyzing real data to construct useful features for the pipeline, and training the model on synthetic data to be tested on manually verified real data.