Specs:

All algorithms were executed in Python.

Feature Extraction Algorithm

// Feature Extraction Algorithm converts CSV-imported radial velocity time series with columns:

- Time
- Radial Velocity
- Error of Radial Velocity

to the time series signals and then extracts the following parameter information:

- Period
- Eccentricity
- Power (Statistical Significance)
- False Alarm Probability
- Orbital Phase
- Amplitude

The parameters are outputted in a data frame. Each star takes approximately 5 minutes to fully calculate parameters. //

1. Import radial velocity data as a pandas data frame from CSV files (pandas.DataFrame)
2. Extract periods from time-series data with Scipy Lomb-Scargle periodogram (list)
3. Calculate power and false alarm probability from periodogram (list)
4. Optimize for eccentricity using Radvel eccentricity algorithm. Output eccentricity terms in a list (list)
    a. Calculate eccentricity from list (int)
    b. Append eccentricity to a list (list)
5. Fit orbital phase and amplitude to function with given period (list)
6. Append each parameter to a list with orbital phase and a list with amplitude (list)
7. Append: period, eccentricity, power, false alarm probability, orbital phase, and amplitude lists to final data frame (pandas.DataFrame)
8. Save data frame to CSV (string)
9. Output data frame (pandas.DataFrame)
10. Repeat steps 1-9 for all given stars in sequence.

Noise Reduction Algorithm (Control Treatment)

// Noise reduction algorithm takes as inputs a CSV file containing the parameters as outputted by the Feature Extraction Algorithm:

- Period
- Eccentricity
- Power (Statistical Significance)
- False Alarm Probability
- Orbital Phase
- Amplitude

And outputs the signals most likely to be exoplanets, using the specified control treatment.

The predicted results are then evaluated with accuracy, precision, confusion matrix, AUC parameters, and F1 score and results are outputted in specified file path. //

1. Input CSV orbital parameter files as a data frame (pandas.DataFrame).
2. Order signals based on their power in descending order and false alarm probability in ascending order (pandas.DataFrame).
3. Index top 15 signals with highest power and lowest false alarm probability
4. Print indexed results as a pandas.Dataframe.
5. Import corrected CSV exoplanet dataset as a pandas data frame (pandas.DataFrame).
6. Identify correct signal in corrected dataset and label predicted signal as false positive, false negative, true positive, and true negative based on corrected dataset.
7. Output confusion matrix (float)
8. Calculate accuracy (float).
9. Calculate precision (float).
10. Calculate recall (float).
11. Calculate F1 score (float).
12. Calculate true positive rate and false negative rate [AUC parameters] (float).
13. Write results to specified file path
14. Repeat steps 1-13 for specified file paths.

Noise Reduction Algorithm (PEA Treatment)

// Noise reduction algorithm takes as inputs a CSV file containing the parameters as outputted by the Feature Extraction Algorithm:

- Period
- Eccentricity
- Power (Statistical Significance)
- False Alarm Probability
- Orbital Phase
- Amplitude

And outputs the signals most likely to be exoplanets, using the specified control treatment.

The predicted results are then evaluated with accuracy, precision, confusion matrix, AUC parameters, and F1 score and results are outputted in specified file path. //

15. Input CSV orbital parameter files as a data frame (pandas.DataFrame).
16. Filter signals based on their orbital parameters period, eccentricity, and amplitude [as outlined by compiled paper].
17. Import corrected CSV exoplanet dataset as a pandas data frame (pandas.DataFrame).
18. Identify correct signal in corrected dataset and label predicted signal as false positive, false negative, true positive, and true negative based on corrected dataset.
19. Output confusion matrix (float)
20. Calculate accuracy (float).
21. Calculate precision (float).
22. Calculate recall (float).
23. Calculate F1 score (float).
24. Calculate true positive rate and false negative rate [AUC parameters] (float).
25. Write results to specified file path
26. Repeat steps 1-13 for specified file paths.

Noise Reduction Algorithm (Combined Treatment)

// Noise reduction algorithm takes as inputs a CSV file containing the parameters as outputted by the Feature Extraction Algorithm:

- Period
- Eccentricity
- Power (Statistical Significance)
- False Alarm Probability
- Orbital Phase
- Amplitude

And outputs the signals most likely to be exoplanets, using the specified control treatment.

The predicted results are then evaluated with accuracy, precision, confusion matrix, AUC parameters, and F1 score and results are outputted in specified file path. //

27. Input CSV orbital parameter files as a data frame (pandas.DataFrame).
28. Order signals based on their power in descending order and false alarm probability in ascending order (pandas.DataFrame).
29. Filter signals based on their orbital parameters period, eccentricity, and amplitude [as outlined by compiled paper].
30. Index top 15 signals with highest power and lowest false alarm probability that satisfy the filtering methods in step #29.
31. Print indexed results as a pandas.Dataframe.
32. Import corrected CSV exoplanet dataset as a pandas data frame (pandas.DataFrame).
33. Identify correct signal in corrected dataset and label predicted signal as false positive, false negative, true positive, and true negative based on corrected dataset.
34. Output confusion matrix (float)
35. Calculate accuracy (float).
36. Calculate precision (float).
37. Calculate recall (float).
38. Calculate F1 score (float).
39. Calculate true positive rate and false negative rate [AUC parameters] (float).
40. Write results to specified file path
41. Repeat steps 1-13 for specified file paths.