

Can you predict whether a planetary candidate is a bona fide exoplanet?

Exoplanets, or extrasolar planets, are planets that exist outside of our Solar System. Due to their small size and their faintness, it is almost impossible to discover them via direct imaging; rather, they are discovered indirectly, most commonly via

- the radial velocity method, in which one detects a star’s (relatively tiny) wobble around its planetary system’s center of mass; and
- the transit method, in which one detects an exoplanet passing in front of, and thus partially eclipsing, its host star.

The transit method relies on a bit of luck: an exoplanet has to pass directly between us and the host star. That sort of chance alignment is rare. Hence for the transit method to be truly useful, we have to monitor *many* star systems.

Between 2009 and 2013, NASA’s *Kepler* satellite stared at a star field in the constellation Cygnus and kept tabs on over 100,000 stars at once. Data processing software used to analyze all the light curves (i.e., the brightnesses of each star as a function of time) identified “objects of interest,” i.e., stars with possible exoplanets. The *Kepler* observations, along with observations made independently, were used to take these objects of interest and label them as `CONFIRMED` (really an exoplanet) or `FALSE POSITIVE` (not an exoplanet).

The data are contained in `kepler.csv` :

predictors: 6859 x 17

| group | variables (all preceded with “koi_”) |
|----------------------------|---------------------------------------|
| exoplanet orbit-related | period, eccen, incl, dor |
| transit/eclipse-related | impact, duration, depth |
| exoplanet property-related | ror, prad, teq, insol |
| host star property-related | srho, steff, slogg, smet, srad, smass |

The definition of each measurement is given on this web page (https://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html).

response: 6859 x 1

| name | description |
|-------|---|
| label | <code>CONFIRMED</code> or <code>FALSE POSITIVE</code> exoplanet |