Exoplanet Detection

Finding other Earths

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INTRODUCTION

The **Kepler** mission was launched so that we can know, "Are we alone?", more specifically, it was sent into orbit with the aim of finding earthlike planets revolving other stars. There have been more than 1000 confirmed stars with exoplanets thanks to this mission and more than 3000 stars with potential planets around it.
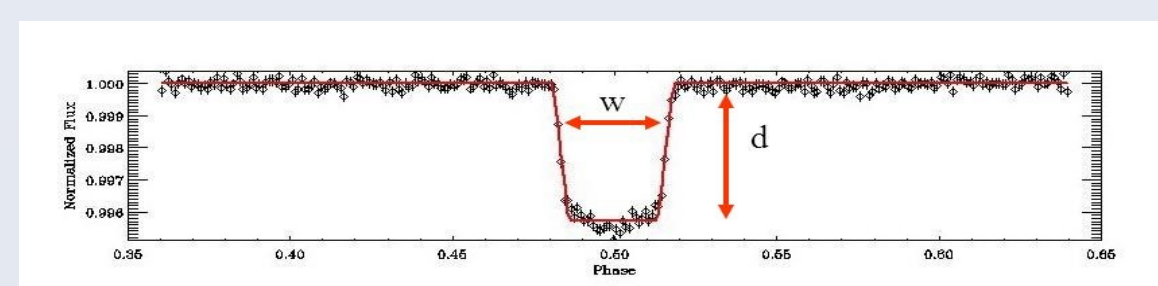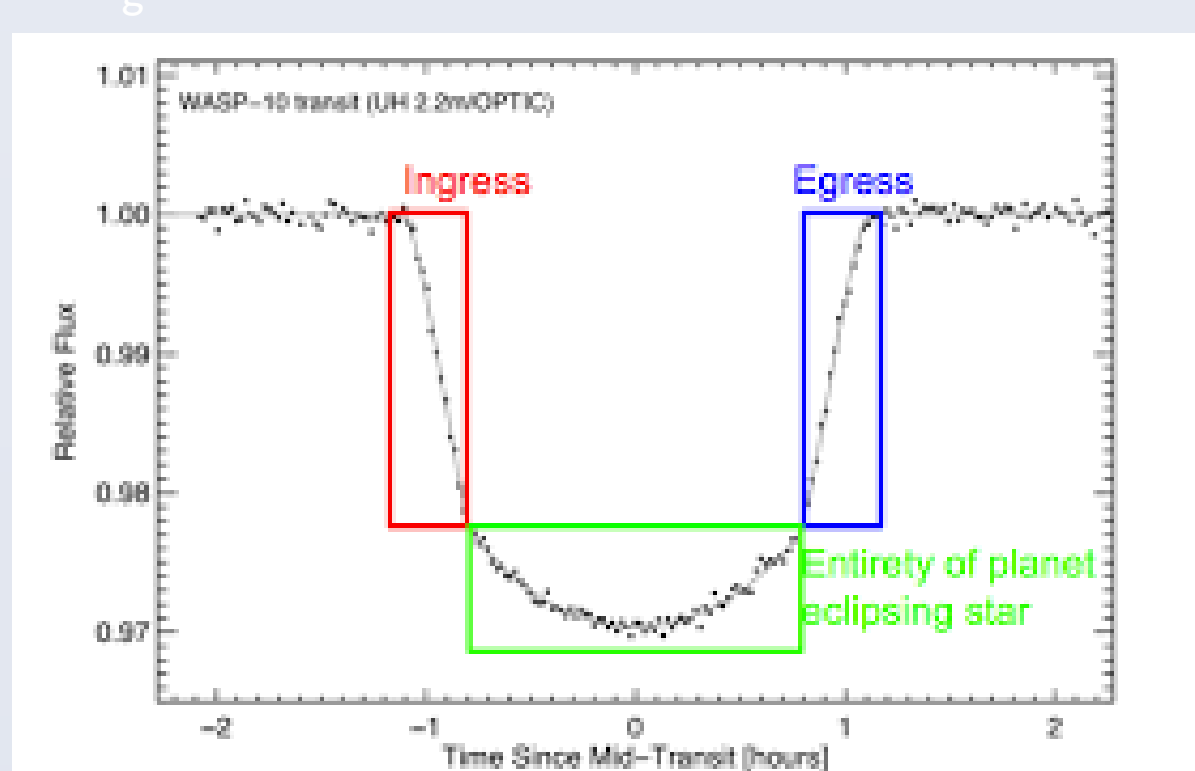
TRANSIT METHOD
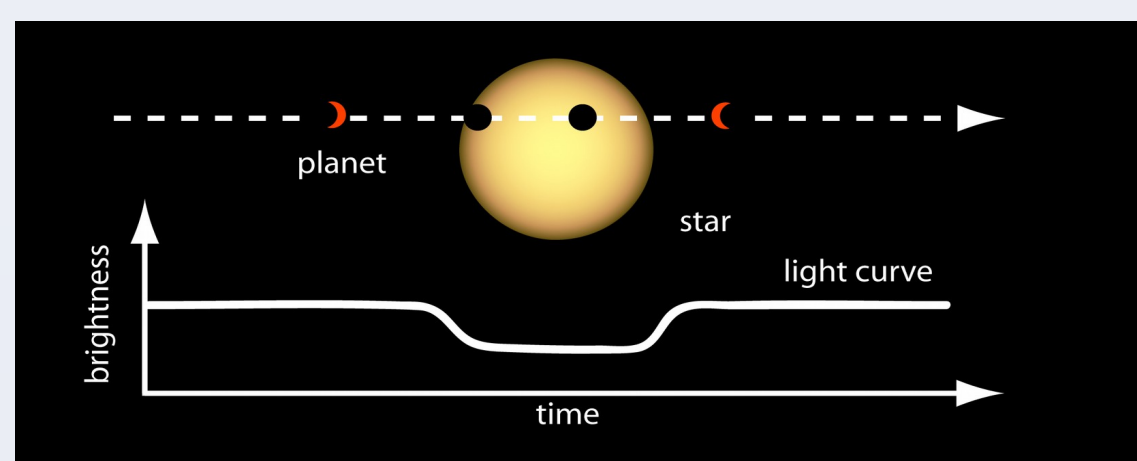
TRANSIT: Planet is between Earth and the star.
OCCULTATION: Planet is hidden behind the star.
In this method we try to detect presence of a planet around star using the miniscule reductions in the flux intensity of star during transit.

LEAST SQUARE BOX-FITTING

$$\tilde{w}_i = \frac{\frac{1}{\sigma_i^2}}{\sum_{j=1}^{j=n} \sigma_j^2}$$

$$R(i_1, i_2) = \sum_{i=1}^{i=i_1-1} \tilde{w}_i (\tilde{x}_i - H)^2 + \sum_{i=i_1}^{i=i_2} \tilde{w}_i (\tilde{x}_i - L)^2 + \sum_{i=i_2+1}^{i=n} \tilde{w}_i (\tilde{x}_i - H)^2$$
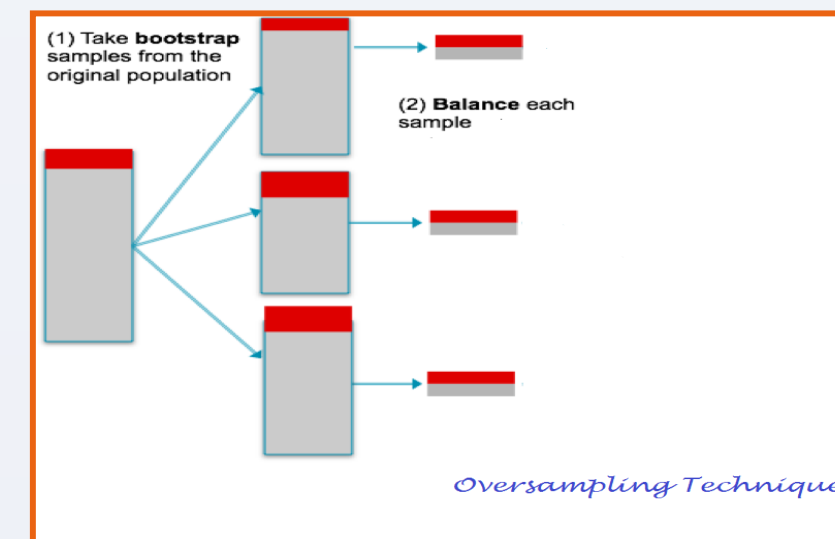
Fit a rectangular box in the dip of transit such that the cost function is minimum. This can calculate various values for the system.
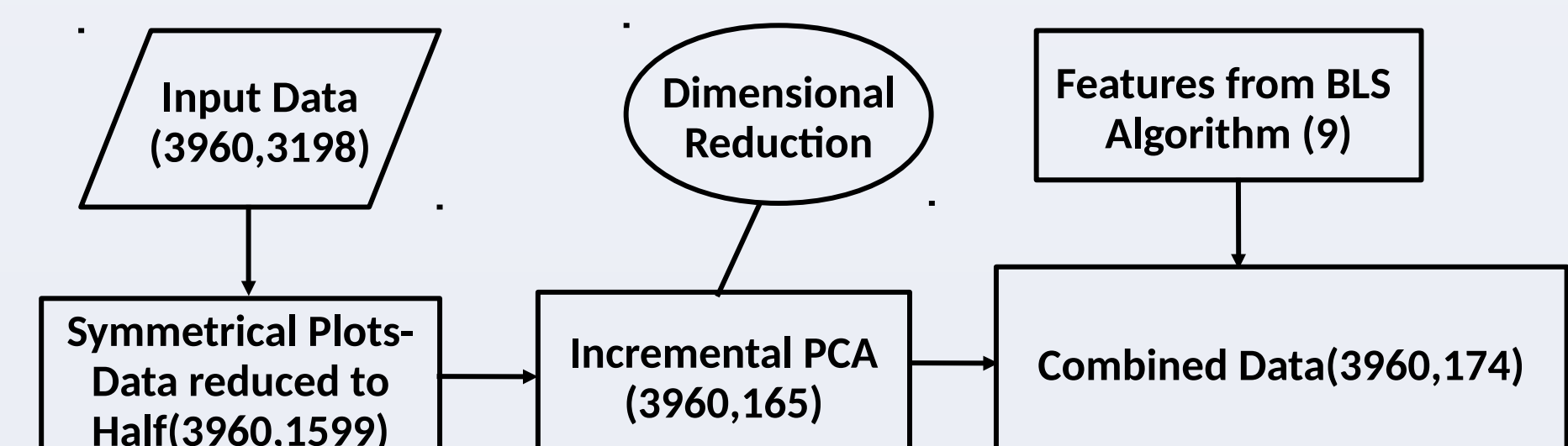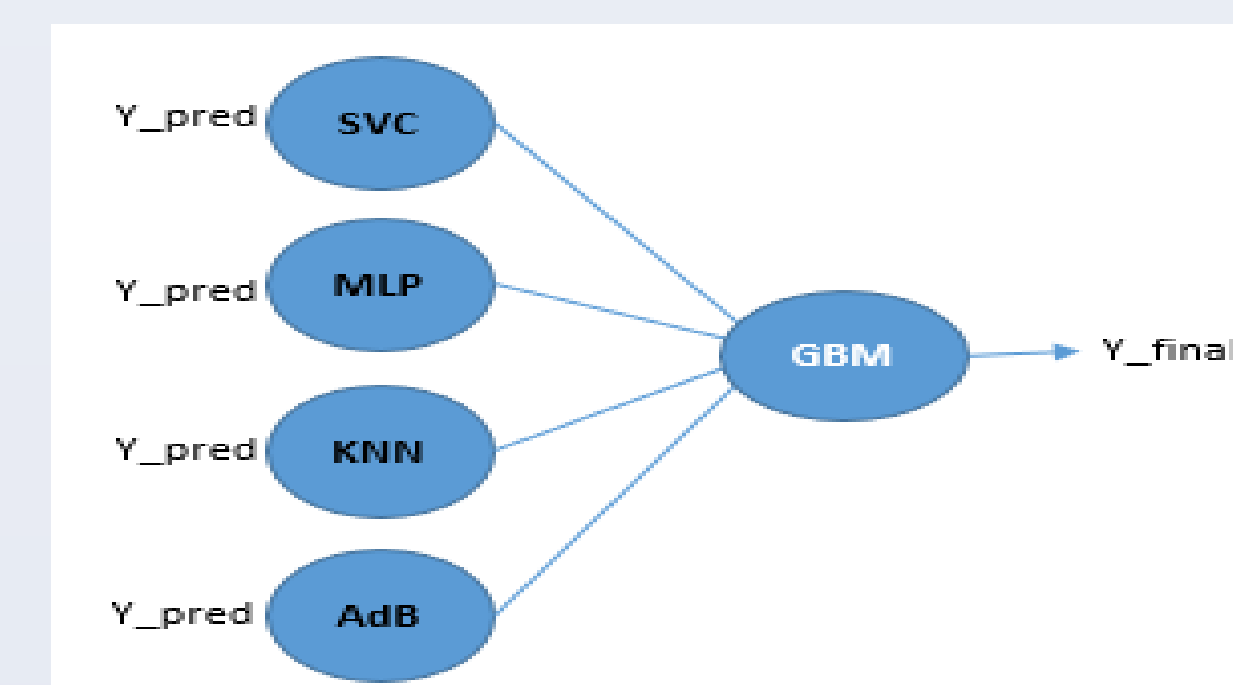
FAST FOURIER TRANSFORM

MODELLING

BOOTSTRAPPING:- The data is highly imbalanced, so bootstrapping.
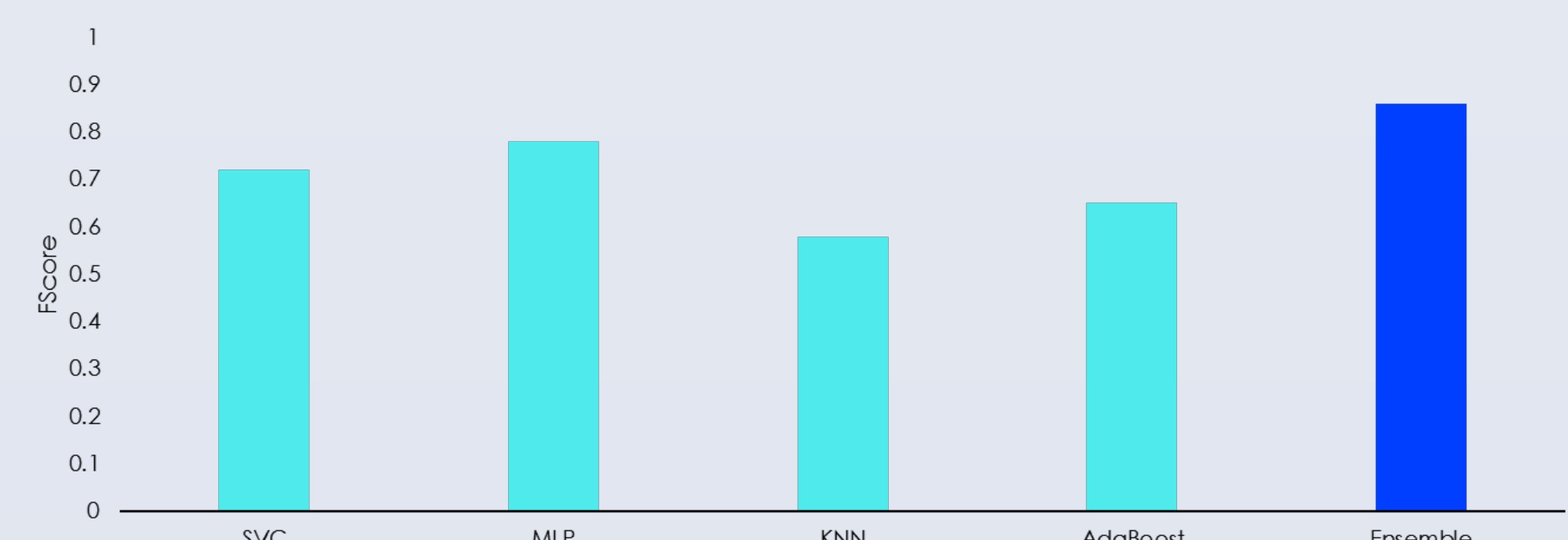- Stratified 5-fold cross validation.

INCREMENTAL PCA::

ENSEMBLE:

RESULTS:

Average Accuracy:	0.994
Average Precision:	0.894
Average Recall:	0.832
Average F1:	0.862

REFERENCES

Kovács, G., Zucker, S. and Mazeh, T., 2002. A box-fitting algorithm in the search for periodic transits. Astronomy & Astrophysics, 391(1), pp.369-377.

McCauliff, S.D., Jenkins, J.M., Catanzarite, J., Burke, C.J., Coughlin, J.L., Twicken, J.D., Tenenbaum, P.,Seader, S., Li, J. and Cote, M., 2015. Automatic classification of Kepler planetary transit candidates. The Astrophysical Journal, 806(1), p.6.

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