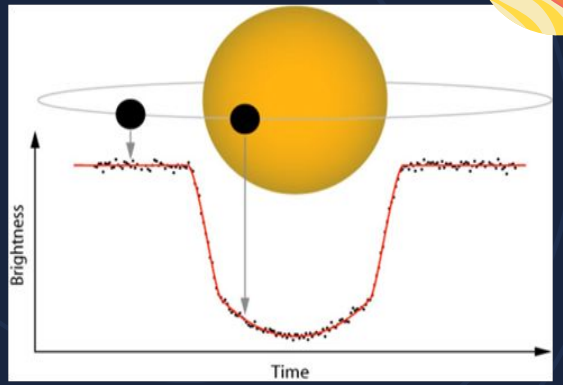
Planet Hunters: Discovering Exoplanets

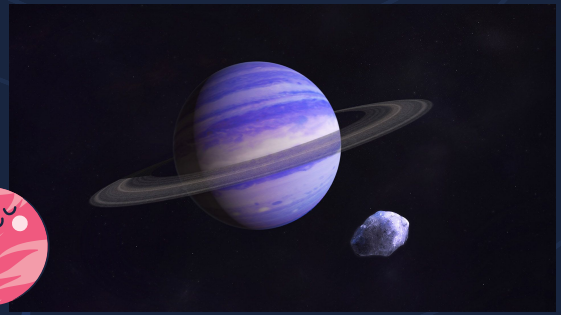
Isabella Tuason, Vienna, Audrey Creighton,
Shreya Sareen, Sofie Budman

Background Information

Data has been collected using telescopes about far-away stars:

- Transit Photometry - monitoring brightness (or flux) of stars over time
- Exoplanet - planet orbiting a star other than our own
- Light Curve - plot of a star's brightness
- Data can show patterns in flux that indicate an orbiting exoplanet.





Why Neural Networks?

Accurate

Precise identification of exoplanets through pattern recognition.

Real-time

Quick processing for immediate identification and verification.

Automated

Efficiently processes data without extensive manual intervention.

Scalable

Effectively handles massive datasets, allowing for efficient analysis of the vast amounts of data collected

Data/ML Problem Setup

Supervised Machine Learning

- useful for pattern recognition

Input Data

Transit Photometry

- measurements of the flux (brightness) of a star over a period of time
- obtained from transit photometry data from NASA's dataset from the Kepler Space Telescope

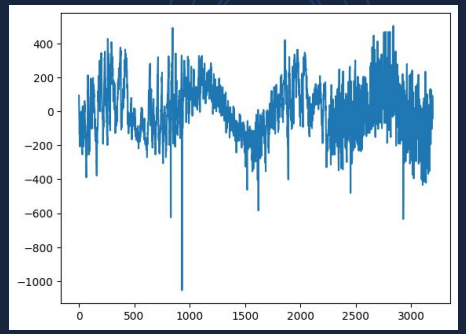
Output Data

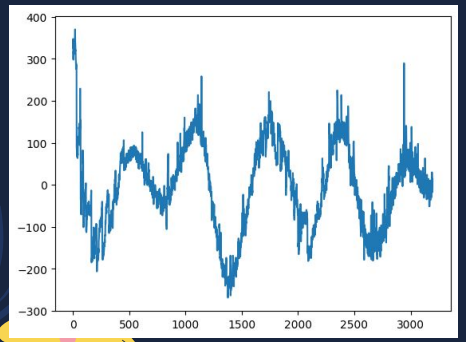
Exoplanet vs Non-exoplanet

- outputs graphs of light curves which shows the brightness (y-axis) over time (x-axis)

Classification : Exoplanet

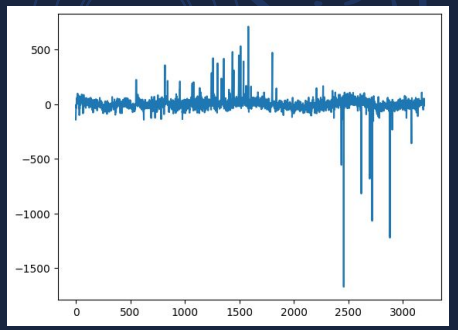
consistent pattern of dips

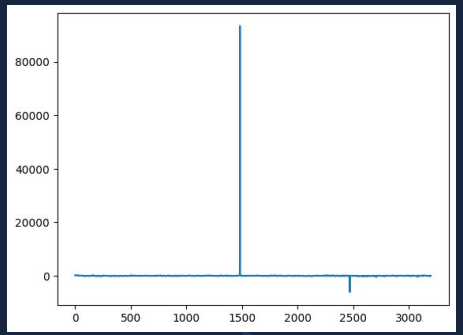




Classification : Non-exoplanet

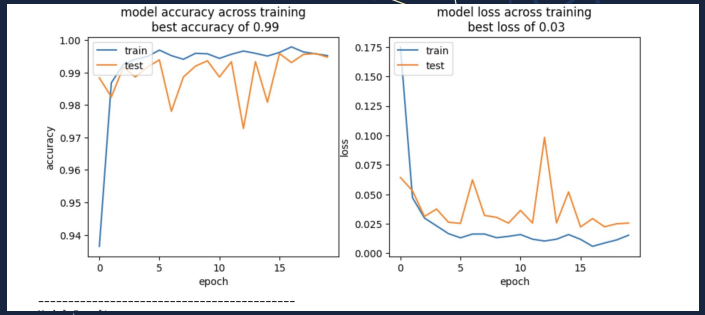
no pattern of dips





Building AI models

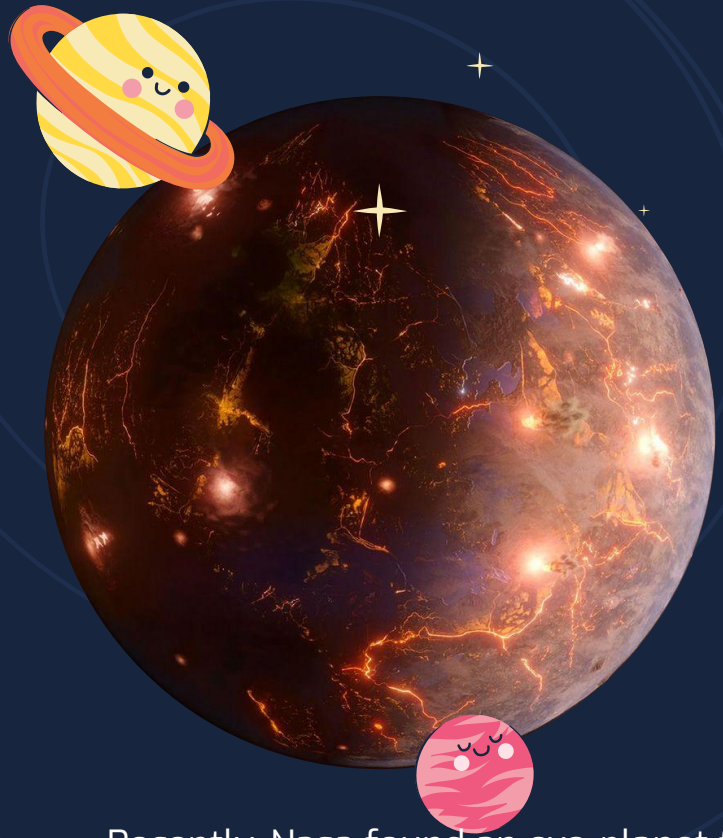
- Our highest performing AI model was one using a sequential model using Tensorflow and Keras. It had a best model accuracy across training of 0.99, and it had a best model loss across training of 0.03.
- While other models had produced high accuracies as well, using Tensorflow and Keras has allowed us to produce more complex models that are trained over time.
- To further improve the model, we analyzed the number neurons within each layer and the number of layers.
- In contrast, when we took advantage of Convolutional Neural Networks, the results produced were relatively low.



In the image, we see the accuracy levels produced by the sequential model. We took advantage of Neural Networks to achieve these results.

Real-World Application

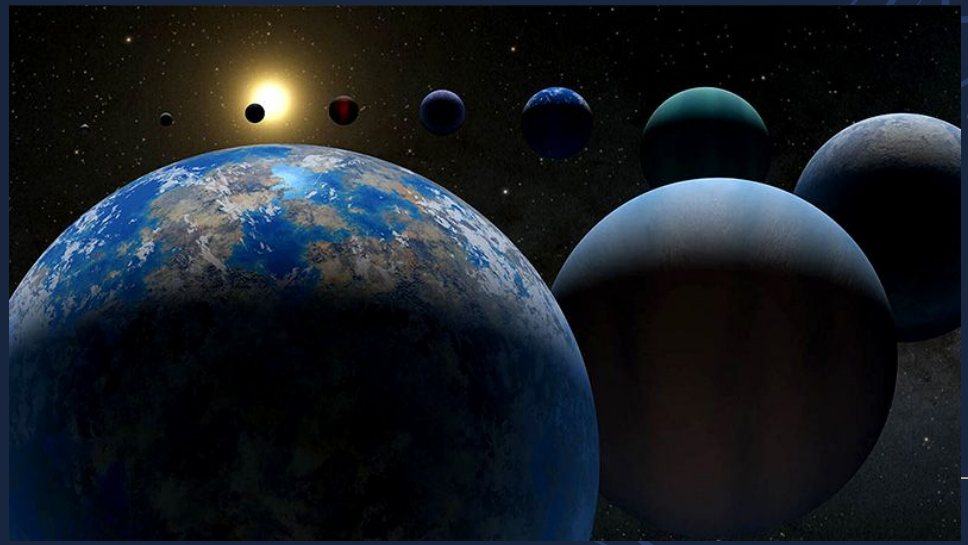
- The Nasa telescope, Kepler is used to search for exoplanets
- Information about exoplanets
- Narrows search for life
- More understanding of space



Recently, Nasa found an exo-planet the same size as earth that is covered in volcanoes

Real-World Implementation

- Future research and space exploration
- Improve understanding of the population of exoplanets
- Life?



A variety of exoplanet possibilities are shown in this illustration.
Image credit: NASA

Acknowledgements

https://www.cnn.com/2023/05/17/world/earth-size-volcanic-exoplanet-scn/index.html

https://newsroom.usra.edu/discovery-of-69-new-exoplanets-using-machine-learning/#:~:text=In%20a%20groundbreaking%20achievement%2C%20a,publication%20in%20the%20Astronomical%20Journal.


Thanks for watching!
=D