

# The Use of Machine Learning for Exploring TESS Light Curves



Adam Friedman

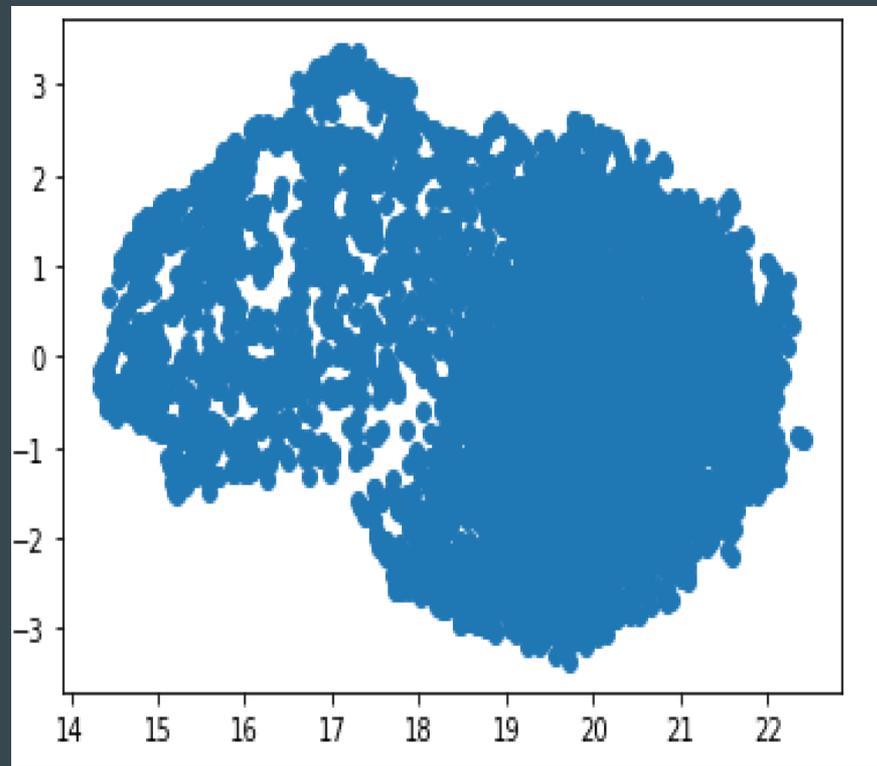
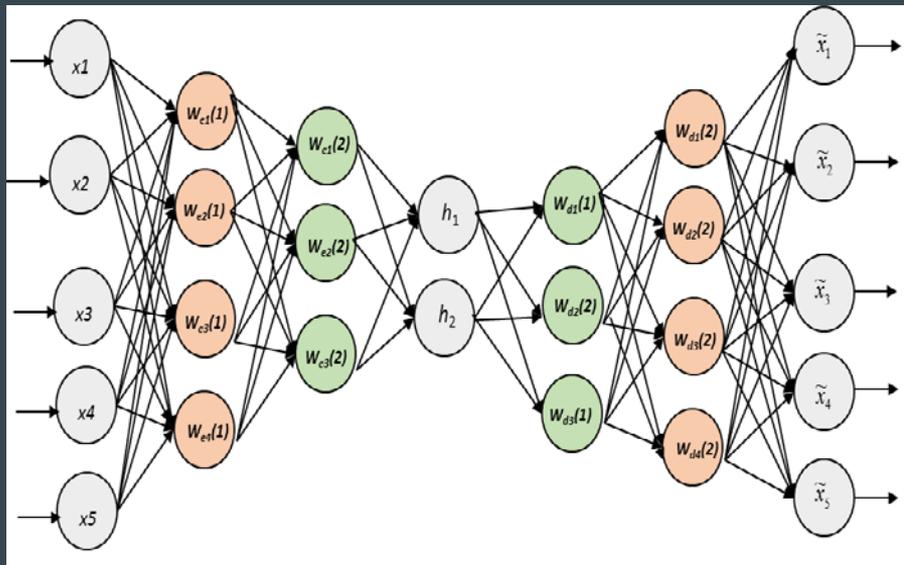
University of Michigan-Sophomore CS undergrad

# Overview

- Machine Learning is an invaluable tool for the future of space exploration
- Machine learning is often much more efficient in classifying data than humans
- Asking the right question is crucial

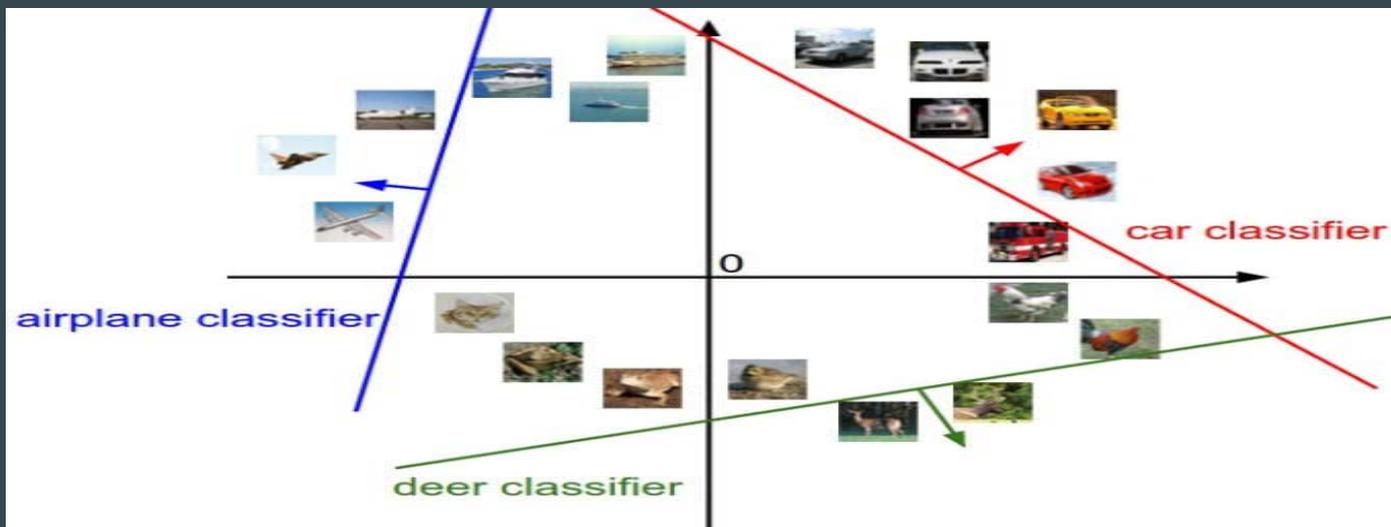
# Exploring the Light Curve Embedding Space

- Convolutional autoencoder
- Utilizes UMAP on central layer

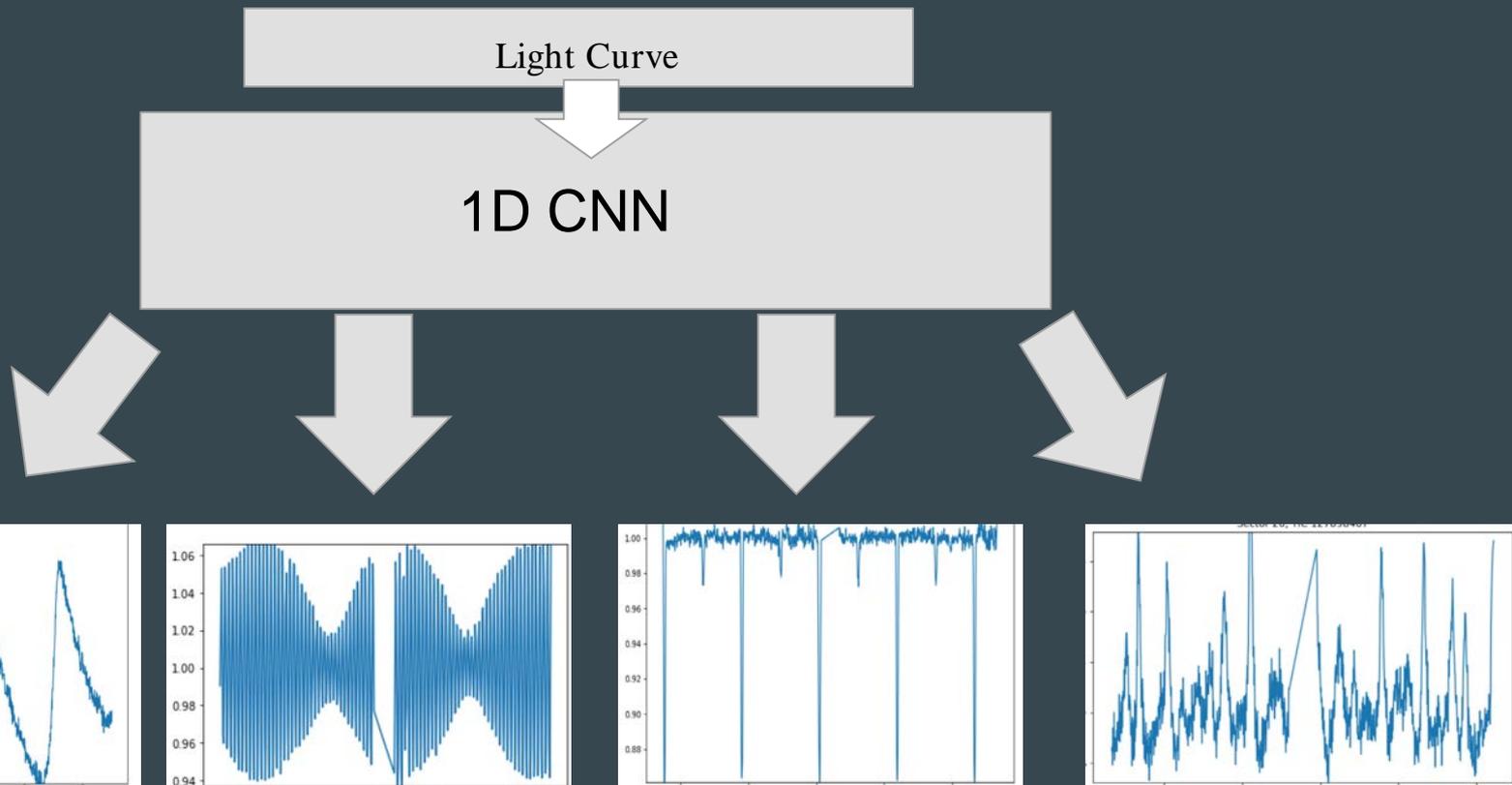


# Transition to Supervised Classification

- Mutually exclusive categories (read in from Spreadsheets)
- Collected training data to train classifier
- Iterative strengthening of neural net through data collection
- Use of NCCS GPUs and access to TESS ffi light curves sectors 1-24

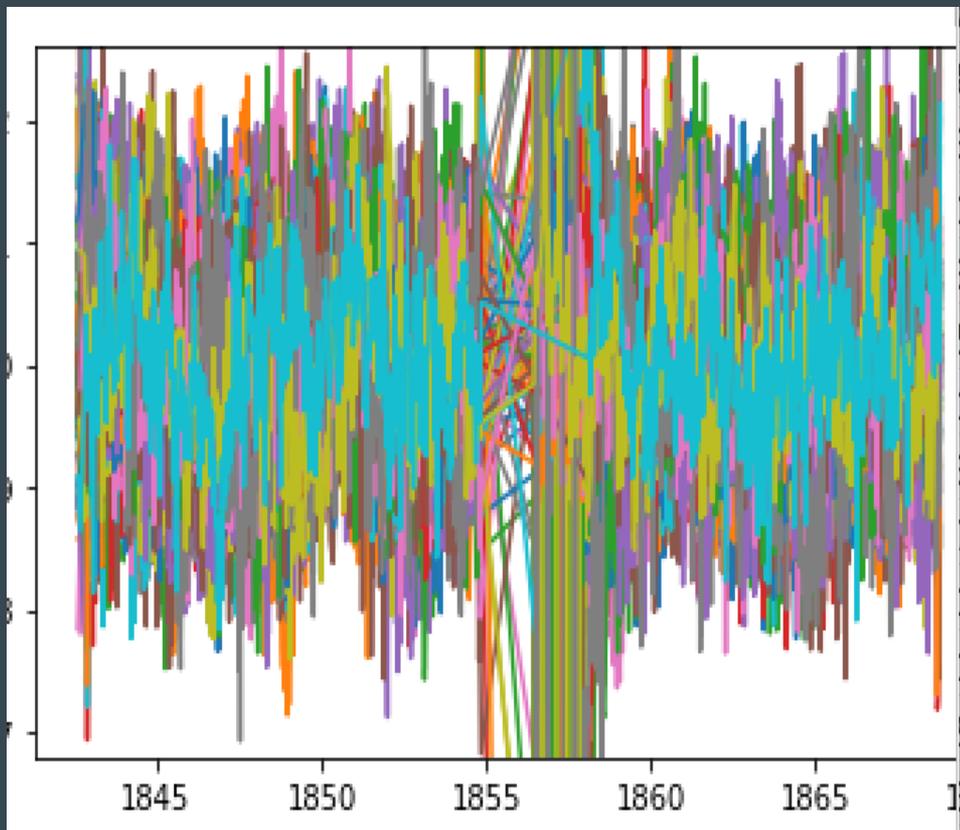


# Light Curve Classifications

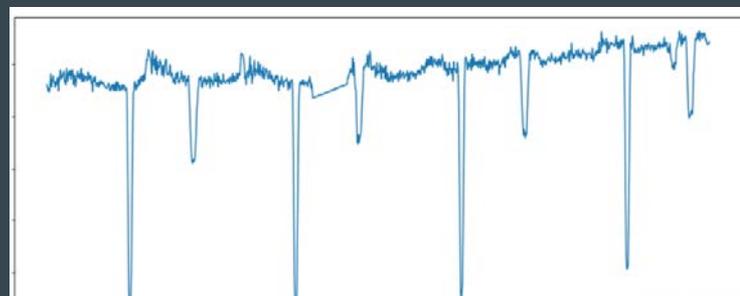
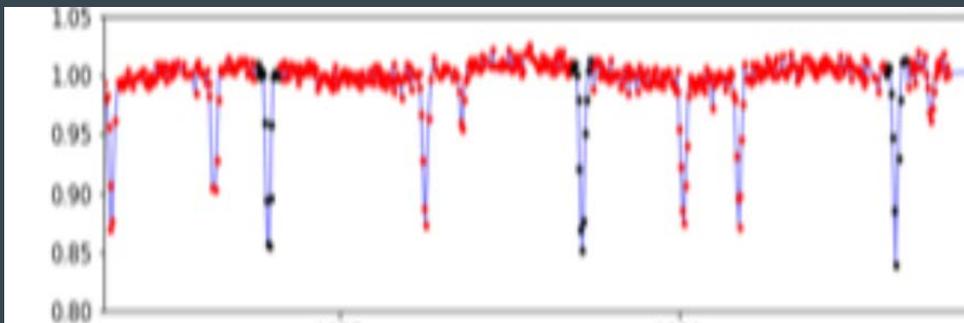
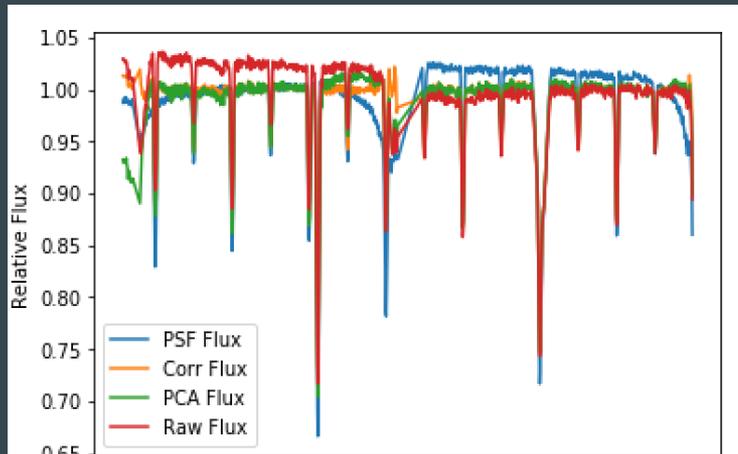
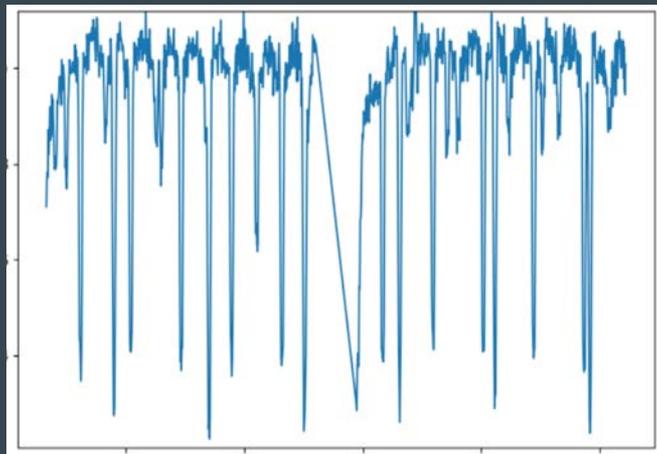


# Roadblocks

- Trial and error with the neural net
- Misclassification
- Technical errors (see right)
- TESS systematics and bad data



# NEW Quadruple Systems...and a Planet?!



# Results and Next Steps

- Automatic upload of category predictions from sector 25 to Slack using Slack API
- Impact to scientific community: immediate access to new organized FFI light curves
- Create more classes of light curves
- Apply to new data sets

TESS FFI Distribution ▾  
● Adam Friedman

# beating  
# **cepheids**  
# delta-scutti  
# eclipsing-binaries  
# fast-eclipsing-binaries  
# general  
# heartbeats  
# **high-frequency-oscillation**  
# random  
# rapid-rotators  
# sinusoidal-variability  
# **star-spots**  
# weird

▼ Direct messages +  
♥ Slackbot  
● Adam Friedman (you)

#star-spots ☆  
👤 2 | Add a topic

slacklc ▾

9:27 Classifier Score: 1.00, TIC 124320369, Sector 6  
slacklc ▾

Classifier Score: 1.00, TIC 453118867, Sector 19  
slacklc ▾

TESS FFI Distribution ▾  
● Adam Friedman

▼ Channels +  
# beating  
# cepheids  
# delta-scutti  
# **eclipsing-binaries**  
# fast-eclipsing-binaries  
# general  
# heartbeats  
# high-frequency-oscillation  
# random  
# rapid-rotators  
# sinusoidal-variability  
# star-spots

▼ Direct messages +  
♥ Slackbot

#eclipsing-binaries ☆  
👤 2 | Add a topic

slacklc ▾ Yesterday ▾

9:26 Classifier Score: 1.00, TIC 46293701, Sector 12  
slacklc ▾

Classifier Score: 1.00, TIC 157250338, Sector 6  
slacklc ▾

Q and A

Questions?