LightPred -Analyzing Light Curves using Deep Learning

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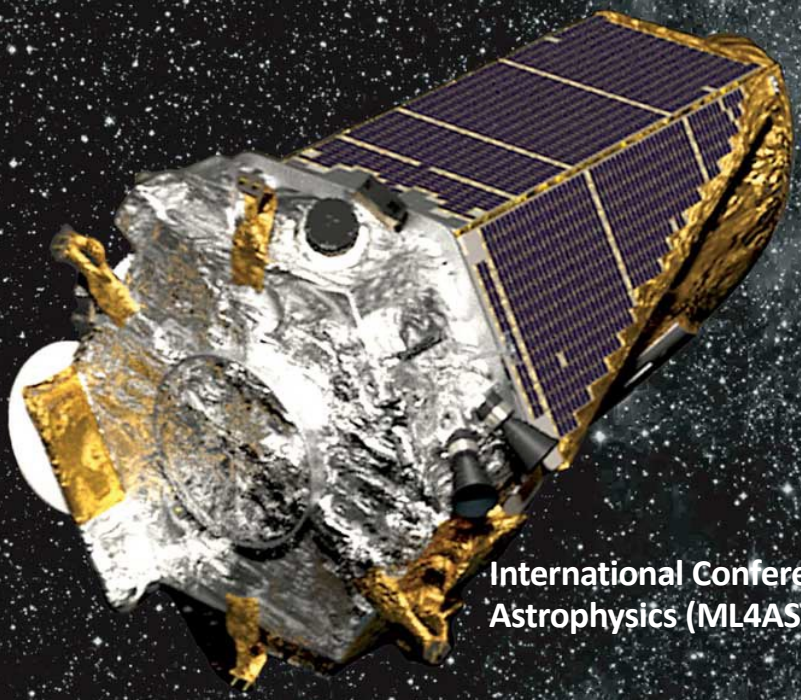
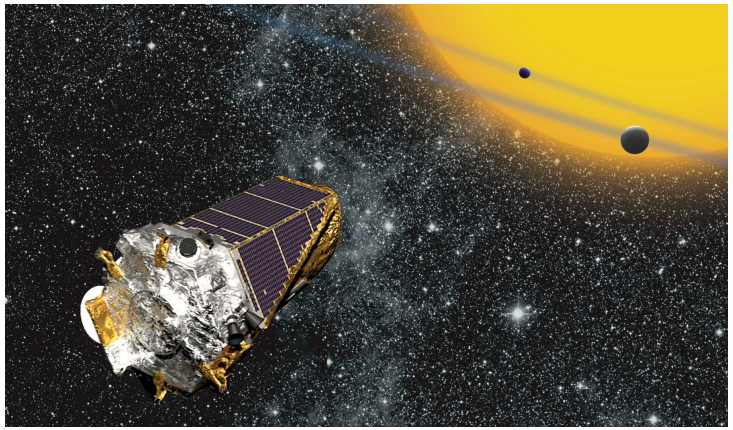
Technion

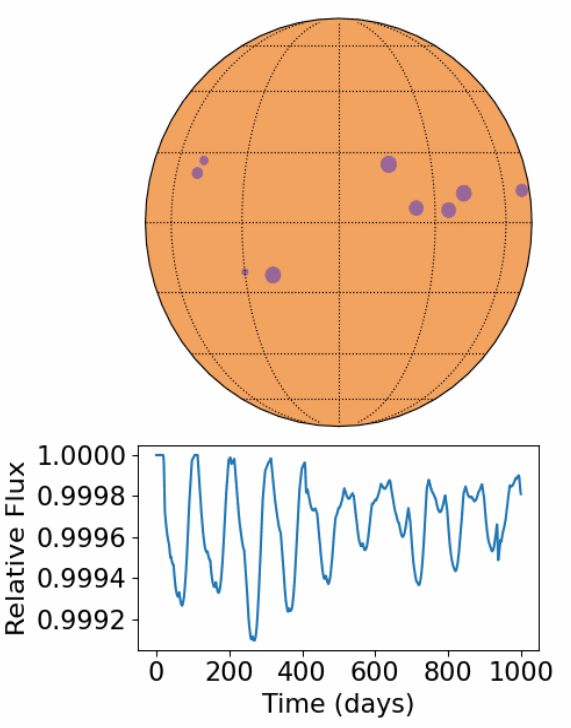


International Conference on Machine Learning for Astrophysics (ML4ASTRO2), 8–12 July 2024, Catania

Image credit: W Stenzel/NASA

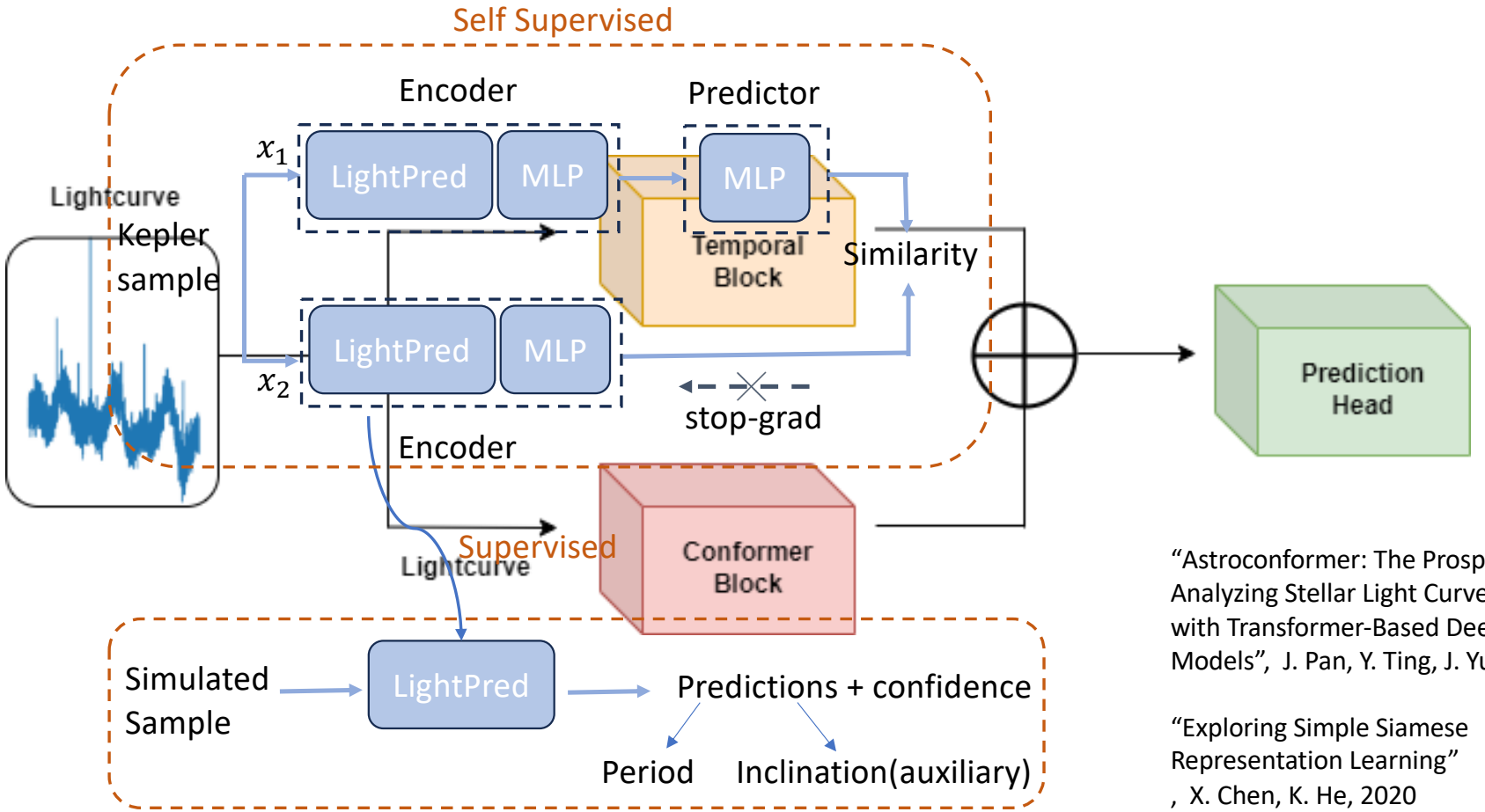
Problem Setting





- Equatorial Stellar Period
- Inclination
- Differential Rotation
- Spots Configuration
- Spots Lifetime

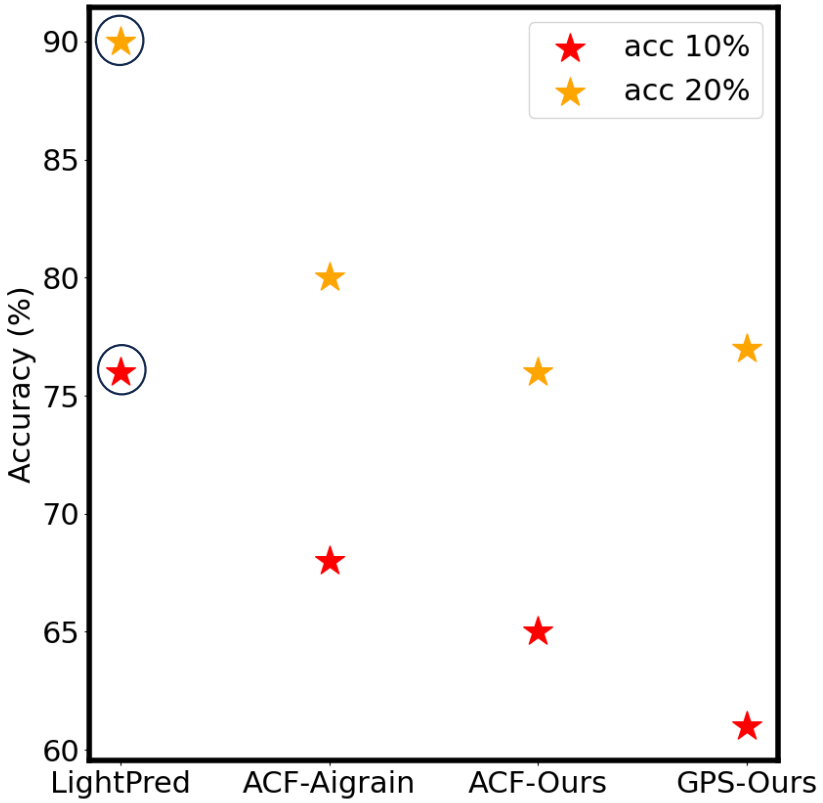
LightPred Model

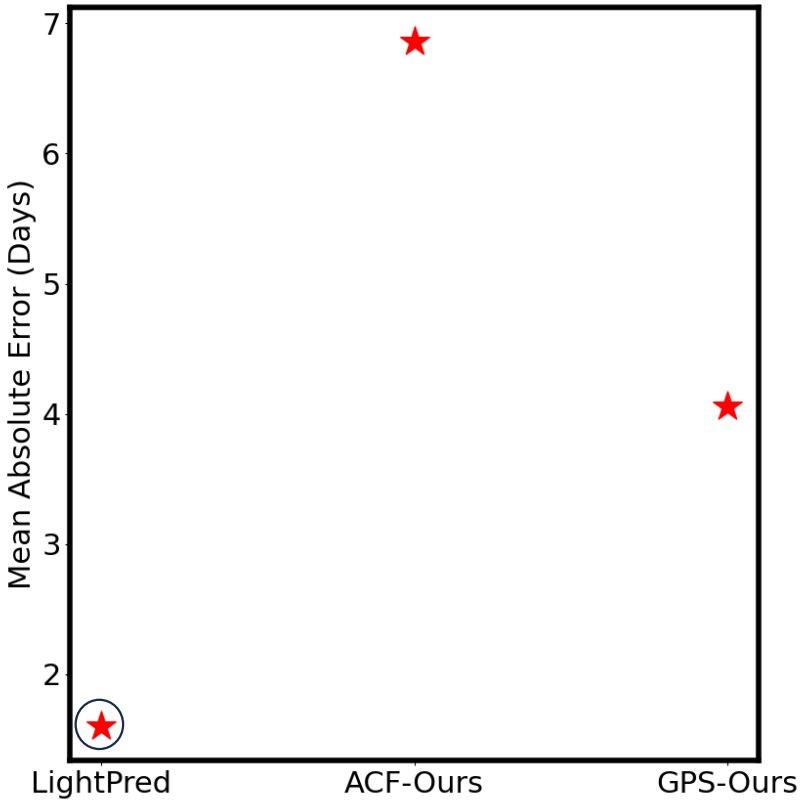


"Astroconformer: The Prospects of Analyzing Stellar Light Curves with Transformer-Based Deep Learning Models", J. Pan, Y. Ting, J. Yu, 2024

"Exploring Simple Siamese Representation Learning" , X. Chen, K. He, 2020

Results - Simulation



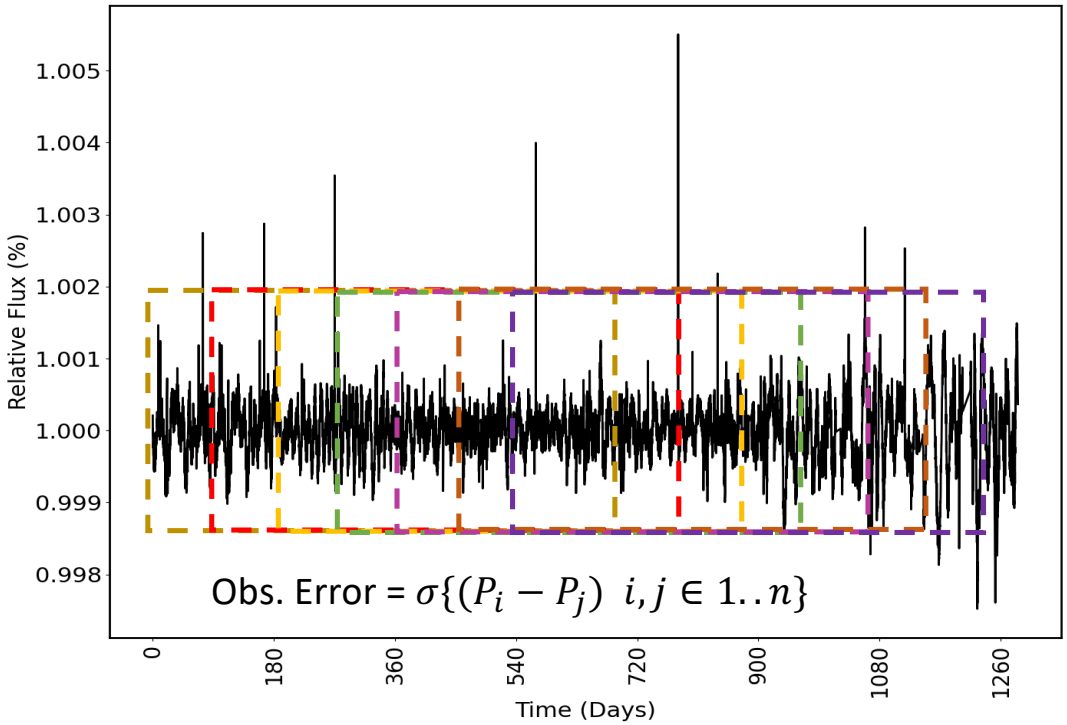


"Testing the recovery of stellar rotation signals from Kepler light curves using a blind hare-and-hounds exercise ", Aigrain et al. 2015

Results – Kepler Data

Model	Percent Predicted (%)	Average Obs. Error - All Data (Days)	Average Obs. Error – ACF Subset (Days)
LightPred	**100**	**2.01**	**1.55**
ACF	33	2.98	1.65

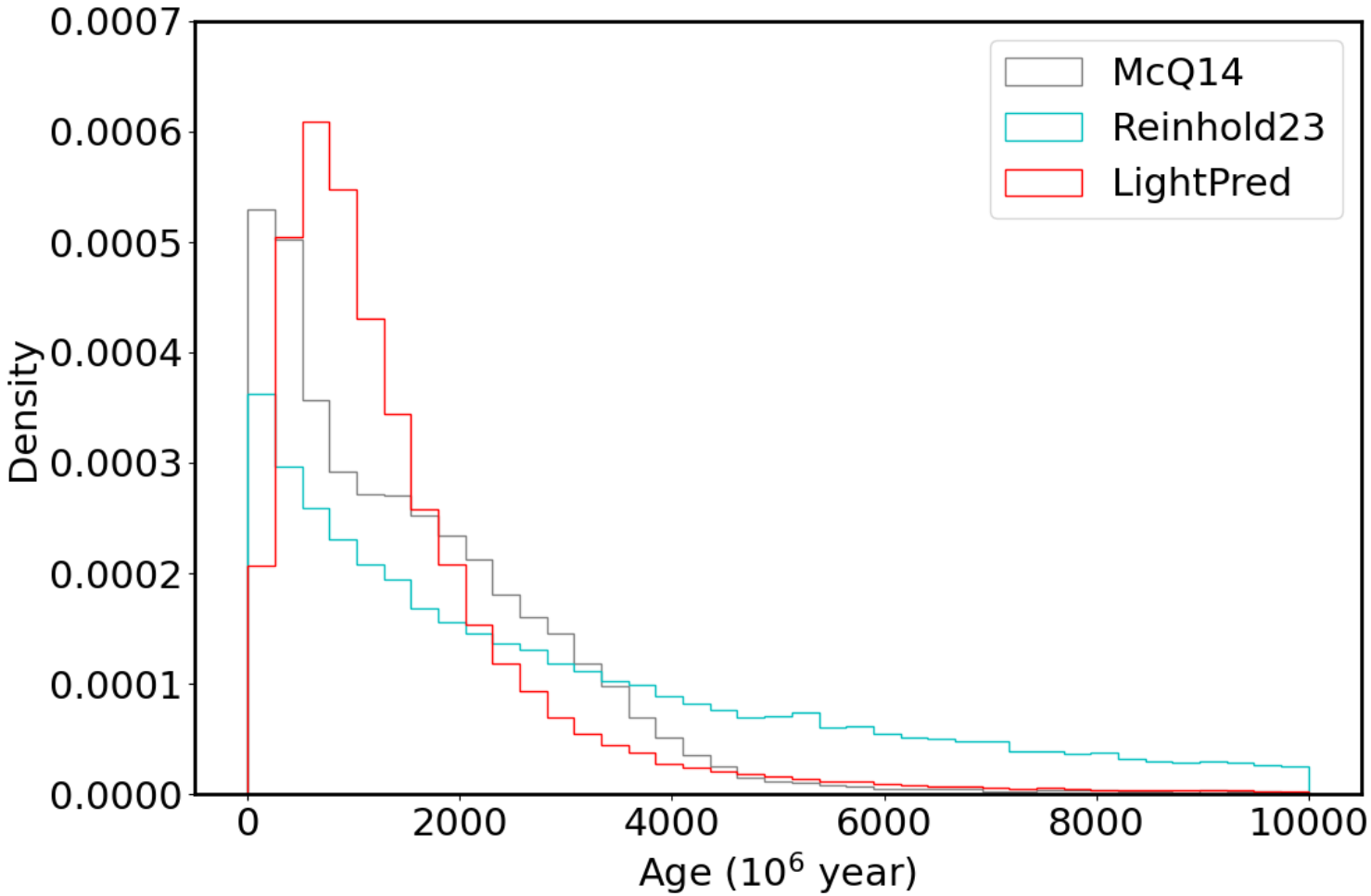
Kepler samples are quarter invariant



108785 stars period catalog

"New Rotation Period Measurements for Kepler Stars Using Deep Learning: The 100K Sample", Kamai, Perets 2024

Age Distribution



Conclusions

- LightPred outperforms current SOTA methods
- Self Supervised training can help to “close the gap” between simulation and real data
- New period catalog with 108785 stars
- Future – Inclinations, spots parameters

Our paper on Arxiv

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