Jia-Shu Pan

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panjiashu.github.io Jia-Shu Pan

Education

2018 – 2023 **B.S., Nanjing University** Astronomy
GPA: 4.39/5.00 (3.42/4.00)
TOEFL: 106 (R 30 L 28 S 23 W 25)

Research Interest

My research is centered on **representation learning** of stellar light curves, the temporal brightness variation of stars, with a specific focus on **unsupervised learning** algorithms on irregular and noisy time series.

Selected Work

The Scaling Law in Stellar Light Curves
Jia-Shu Pan, Yuan-Sen Ting, Yang Huang, Jie Yu, Ji-Feng Liu
ICML 2024 AI4Science Workshop
Motivation: Despite petabytes of time series data in astronomy, the ground truth label of stellar properties is observationally expensive, which necessitates a scalable unsupervised learning approach to make use of the unlabelled data.
Contribution: We trained autoregressive generative models with $10^4 - 10^9$ parameters based on GPT-2 on stellar light curves (7.7B tokens), and utilized the learned representations for downstream tasks.
Results: For the first time, we observed the scaling law on astronomical data: the more compute budget, the lower the prediction error. We found that as the pretraining prediction error decreases, the downstream task error based on the learned representations decreases as well. An MLP based on the largest 1.5B model's representations is 3-10 times more sample-efficient than the state-of-the-art transformer trained from scratch.

Astroconformer: The Prospects of Analysing Stellar Light Curves with Transformer-Based Deep Learning Models
Jia-Shu Pan, Yuan-Sen Ting, Jie Yu
Monthly Notice of Royal Astronomical Society, ICML 2022 ML4Astro Workshop
Motivation: Brightnesses of different types of stars vary at different timescales, among which long-range correlation could not be well captured by CNNs due to their locality inductive bias.
Contribution: We introduced both self-attention mechanisms and convolutional layers in our model, Astroconformer, to capture both local and global information simultaneously.
Results: With the same data and fewer parameters, Astroconformer is 30% more accurate than pure CNNs and 10% more accurate than pure Transformers.

Skills

Languages Mandarin Chinese (native), English
Coding Python (Pytorch), C, LaTeX

References

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