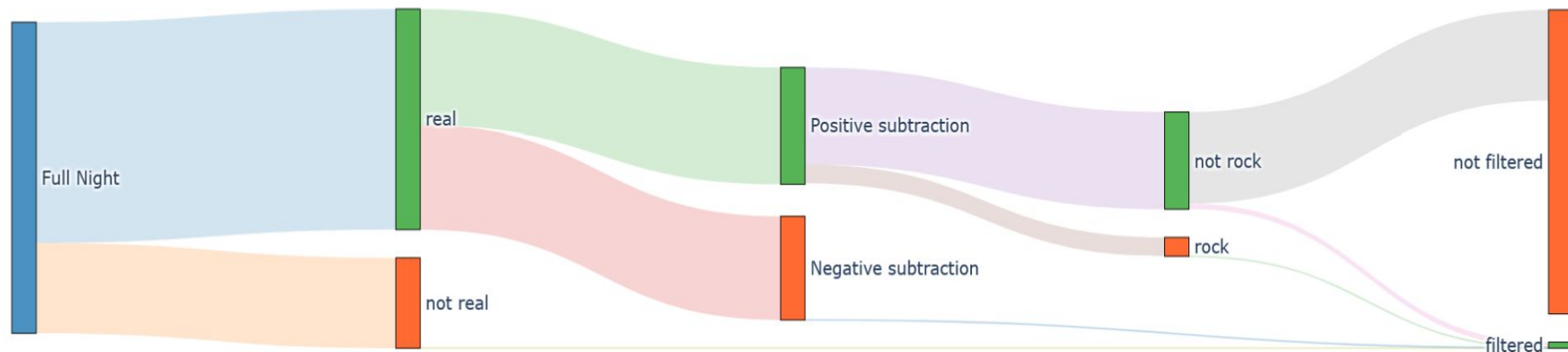


ZTF ML updates

Filtering of ZTF Data



Ashish Mahabal
Stockholm, 2024-06-11

Weekly meetings: 9 AM PT Wednesdays, run by Theo
Other group organizers: Michael Coughlin, Niharika Sravan

SCoPe (Brian Healey, Daniel Warshofsky, Michael Coughlin, Theophile du Laz, Ashish Mahabal, ...)

ZTF Source Classification Project (SCoPe):

- Light curve features on ZTF DR16 continues to run on ACCESS (SDSC Expanse)
 - Small scale: variables near new transients
 - Large scale: many/all ZTF fields (Maximize ACCESS proposal Jan 2024)
- Inference complete for 90+ ZTF fields (>230M LCs)

Significant Results / Key Outcomes: Data release available on Zenodo [here](#). Paper accepted to ApJS on 3/12/2024!

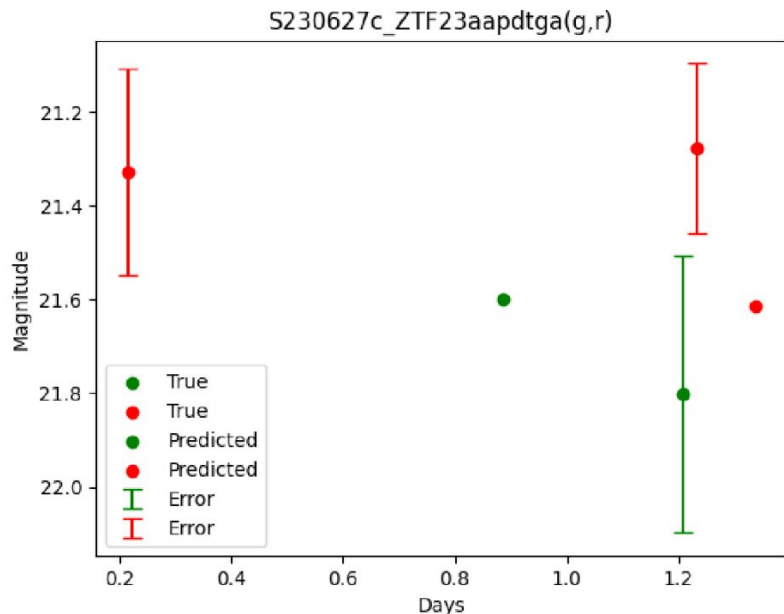
Plans: Faster periods, shorter periods, better chunking of releases.



KNe light curves with RF regression, LSTMs etc.

S230627c (ZTF23aapdtga)

Natalya, Ari, ...



ORACLE

- RF predicted a peak magnitude of 21.61 mag in the r-band and 22.16 mag in the g-band for the kilonova associated with S230627c.
- ZTF23aapdtga observations agreed with our expectations within 3σ .
- No other candidate for any other GW event was within 3σ of the predicted peak.

Predicted magnitudes for S230521k, S230528a, S230529ay, S230615az, S230627c, and S231029k.

AGN classification

Szymon Nakoneczny
Matthew Graham

Contact:
nakonecz@caltech.edu

- **Data:** SDSS (label) x ZTF (*g* band) x Pan-STARRS (*griz*), minimum 20 observation in ZTF
- **Classification:** galaxy vs QSO vs star, 33% random test split
- **Conclusions:**
 - Deep learning essential for the best classification
 - ZTF variability gives better results than the standard PS colors
 - RF necessary to ensemble deep learning on ZTF lightcurves with colors from other surveys

	QSO precision	QSO recall	QSO F1	3 class accuracy
RF on PS <i>griz</i>	0.82	0.83	0.83	0.91
RF on ZTF features	0.87	0.82	0.85	0.90
Astromer* on ZTF lightcurves	0.90	0.88	0.89	0.92
Astromer with PS colors added	0.94	0.92	0.93	0.95
RF on Astromer classification + PS colors	0.95	0.94	0.95	0.97

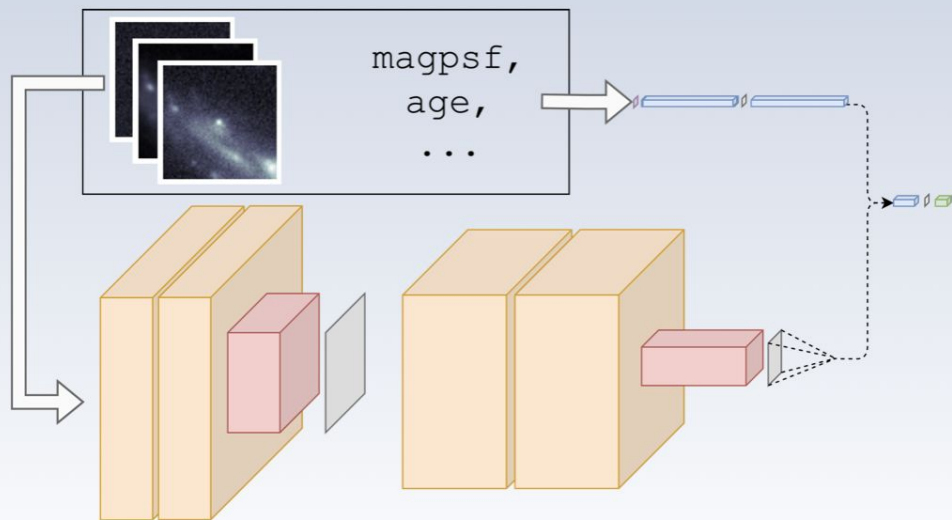
* <https://github.com/astromer-science>

Next steps: Unsupervised learning; adding r and WISE data

BTSbot

Automating BTS scanning with a multi-modal convolutional neural network

Alert packet  Bright transient score



~96% saving and triggering purity in production

Nabeel Rehemtulla

PhD student, Miller group
nabeelr@u.northwestern.edu



Adam Miller

Theophile Jegou du Laz

Michael Coughlin

- Now automatically sending TNS AT reports
- >1,000 sources saved by [BTSbot](#)
- >700 SEDM triggers sent
- ~80 fully autonomously classified [Type-Ias](#)
- Accepted for publication

Arxiv: [2401.15167](https://arxiv.org/abs/2401.15167)

Hydrogen Rich vs. Poor SN Classifier Using SEDM spectra + ZTF light curves

Results for high confidence (>0.98) classification



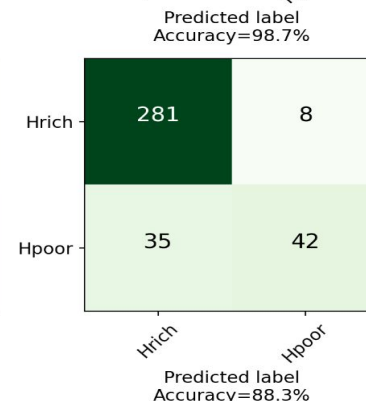
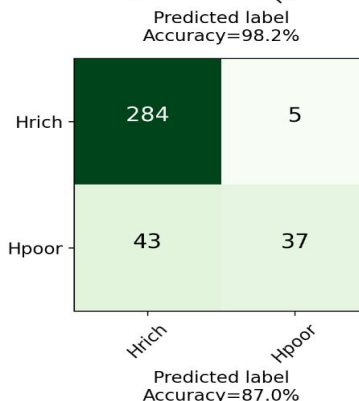
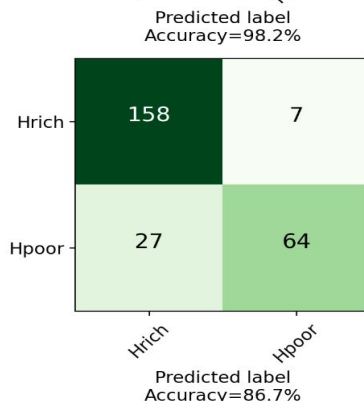
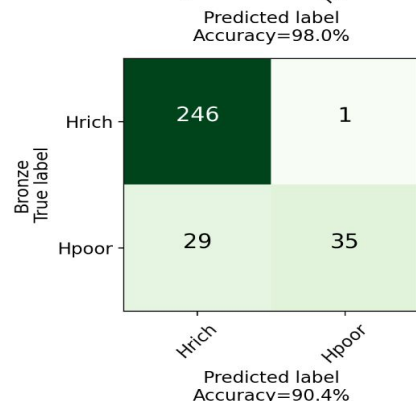
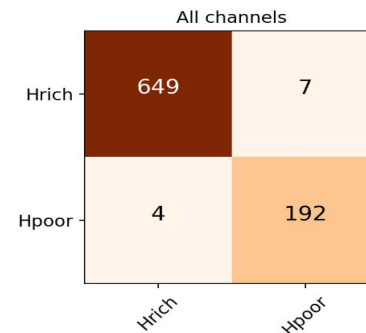
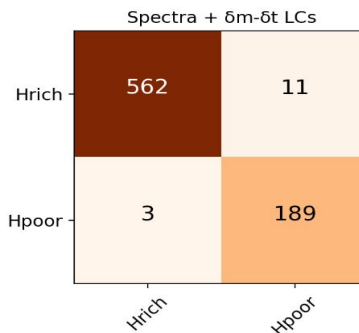
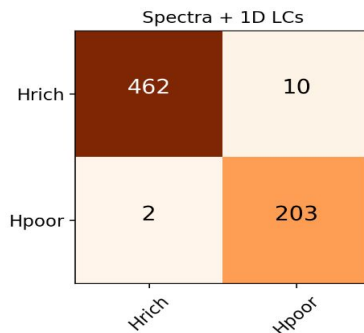
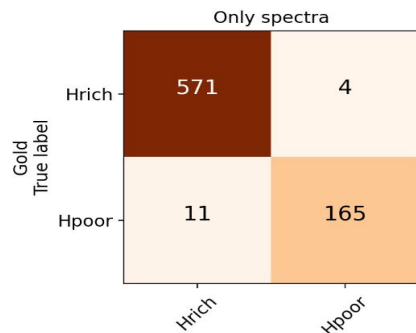
Yashvi

% classified: 62%

56%

63%

71%



% classified: 38%

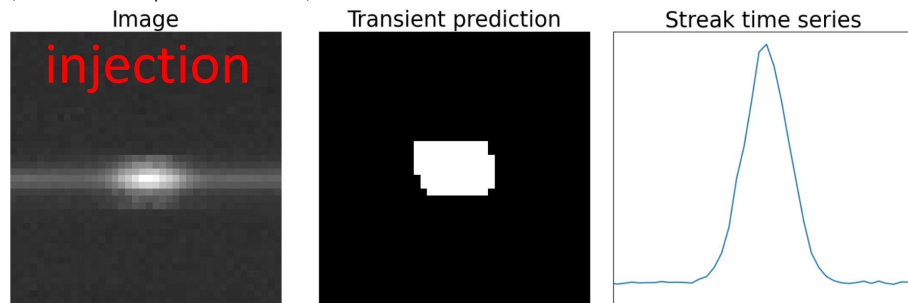
31%

45%

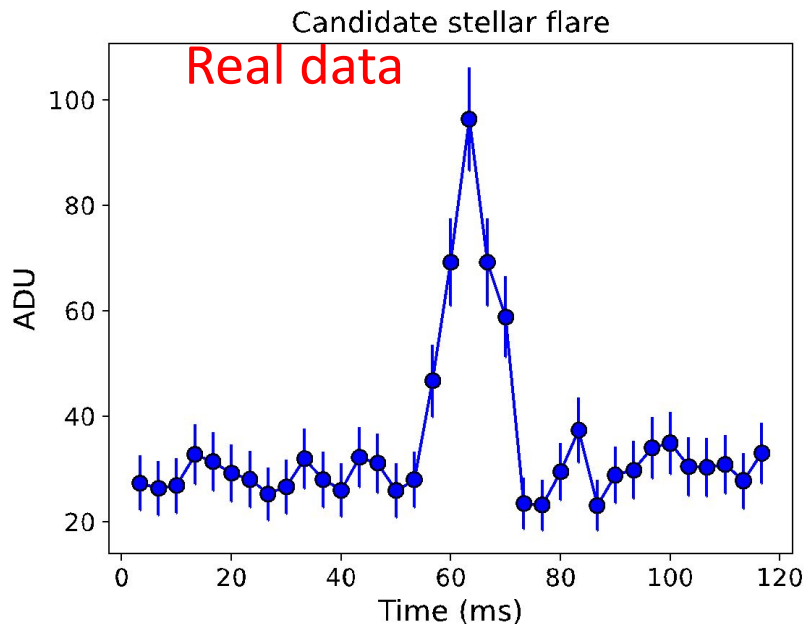
44%

RWE Data Mining: Deep Learning

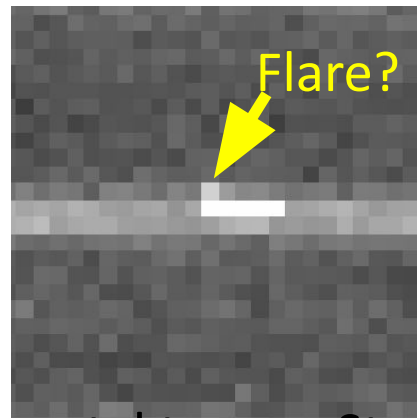
Igor, Roger, Ashish, ...



- $\sim 1400 \text{ deg}^2$ observed to date
- Aim $4,100 \text{ deg}^2$ (10% of sky)



Shar Daniels
(UD, with Fed)

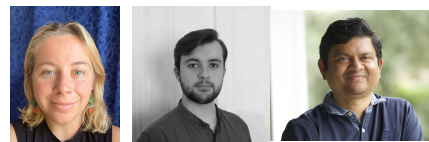


Horizontal trace = Star

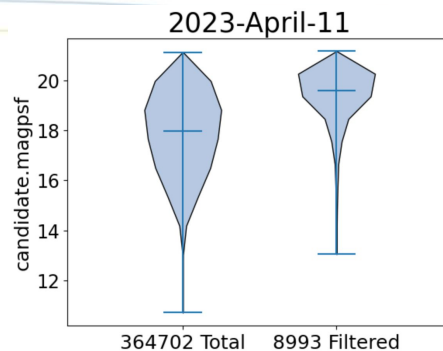
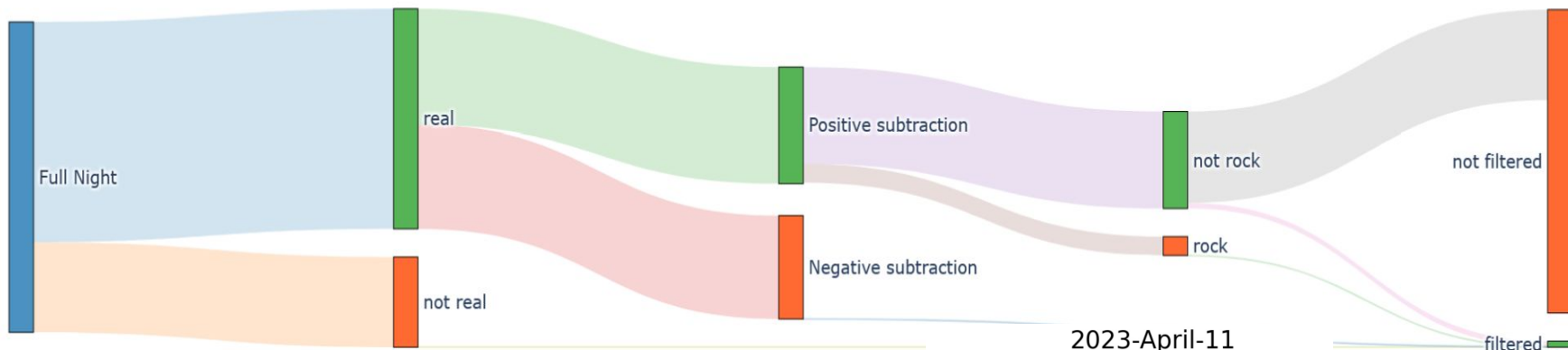
FRIGATE: Fritz Gap Analysis

How do alerts flow through science filters

Filtering of ZTF Data

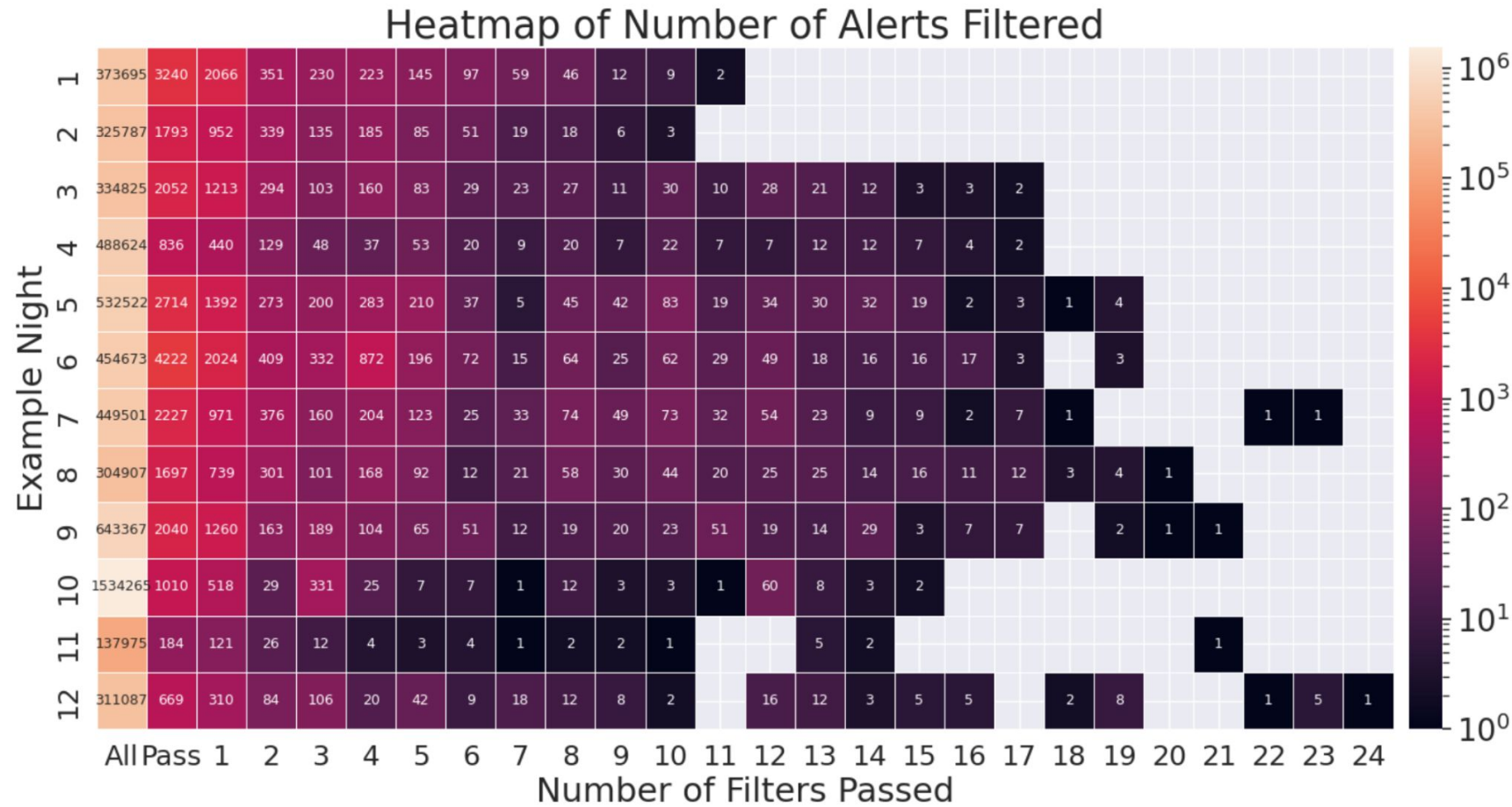


Kira, Theo, Ashish



FRIGATE: Fritz Gap Analysis

~1% objects pass any filter



ZARTH status

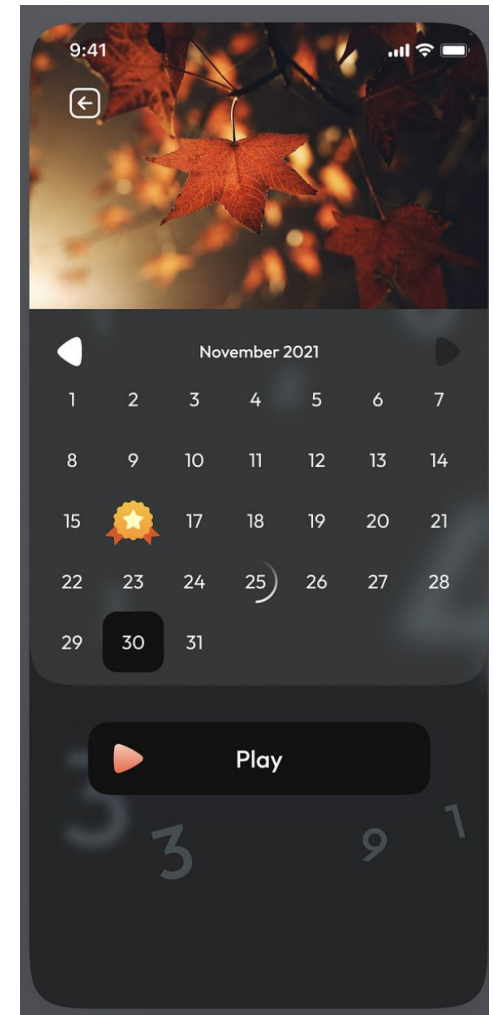
With Dhyey Thummar (IIT G), Theo ++

- Played in 60+ countries
- 2 players reached 2 million points
- 100+ day streaks
- New features added:
 - historic longest streak
 - Archival sets for cloudy days

ZARTH updates

With Naman Dharmani (IIT G)

- Make available on iPhones (as a web-app)
 - You can track development at zarth.netlify.app
- Add features (STEM friendly)
- Add gamification



Legacy products (ongoing discussions)

- BTS data
- Various ML-ready data
- ZTF images on Amazon

Plus projects like:

Search for YSOs

Jovian trojans (with Chester Li, Željko Ivezić, ...)

ML meetings: 9 AM PT Wednesdays