ZTF II ML - Story So Far

Ashish Mahabal, Lead ML (outgoing), on behalf of the WG

ZTF Team Meeting, Paris, May 2022

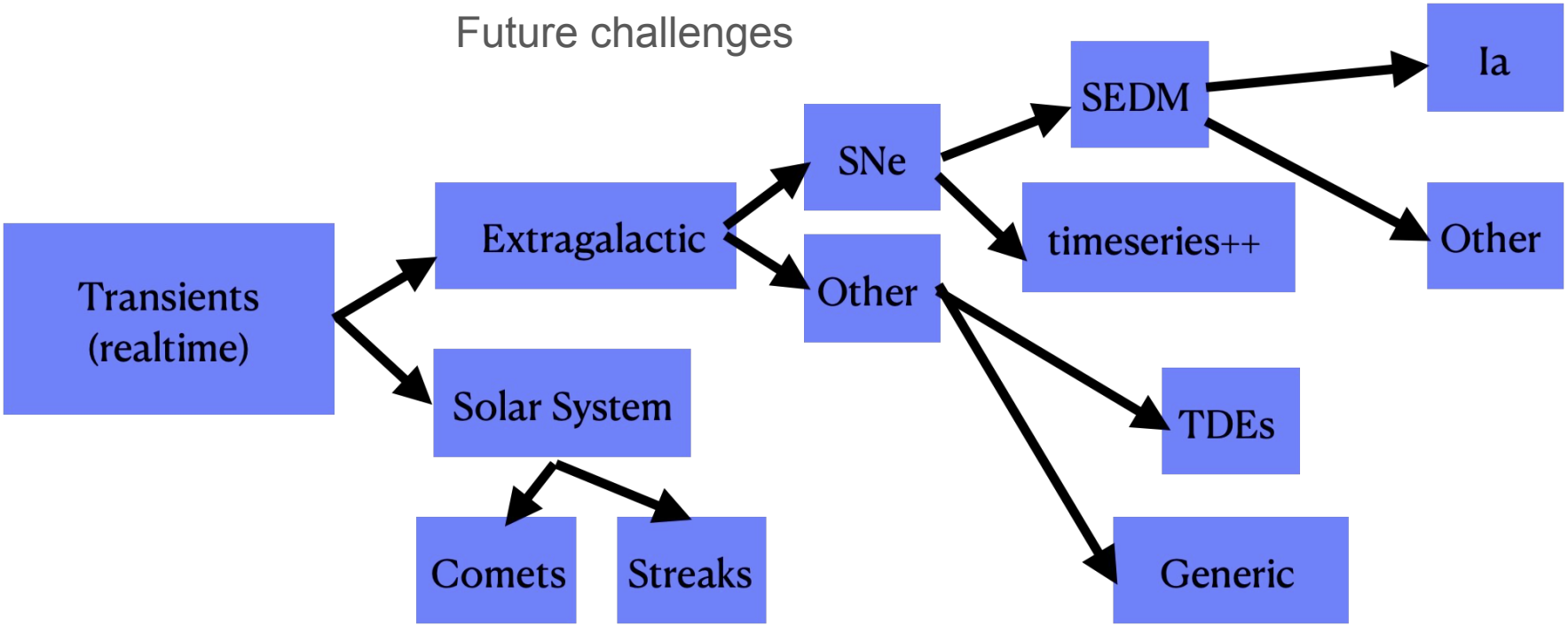
Overview

Solid inculcated work

Various individual projects

Ongoing challenges

Future challenges



Solid inculcated work

Real-Bogus continues to work well

ZStreaks also stable

Comet finding working

ACAI filters (e.g. nuclear-ness of transients) working

Retraining/updating will still be useful

ZTF DeepStreaks

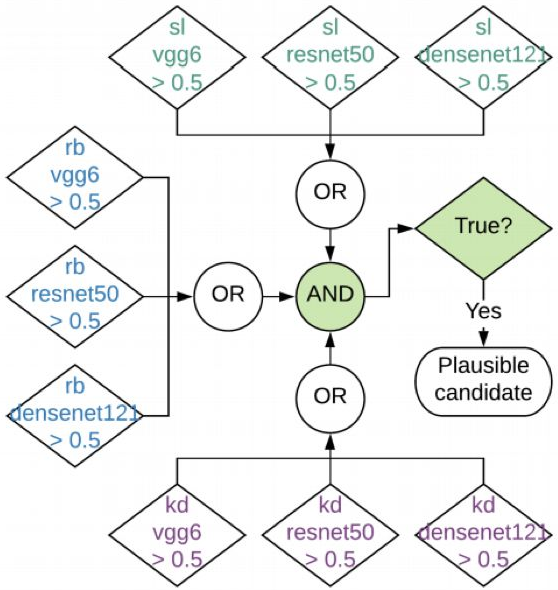
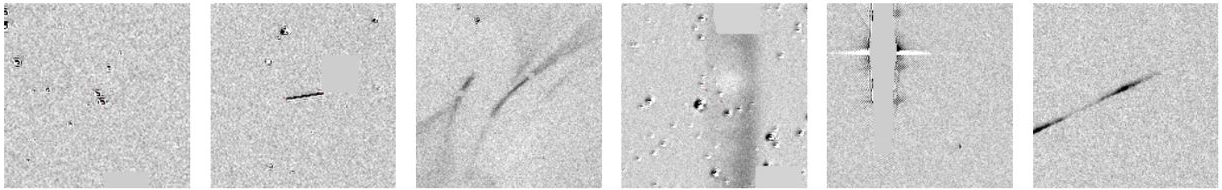
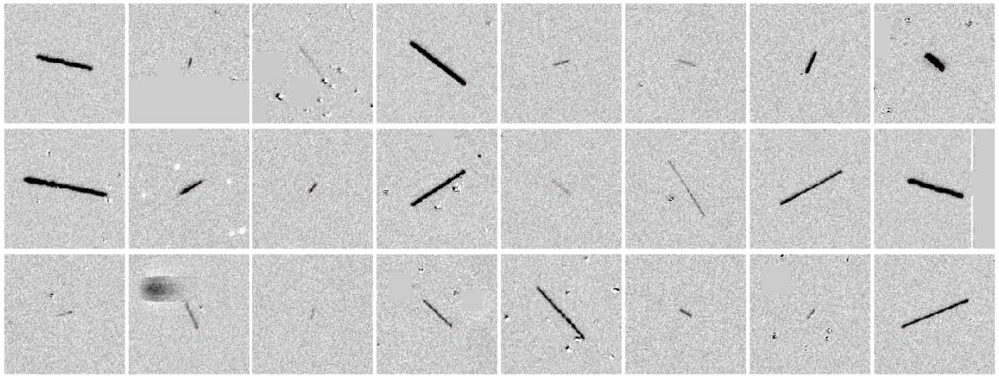


Figure 2. Decision logic used by `DeepStreaks` to identify plausible streaks. The problem is split into three simpler sub-problems, each solved by a dedicated group of classifiers assigning real vs. bogus ("rb"), short vs. long ("sl"), and keep vs. ditch ("kd") scores. At least one member of each group must output a score that passes a pre-defined threshold. See Section 2.1 for details.



(a) Bad subtraction (b) Cosmic ray (c) "Dementor" (d) "Ghost" (e) Masked star (f) Satellite trail

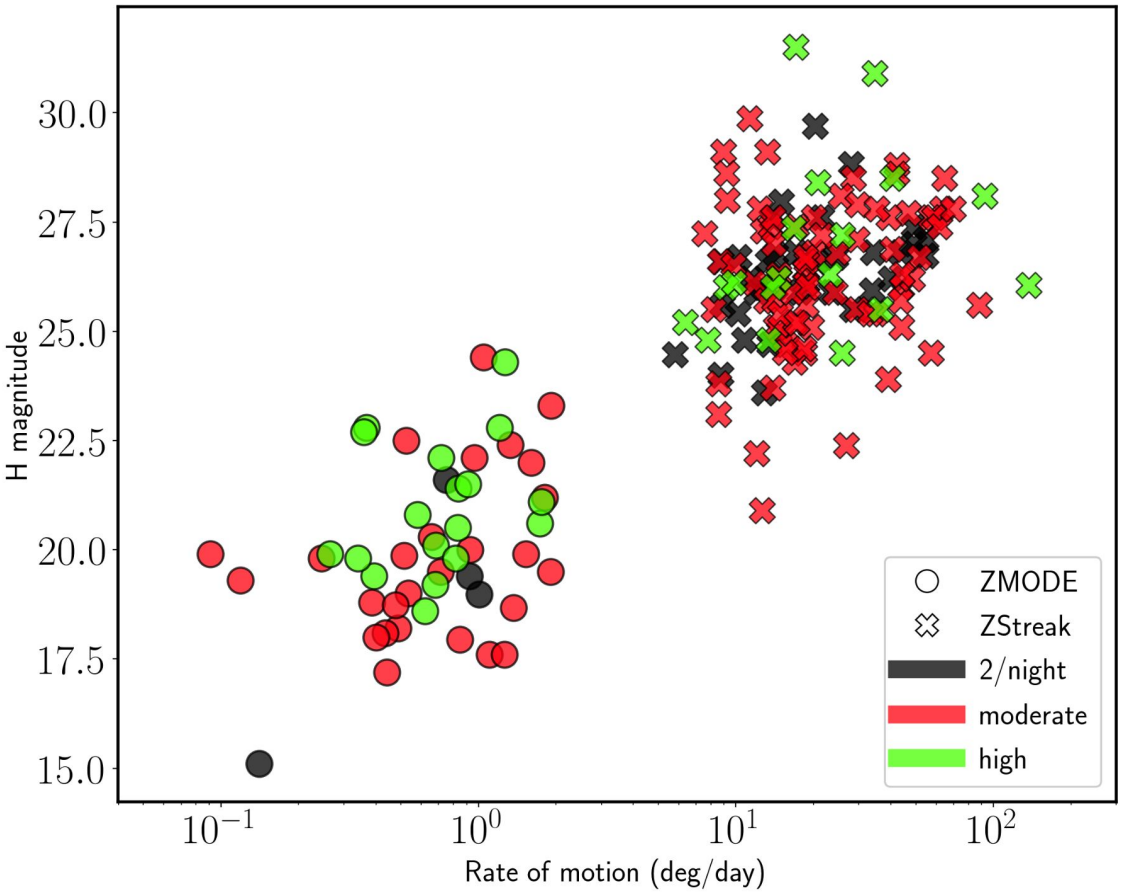


CNNs

Duev, Mahabal, … arXiv:1904.05920

X

Filling the gap between ZMODE and ZStreak



Various other projects

Extra-Galactic

- Supernova Ia (Fremling++)
- **Supernova non-Ia** (Sharma++)
- SNGuess (Miranda++ - AMPEL)
- AGN (Graham++)

Solar System

- Atiras/Vatiras (Bolin++)
- **Rotation Periods**

Galactic

- **SCoPe** 20 fields (Van Roestel et al.)

Tools/general

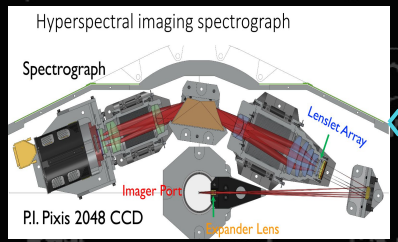
- ZARTH
- GPRs (Sravan)
- **Anomaly detection (DBSCAN, IsoF)**
- **Classification (Dist. metrics, transformers)**

Interpretability

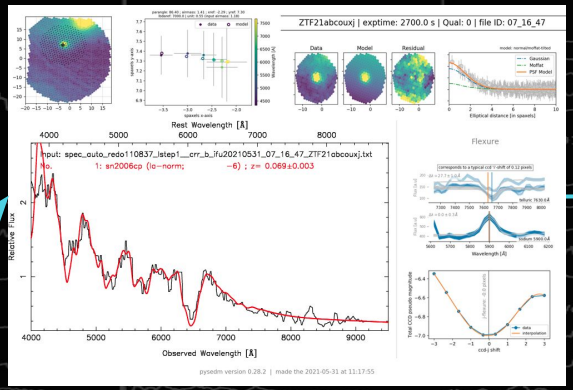
From Photons to TNS

SEDM Spectral Classifier

Fremling++



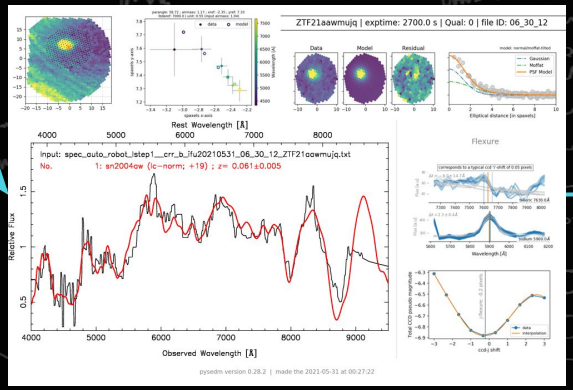
pySEDM



SNIascore
Automatic reports

For Type Ia with SNIascore>0.9

TRANSIENT NAME SERVER (TNS)

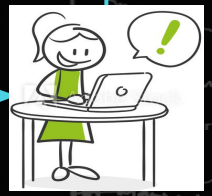


MANUAL for other SN types!

Human classifiers

+SNID, Superfit, DASH, etc.

Classification reports

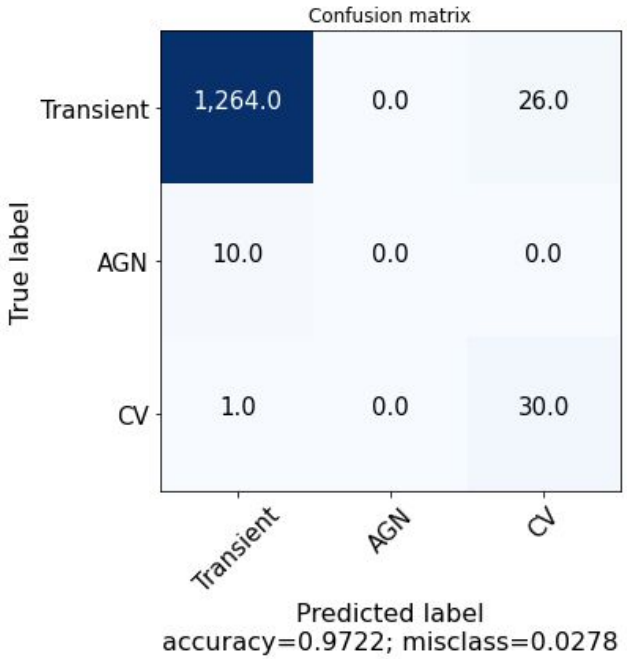


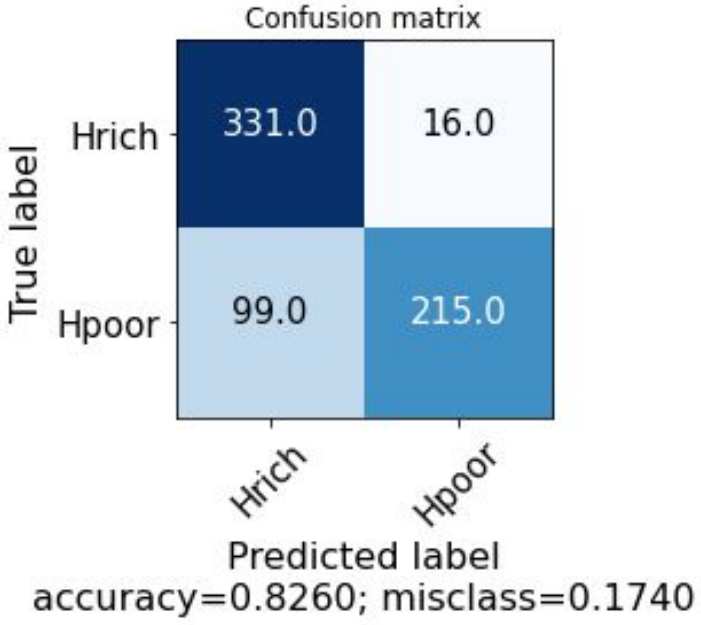
Yashvi Sharma

Yashvi Sharma++

Unbalanced non-Ia classes

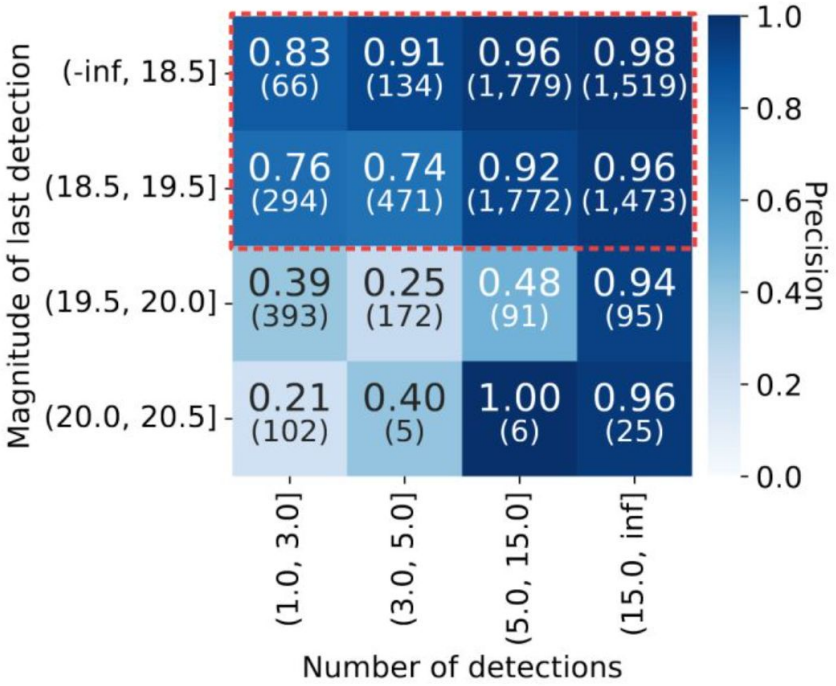
Remove non-SN (e.g. AGN, CV - >90%)





Separate non-Ia into H-rich and H-poor.

SNGuess



Uses public alert data

Feature based

XGBoost

Allows few data points

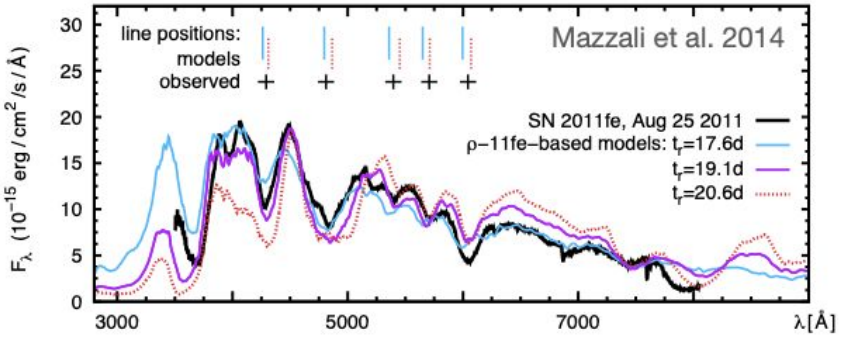
Incorporated into AMPEL

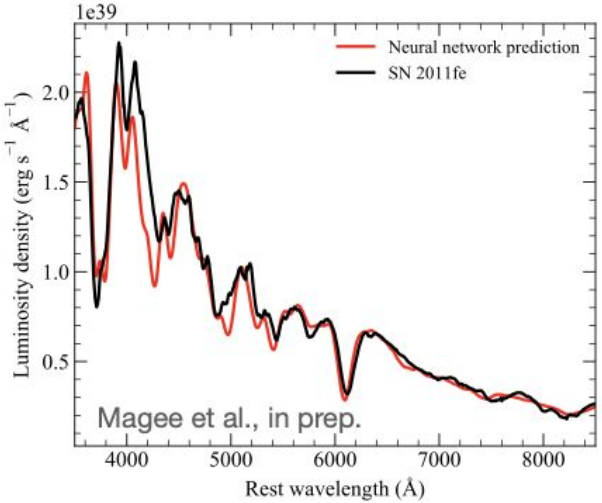
Nicolas Miranda et al.

Rapid automatic spectral modelling of Type Ia Supernovae

- Spectral modelling normally evolves tweaking many different parameters across multiple iterations

- Best fitting model is usually by visual inspection. (e.g. Mazzali et al. 2014). This results in subjective results and cannot provide uncertainties





- Neural network-based approach that will quantify and automate this process, enabling rapid modelling of entire spectral sequences

- Our neural networks will also be made publicly available (Magee et al. in prep.)

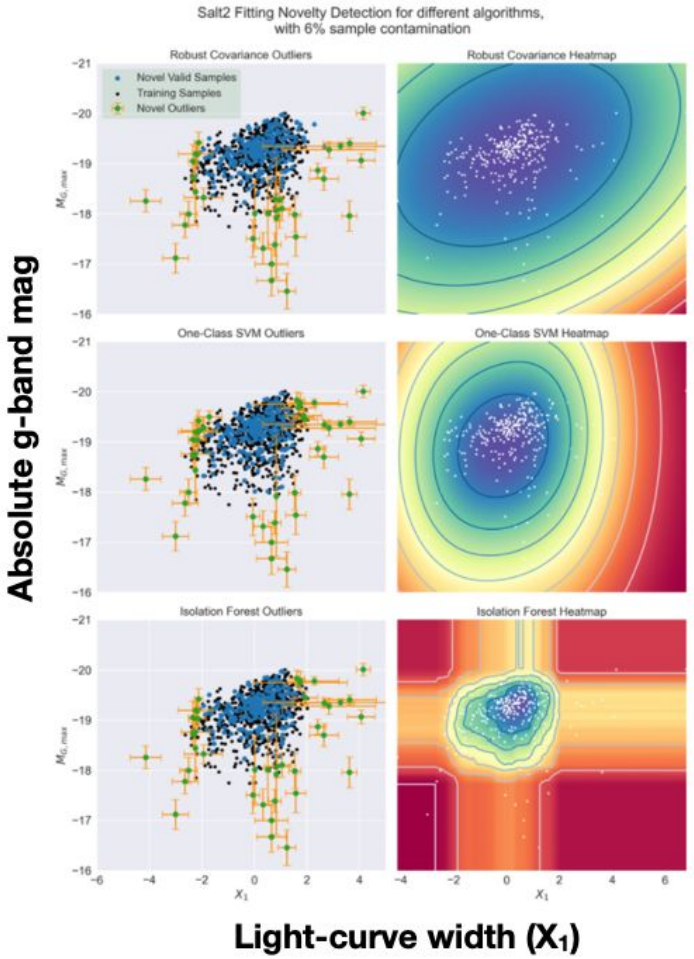
Mark Magee (University of Portsmouth)

via Kate Maguire

Identifying outliers in thermonuclear supernova samples

- Pilot novelty detection in absolute magnitude vs light-curve width (SALT2 X_1 parameter) - led by Nathan Simoncini (TCD)
- Methods - Robust covariance, SVM, Isolation Forest

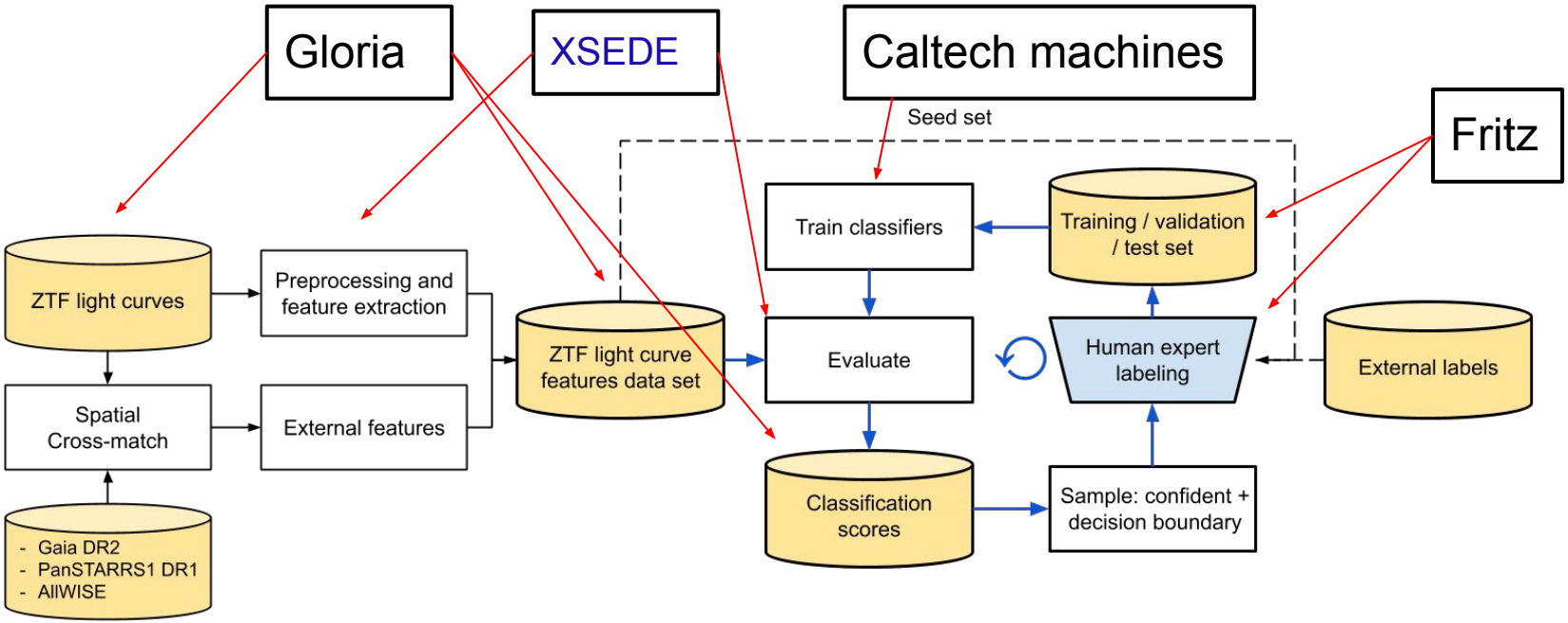
- Next steps: include host galaxy environment parameters, colour
- Adapt to work on full light curves



Nathan Simoncini (Trinity College Dublin)

via Kate Maguire

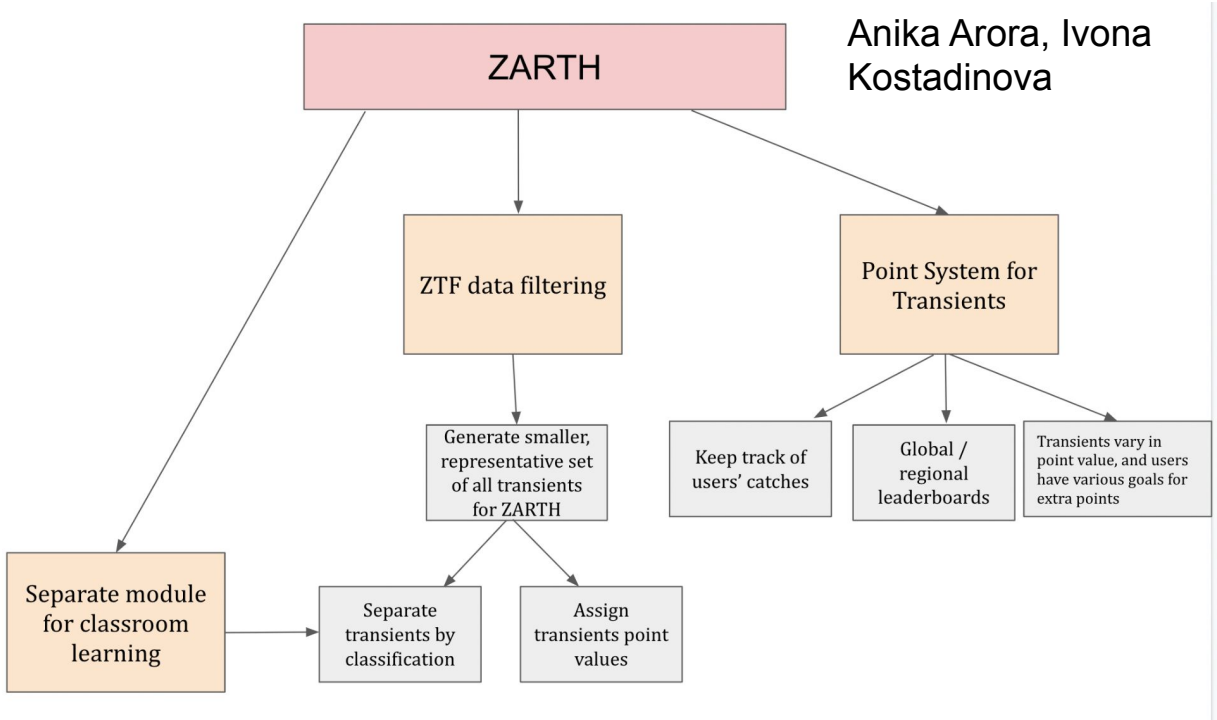
Technical infrastructure - and challenges



Slide from Van Roestel

Labeling systems etc.
Retraining and inferencing

ZARTH (ZTF Augmented Reality Transient Hunter)



Anika Arora, Ivona Kostadinova

Prof. Arnav Bhavsar (IIT Mandi), Manhas, Shrikha, Adithya

Summary

More partnership wide collaborations will add strength

ZTF-III - archives/stats - hence ML

Tool-box

Over to Michael Coughlin and Niharika Sravan