Classification of new transients

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SOXS Consortium Science Meeting



The Working Group 13

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A service work for all WGs with a double aim

optimising broker filtering and



templates for the classification tools training set for M. L. based classifiers

improvement of the classification accuracy both photometric and spectroscopic



Which transients?

known unknowns (e.g. very fast transients)



legacy projects (proposals across different science cases)

e.g. complete samples of objects (all transients brighter than 17 mag or within a given distance)

How many transients?

up to 25% of SOXS time (45 nights per year)



~ 20 targets/night

assuming a mean exp. time of 30min (overhead included) and an average night length of 10h

- ~ 900 targets/year
- ~ 4500 classifications



90 nights per year

~20-30% for classification (~22 nights per year)
2329 classified so far (~12 targets/night)
582 are being followed (25%)

How does it work?



We should discuss:

- selection criteria for classification targets
- priority for classification across different science cases
- overall number of classified targets for each science case
- timeshare rules

Actions: collecting desiderata from all WGs inputs from SOXS Science Board



Transient classification workflow 1



Transient classification workflow 2



Selecting and prioritising targets for classification



Selecting and prioritising targets for classification

	ePESSTO	SOXS
Operations	3 TAT, observers, data reduction teams assigned nights	observing team no pre assigned nights
Duties	select targets, assign a priority	reduce data and classify transients
Duty time	5 days	1 week daily planning meeting open to all SOXS members
Feeder surveys	ZTF, PS1, ATLAS	LSST, ZTF, PS1,
Targets per night	100-200	> 200000

Selecting and prioritising targets for classification

Different observational strategy and operation mode Number of transients per night a factor five higher in the LSST era

human vetting and selection based on specific criteria



automated filtering from broker selection algorithms enhanced early classification

Action: drafting queries for LASAIR with inputs from WGs multiple brokers feeding the marshall? which information we would like to see? what type of classification scores do we need?

Target observations

An early classification allows us to optimize

- the observational priority
- the automated observation scheduling
- the S/N of the classification spectrum
 (e.g. S/N high for fast transient and S/N low for slower transients)
- the classification process efficiency

Actions: collecting inputs from all WGs

Target classification: tools

GEneric cl Assification TOol — tAT2020zql 20201114 Gr13 Free slit1.0 1 f.txt z=0.0065 E(B-V)=0.2 2004gg lb phase=-9.2d (Vmax) (date=20041212 1.60e-15 1.40e-15 1.20e-15 1.00e-1 8.00e-1 6.00e-16 4.00e-1 2.00e-16 0.00e+ 3500 4000 7000 Wavelength (Å

Harutyunyan et al. 2008

Supernova Identification SNID

Observed Wavelength [\A]

Blondin and Tonry 2007

also

.

SUPERFIT code Howell et al. 2005

DASH package Muthukrishna et al 2019

Others tools for other science cases ??? (AGNs, GRB afterglows, novae...)

Actions: implementing classification tools on SOXS pipeline extending the comparison to the NIR range and different transients classes

Target classification: template archive

SNe (in plenty but only for the optical range)

e.g. Gelato has 3019 template spectra from Padova-Asiago Supernova, SUSPECT, WISEREP Archives

ILOTs and other unusual transients from WG 7

Other transients?!?

ESO X SHOOTER archive?

e.g. The X-shooter GRB afterglow legacy sample

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Action: collecting template for all transient covered by SOXS WGs

Classification release policy

Classification results on Astronote, ATEL, GCN ???



Fast release of the classification data to the consortium

within 3 days

if the transients fall under a GTO proposal the data can be claimed by the SOXS PI and will then remain private for 12 months

otherwise classification data are public

Actions: guidelines on the policy for classification release drafting templates for Astronote, ATEL, GCN

Classification database analysis

• History is important!

transients with uncertain classification or transitional type transients



Padova-Asiago Supernova Group

The Asiago Transient Classification Program

Presentation

The program started in 2011 with the aim to classify all transients that are accessible from Asiago and are bright enough for our telescopen/strumentation. We use mainly the <u>1.82m coperinco</u> telescope of Cima Eakar and, if not available, <u>the</u> <u>1.22m called</u> telescope of the Pennar station. A few cases of transients classified by our group with other facilities (eg. TMG) are included in the database.

Transient classification information and spectra (fits format) are made immediately available at our site. The spectra are semi-automatic reduction with archive calibration data. Please keep this in mind when using them. For SN classification we compare the output of two automatic SN classification codes: <u>Gelato</u> (Harutyunyan et al. 2008,

A&A 488, 383) and <u>SNID</u> (Blondin and Tonry 2007, Ap.J. 666, 1024).

If you use some of the information posted in these pages please make a reference to the paper Tomasella etal. 2014 A.N. 335, 841.

Latest classifications

sn	galaxy	RA	DEC	discoverer	type	redshift	ref	class	fits
SN 2020uem	WISEA J082423.32-032	08:24:23.854	-03:29:19.08	ATLAS	lln- pec	0.041	REF REF		
2020yvv		23:59:13.568	+38:37:50.43	ATLAS	lb	0.032	ATEL	An	fits
2020ууд	SDSS J015405.95+0708	01:54:05.891	+07:08:58.72	ZTF	la- 91T like	0.067	<u>ATEL</u>	Ann	fits
2020rvf	CGCG 465-012	03:54:15.928	+15:55:42.62	ASASSN	Ic	0.022222	ATEL	An	fits
AT2020tjb		20:25:46.204	+08:25:37.12	ZTF	cv	0	ATEL	An	fits

 Verification of the early classification to fine tune broker filtering and Marshall selection criteria

Statistical analysis for legacy projects

Action: creating a web database

Training set sample

Automated algorithms to classify and sort astronomical transients are crucial to deal with this massive onset of LSST data

The machine learning-based classifiers need a sample of transients with well sampled light curves and spectroscopic classification

SOXS could provide classification data as training set in collaboration with LSST, LSST brokers and 4MOST



Action: Discussion on this project

How should we use SOXS to create the best possible training sample for photometric classification?

- **1.** Selection and priority criteria
- 2. Timeshare rules
- 3. Queries for LASAIR to obtain an early classification
- Updated version of the classification tools including new templates NIR spectra

other transient classes

- 5. Guidelines on the policy for classification data release and template for TNS and ATEL
- 6. Set-up of the classification database
- 7. Plans to obtain a training set sample
- 8. Training on transient classification for observing teams

THANKS!

to do list

