Updates from the DESC PZ Working Group

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For the DESC PZ WG

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Dark Energy Science Collaboration Photo-z WG



Developing infrastructure to estimate both individual galaxy redshifts and ensemble (tomographic bin) redshift distributions for a wide variety of cosmological science cases

Strong overlap in the needs of DESC and Rubin in maximizing performance individual galaxy redshift estimates

Sharing infrastructure can minimize duplication of effort and benefit DESC, Rubin, & beyond

PZ working group team

The convenors: Markus Rau, Sam Schmidt, Bryce Kalmbach(incoming)

RAIL topical team leads: Eric Charles, Alex Malz

Pipeline scientists: Eric Charles, Huan Lin, Sam Schmidt

In-kind contributors: Josue De Santiago, Sebastien Fromenteau, Qianjun Hang, Luca Tortorelli, Jan Luca van den Busch, Ziang Yan, Benjamin Stölzner

LINCC Frameworks: Drew Oldag, Melissa DeLucchi, Olivia Lynn, Jeremy Kubica, Max West





Redshift Assessment Infrastructure Layers

https://github.com/LSSTDESC/rail

DESC infrastructure for computing and evaluating photo-z distributions for both individual objects and ensemble distributions (e.g. bins in redshift)

Many illustrative demo notebooks and pipeline scripts available to help introduce new users

RAIL Creation

-fsps/dsps models can generate catalogs with photometry, SED, generated with physical parameter estimates

-PZFlow fits normalzing flow to existing catalog (can include physical params), can draw samples from flow for mock catalog

-Several "degraders"/modifiers included in RAIL to model incompleteness, dust, photometric errors, spectroscopic selections, etc...



RAIL Estimation



Current individual object redshift estimation codes:

BPZ, CMNN, GPz, FlexZBoost, Delight, PZFlow, k-nearest neighbor, sklearn_neuralnet

Several more algorithms on the way

Store 1D PDF as qp Ensemble, comes with much of the scipy.stats functionality

PZFlow could potentially joint estimate redshift & physical params, not yet explored. Flow/dsps mock data could be used to test, 2D+ PDF storage an issue

RAIL Evaluation

Suite of metrics to evaluate quality of photo-z estimates

"Point estimate" statistics, ensemble distribution statistics, metrics on individual PDFs,

Useful for comparing algorithms against each other, as well as response to systematics/incompleteness in training sets

Can also be used to develop quality flags





Additional work

Supplementing incomplete spectroscopic training sets with simulated data (Irene Moskowitz)

Joint modeling of intrinsic alignments and galaxy LFs (Nico Sarcevic)

Calibrated predictive distributions for photo-z's (Biprateep Dey, this session!)

Image-based machine-learning methods for photo-z (Valentin Brekke, Simona Mei, this session!)

International in-kind contributors and pipeline scientists are developing additional methods and utilities







Moving forward



Tests using existing simulations, new fsps/dsps-based simulations, and precursor HSC data, running at scale and evaluating code performance

Work on calibration methods to remove remaining biases

Broad overlap in DESC PZ WG and Rubin PZ Validation group, work together to optimize PZ catalogs

If you are interested in using or contributing to RAIL, look at the Github repo, documentation page (currently being overhauled), or talk to members of the RAIL development team for more info

