SLRealizer:
Catalog-level searching of gravitationally-lensed quasars for LSST

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1. Introduction

- **LSST**(Large Synoptic Sky Telescope) will start running in 2019
- **8.4m** telescope in Chile, ten years of sky survey
- Expected to find substantial number of **gravitationally-lensed quasars**, that could be used to study **time-delay cosmology**
- Current Problem: LSST will produce "30 trillion measurements of 37 billion objects" — very costly, if not impossible, to go through all the LSST image data to find the lensed quasars
- Need **a simpler, more economic way** to find those quasars

2. Methods

562 LSST-like OM10 lensed system with **quasar images** and **lensing galaxy**

To simplify the model, we assumed all the sources to have **gaussian PSFs**.

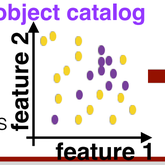
Null-deblend all the sources in the system for each observation epoch using **Galsim,** saving the deblended properties to a **toy source catalog**

PSF + u filter +

Then, make a **toy object catalog** by averaging the measured properties for each object per filter

u g r i z

overlap the features from the **object catalog** with **non-lensed systems' (galaxy pairs, star pairs, quasar pairs, etc)** features and extract distinctive features



Classification of lensed systems using **ML Algorithms** provided in **Scikit-Learn**

3. Results

Toy Source Catalog

562 LSST-like OM10 lenses * 200 observation epochs

Toy Object Catalog

562 LSST-like OM10 lenses, averaged by each filter in Toy Source Catalog

Cornerplot to Select Features

QR

QR

SDSS galaxies

OM10 lensed quasars

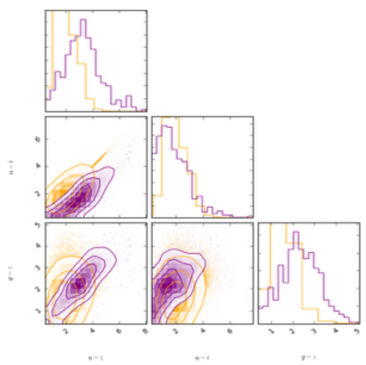


Figure 1. Color Index
Good feature to choose — peaks are separated

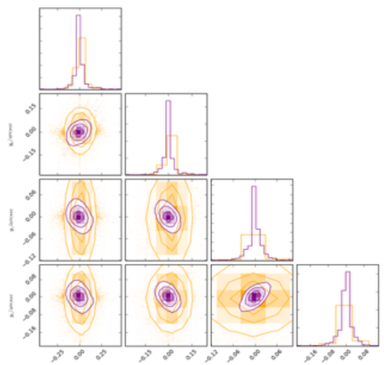


Figure 2. Magnitude
Not a good feature to choose — Peaks are too close

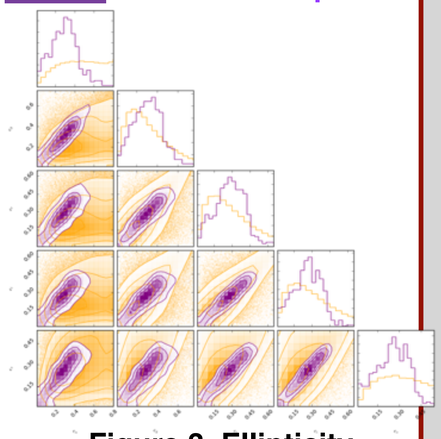


Figure 3. Ellipticity
Some could be useful

Features Chosen:

Classification

4. Conclusion

- It is possible to see the differences in features between SDSS galaxies and lensed systems.
- Machine Learning Algorithm Efficiency Rank
- Future works: more samples

5. Acknowledgements

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6. References

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Oguri, Masamune, and Philip J. Marshall. "Gravitationally lensed quasars and supernovae in future wide-Field optical imaging surveys." Monthly Notices of the Royal Astronomical Society, 2010, doi:10.1111/j.1365-2966.2010.16639.x.