An automated photometric pipeline for the ILMT data

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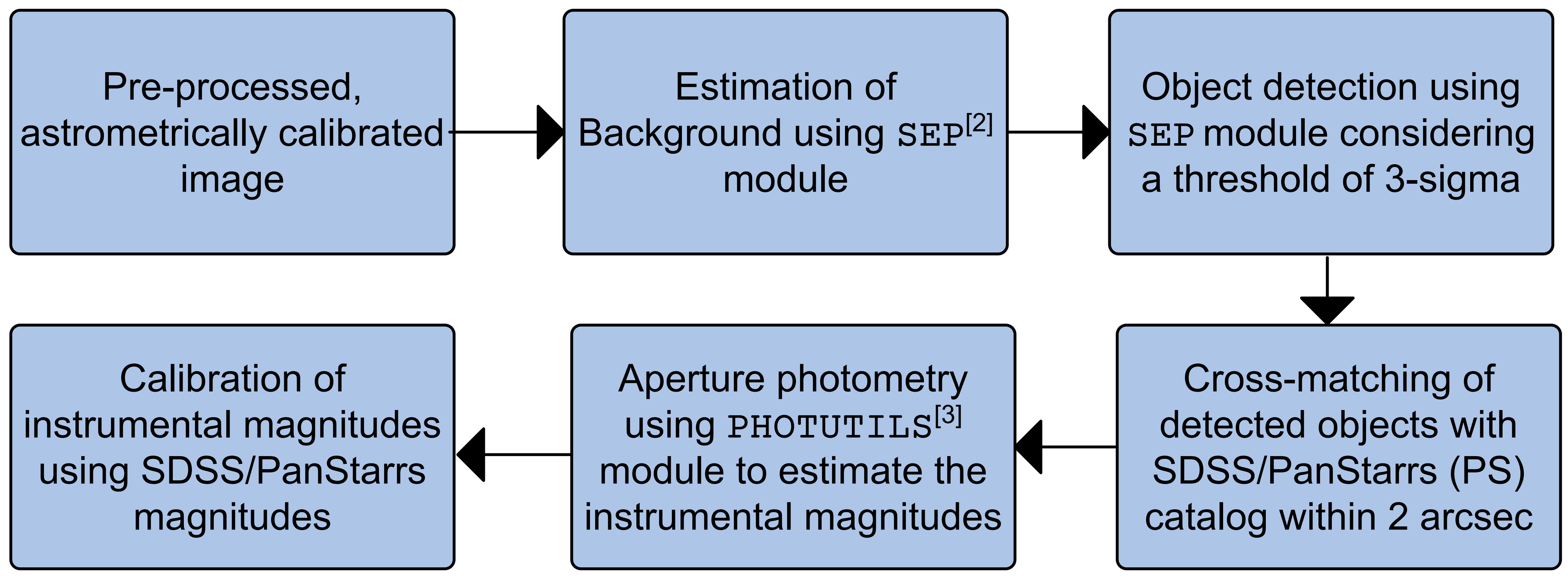
Abstract

The International Liquid Mirror Telescope (ILMT) is a 4-meter survey telescope constantly observing towards the zenith in the SDSS g', r', and i' bands. This survey telescope is designed to detect various astrophysical transients (for example, SNe, GRBs) and very faint objects like quasars and galaxies. A single scan of a 22' strip of sky contains a large amount of photometric information. To process this type of data, it becomes critical to have some tools or pipelines that handle it in an efficient and accurate way with minimal human biases. We offer a fully automated pipeline generated in Python to perform aperture and PSF photometry over the ILMT data acquired through CCD in Time Delayed Integration (TDI) mode. The calibration of the instrumental magnitudes is done with respect to the SDSS/PanStarrs catalog. The lightcurve from these calibrated magnitudes will characterise the objects as variable stars or rapidly decaying transients.

Introduction

- The ILMT is the first 4m optical survey telescope installed at the Devasthal Observatory of ARIES, India[1].
- The bowl is filled with liquid mercury and upon rotation, the rotating liquid surface takes the shape of a paraboloid and acts as the primary mirror of the telescope.
- The telescope performs zenithal observations in Sloan g', r', and i' filters using a large format 4kX4k CCD camera in Time Delay Integration (TDI) mode.
- The daily observing cadence with the ILMT is useful to discover variables and transients.
- To perform photometry on the ILMT data, a customised pipeline is developed in python. The methodology followed and the initial results from the pipeline are discussed in this poster.

Methodology



Initial results from the pipeline

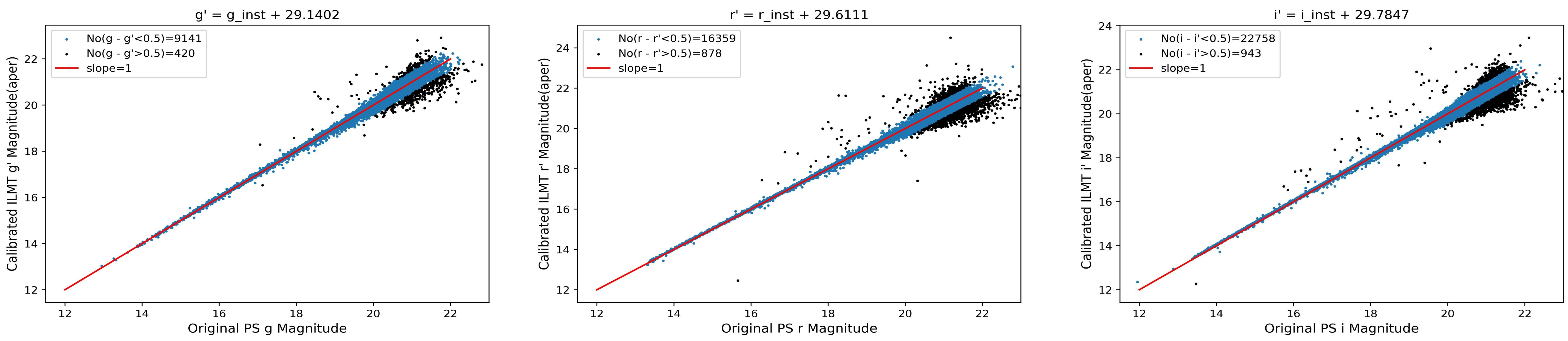


Fig. 1. Calibrated ILMT magnitudes in g', r' and i' bands with respect to the PanStarrs magnitudes. The calibrated ILMT magnitudes and the PanStarrs magnitudes are found to be in good agreement.

Color-Color Plots

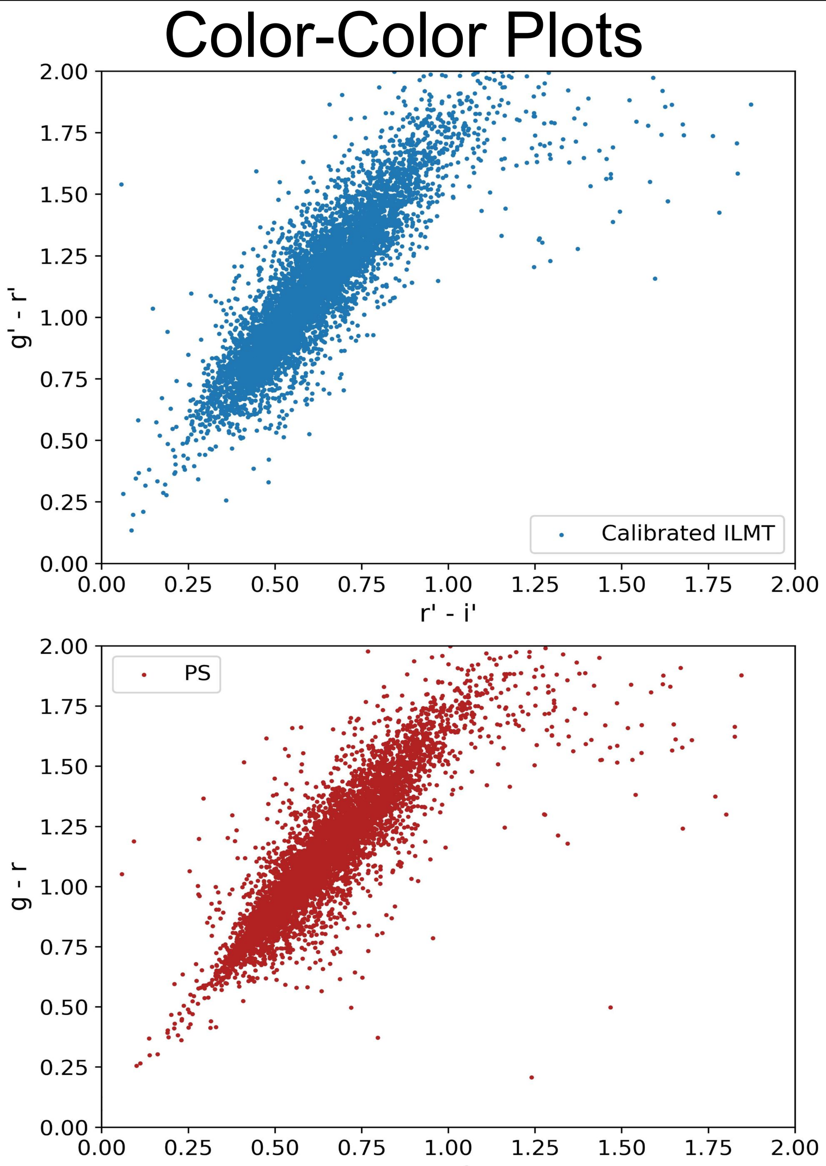


Fig. 2. The top and bottom plots show the color-color diagrams for both the ILMT calibrated magnitudes and the PanStarrs magnitudes.

Color-Magnitude Plots

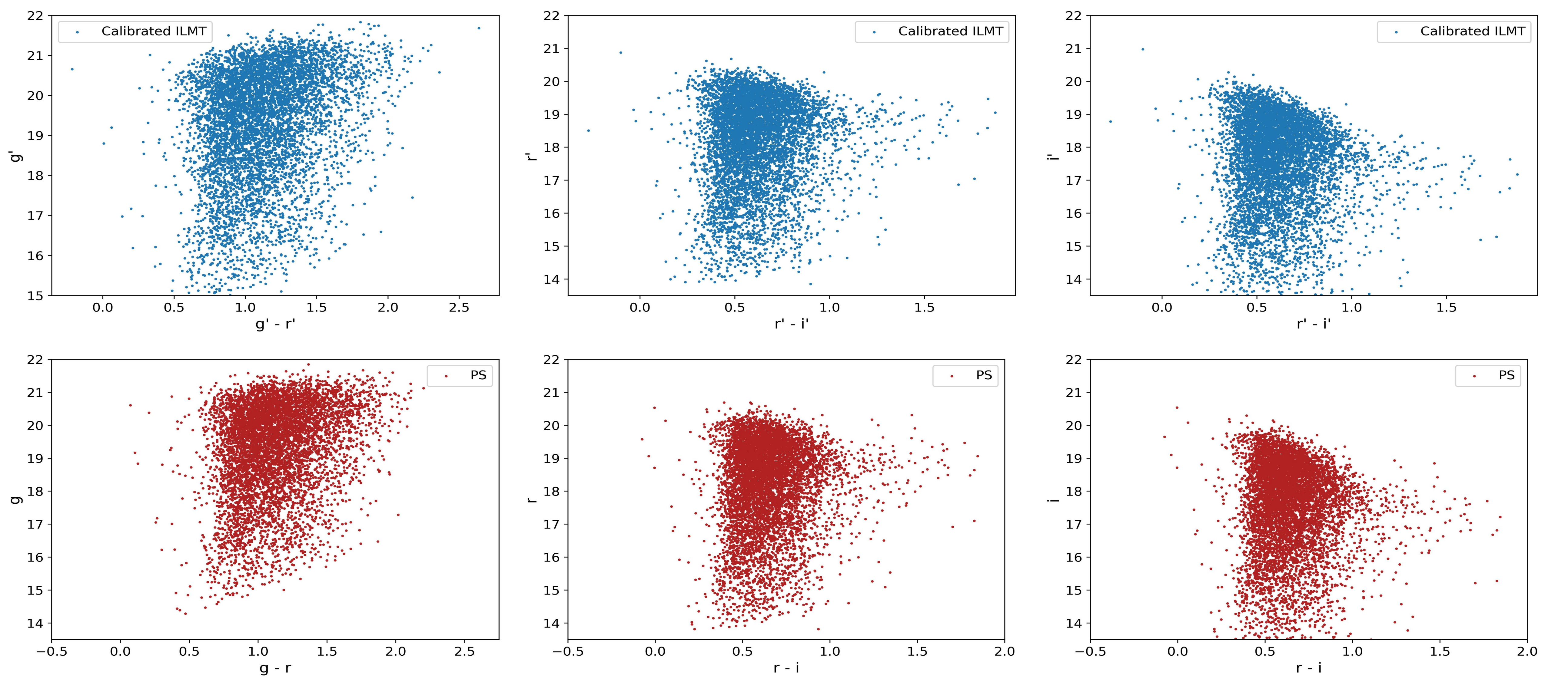


Fig. 3. The top and bottom plots show the color-magnitude diagrams for both the ILMT calibrated magnitudes and the PanStarrs magnitudes.

Estimation of Limiting Magnitude in the ILMT data

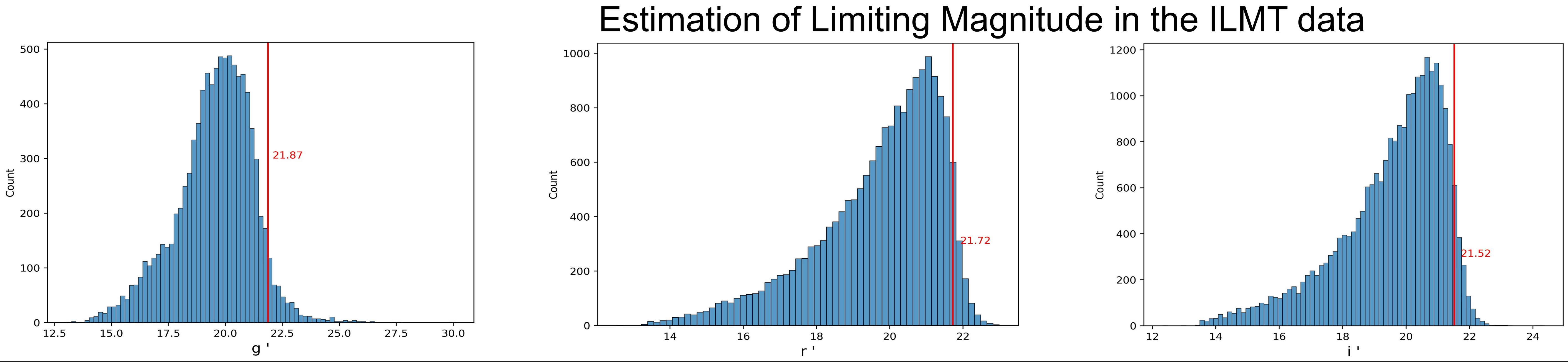


Fig. 4. The histogram of the calibrated ILMT magnitudes in g', r', and i' bands are shown. The red vertical line is the limiting magnitude evaluated considering the 95 percentile value.

Conclusion and Future Plan

- The customised pipeline, developed in python, to perform aperture photometry on the ILMT data has been successfully tested on the Oct-Nov 2022 data.
- The calibrated ILMT magnitudes are in good agreement with the SDSS/PanStarrs magnitudes with around 50 % sources having deviation less than 0.05 mag.
- The color-color and color-magnitude diagrams generated using the calibrated ILMT magnitudes and the PanStarrs magnitudes also show similar trends.
- Using the 95 percentile value, the limiting magnitudes in g', r' and i' bands are estimated to be 21.87, 21.72 and 21.52 mag respectively.
- In future, the pipeline will include the scope to perform PSF photometry also.
- This automated pipeline will be useful to generate long-term lightcurves and identify the variations in the sources.

References

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Acknowledgements

The 4m International Liquid Mirror Telescope (ILMT) project results from a collaboration between Aryabhatta Research Institute of Observational Sciences (ARIES, India), the Institute of Astrophysics and Geophysics (University of Liège, Belgium), the Universities of British Columbia, Laval, Montreal, Toronto, Victoria and York University. The authors also thank Hitesh Kumar, Himanshu Rawat and Khushal Singh for their assistance at the 4m ILMT. B.A. acknowledges Council of Scientific & Industrial Research (CSIR) fellowship award for this work.