BLENDING IS SCARY

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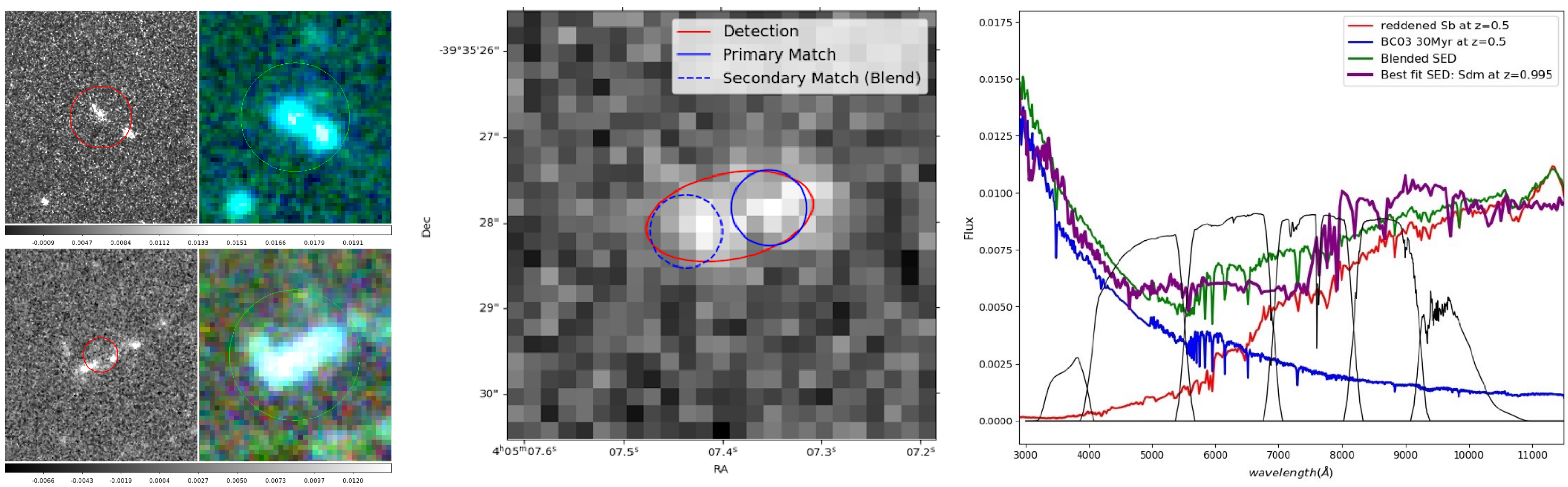
BLENDING IMPACTS BOTH SHAPE AND PHOTO-Z MEASUREMENT

Figure 1: Left: Recognized and un-recognized blends. Middle: Blending affects shape measurement. Right: Blending impacts photo-z estimate (S. Schmidt, DESC meeting).



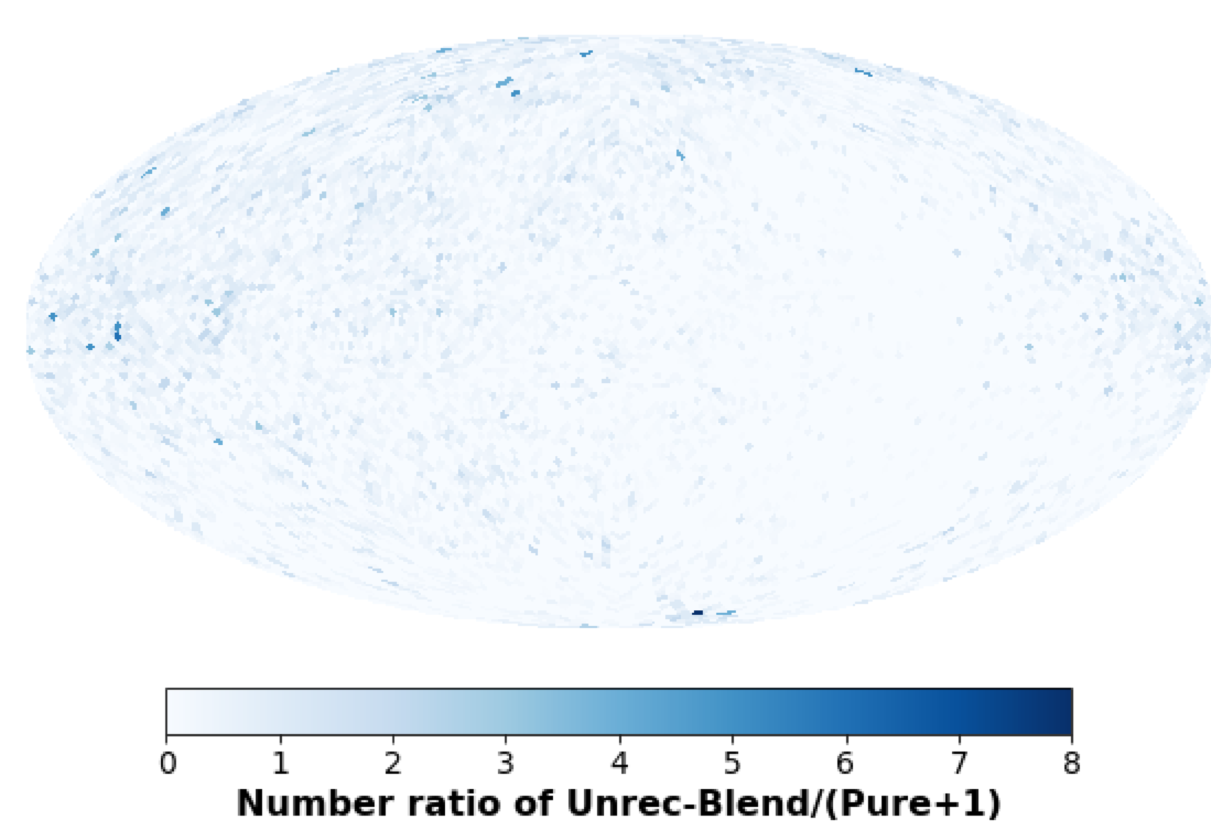
Two or more objects are "blended" when they are close to each other in projection. [1] find that about 58% of galaxies are blended at $i \sim 26$ in the Hyper Suprime-Cam (HSC) survey. [2] show that 14% of objects are "unrecognized blends" at the depth of LSST of $i \sim 27$, where multiple objects overlap so much as to be detected as one source. If not treated properly, they would contribute to 14% increase in shear noise for LSST. [3] also show that the impact of blends on photometric redshift (photo-z) is especially difficult due to different selections between the training sample and the target sample.

[1] Bosch et al. 2018 [2] Dawson et al. 2016. [3] R. Mandelbaum et al. 2017. [4] Laigle et al. 2015 [5] Melchior et al. 2018 [6] W Dong et al. 2020

DETECTING UN-RECOGNIZED BLENDS WITH MACHINE LEARNING

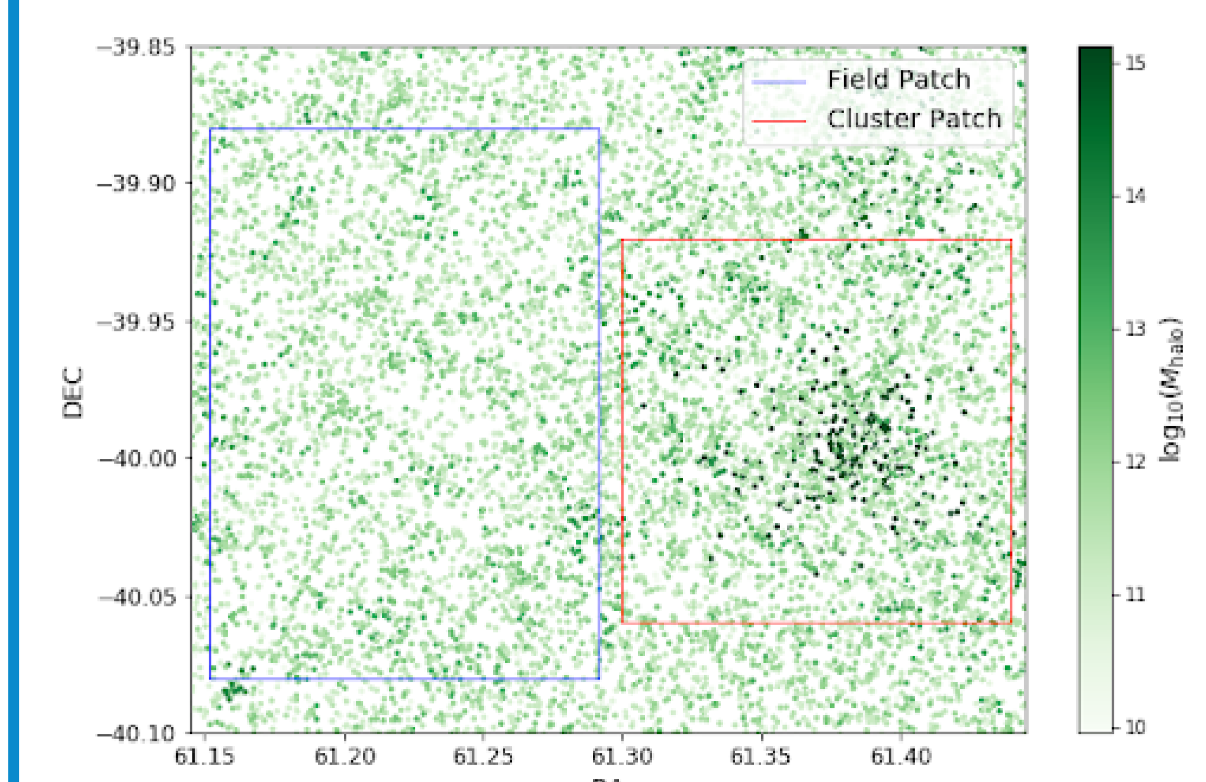
We have developed a method for detecting un-recognized blends at the catalog level, based only on the measured colors. Assuming that the blended sources have unique colors, we seek to identify regions in the galaxy color space with high probability of blends. A machine learning algorithm (Self Organizing Map, SOM) is used to map the high-dimensional color space onto a 2D chart and to idenfity such blended regions.

The right figure shows the identified "blending regions" on the SOM chart based on the COSMOS data set [4]. Using this method, we are able to remove 14.7% to 67.8% of the un-recognized blends at the cost of 7.5% to 48.8% of all sources.



S. Liang and A. von der Linden 2022 (in prep)

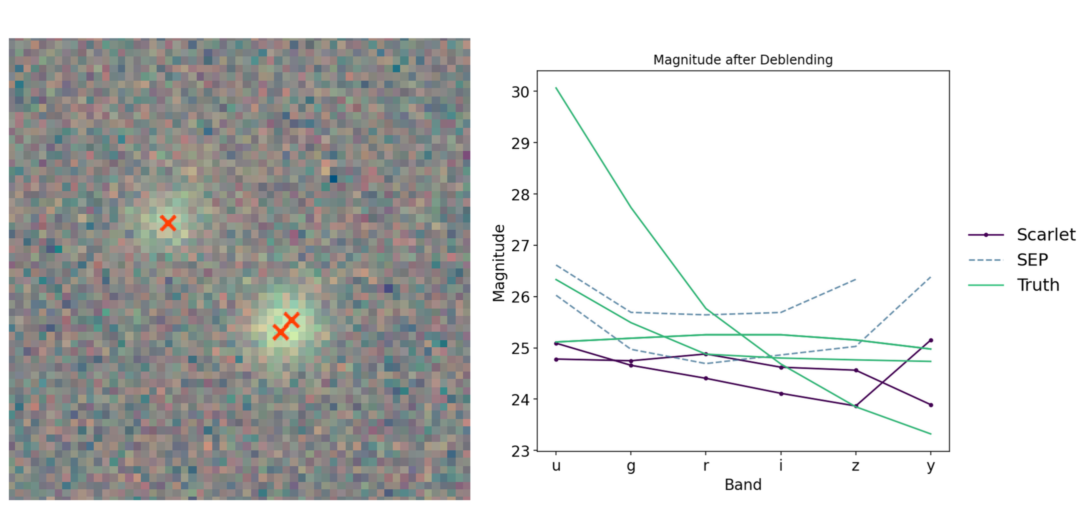
BLENDING IN CLUSTERS



I'm leading a DESC project to study the impact of blending on photo-z in clusters. The blending issue is more serious in galaxy clusters (higher number density). However, we can opt to use a shallower sample (less blended) for cluster weak lensing, as clusters are the most massive halos. Studying to find the right balance!

STRESS-TESTING SCARLET

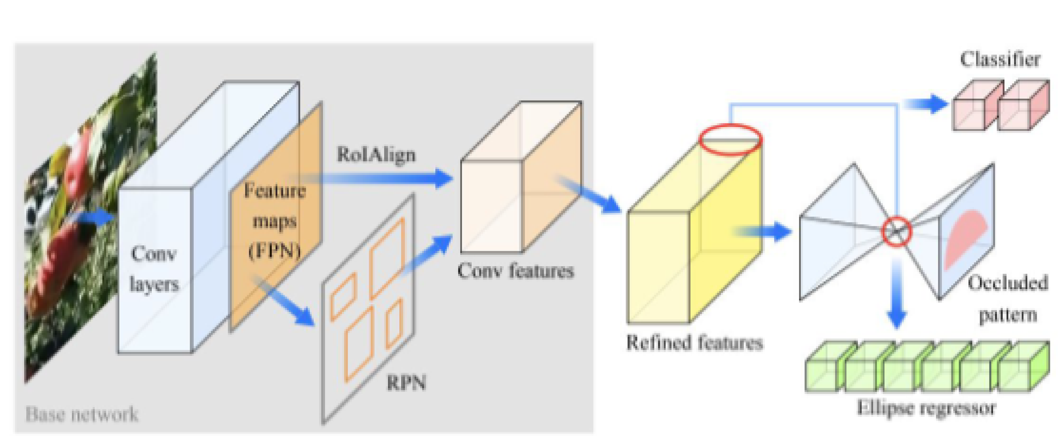
Figure 2: Left: BTK simulation of galaxy blends. Right: Reconstructed flux measurements w. Scarlet.



As part of the cluster commissioning project, I'm working with Prakruth Adari (Ph.D. student in Stony Brook) and Prof. von der Linden on stress-testing Scarlet(-Lite) [5], the LSST deblender, on dense galaxy cluster fields. We're focused on the impact of imperfect deblending on photo-z measurements.

DEBLENDING WITH E-RCNN

Figure 3: Flow-chart of Ellipse RCNN.



I'm also working with (co-mentoring with Sid Mau, Ph.D. in Stanford) Andrii Torchylo, an undergraduate student at Stanford University, on a summer research project with Prof. Burchat. Andrii is currently implementing a source detection algorithm with Ellipse Region Convolutional Neural Network (Ellipse RCNN) [6]. Check out Andrii's poster for more details (PCW only)!

CONTACTS

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