LSST - WFIRST Synergy: A New Domain of Blending Challenges

Wide Field InfraRed Surveys: Science & Techniques

2014 November 18

Collaborators:
Failure modes from ground & space
Blend fractions vs depth

See also: Dawson et al. (2014); The Ellipticity Distribution of Ambiguously Blended Objects
Photo-z’s of blended galaxies can be biased

Both Galaxies $z=0.5$

S. Schmidt
Photo-z’s of blended galaxies can be biased

Both Galaxies
z=0.5

PSF

z=1.0

S. Schmidt
Photo-z’s of blended galaxies can be biased.
Photo-z’s of blended galaxies can be biased

S. Schmidt
Perhaps a more common ambiguous blend scenario
Fainter space galaxies more likely to be “lost”
Key observables: tools in mitigating blending

- Color spatial gradients
- Photometric redshifts
- Light profile morphology
- Space imaging
  - Best ground seeing epochs (more for LSST)
Ex.: using space-based imaging to learn about ground-based imaging

Dawson et al. (2014)
Key observables: tools in mitigating blending

- Color spatial gradients
- Photometric redshifts
- Light profile morphology
- Space imaging
  - Best ground seeing epochs (more for LSST)
How to combine these tools in a consistent/meaningful way

HIERARCHICAL PROBABILISTIC INFERENCE OF COSMIC SHEAR

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arXiv:1411.2608

\[
\begin{align*}
\Pr(\theta, \{\psi_s\}, \{\Pi_i, \Omega_i\}, \{\omega_n, \alpha_n, \xi_n\}, \mathcal{A}, \tau, m, a_\eta | \{d_n\}, \mathcal{X}) & \propto \\
& \Pr(\theta) \cdot \Pr(\{\psi_s\}|W, \{s\}, \theta) \cdot \Pr(\mathcal{A}|a) \\
& \times \prod_{n=1}^{n_{\text{gal}}} \Pr(\omega_n|\alpha_n, I) \cdot \Pr(\alpha_n|\mathcal{A}, a_\eta) \cdot \Pr(\xi_n|m, \tau) \\
& \times \prod_{i=1}^{n_{\text{epoch}}} \Pr(\Pi_{n,i}|\Omega_i, I) \cdot \Pr(\Omega_i|p, d_{\text{anc},i}) \\
& \times \Pr(d_{n,i}|\omega_n, \xi_n, \psi_s, \Pi_{n,i}) \quad (18)
\end{align*}
\]
Measuring galaxy ellipticity (and other properties) from combined survey data

From Schneider talk on Monday
Methods for combining survey data

1. Catalog comparison

2. Interim samples from 1 survey + pixel-level analysis in 2\textsuperscript{nd} survey
   - Need many samples

3. Interim samples from both surveys
   - Need many samples + binning of model parameters

4. Joint analysis of pixel data

From Schneider talk on Monday

Challenge: methods 2 - 4 often require re-analyzing pixel data
Implications for the Future

- Area vs. Depth: new considerations
  - What’s good for WFIRST?
  - What’s good for LSST?
- Best means of integrating WFIRST and LSST?
- Computational requirements (joint fitting)
Galactic Plane Deep Fields

See Huub Rottgering’s Talk Tomorrow