



DARK ENERGY
SURVEY

Photometric Redshifts

How well we can do
How well we can know

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Photo-z checklist

- Getting the data: filter shapes, calibration, ...
- Estimate redshifts photometrically
- Estimate errors
- Quantify uncertainty in error estimates
- Estimate redshift distributions →
Cosmological parameters



Photo-z methods: Best results

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**DES only
griz filters**

Limiting Magnitudes

g	24.6
r	24.1
i	24.0
z	23.65

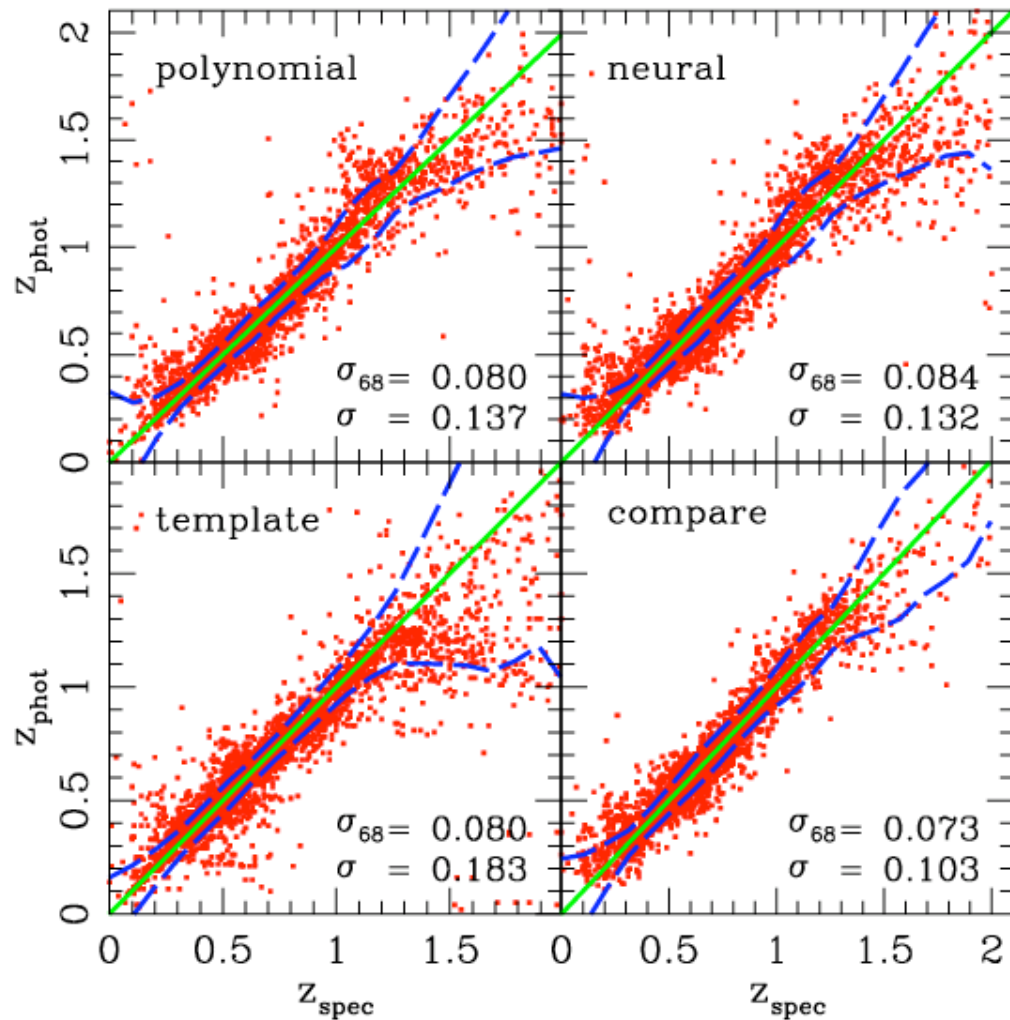




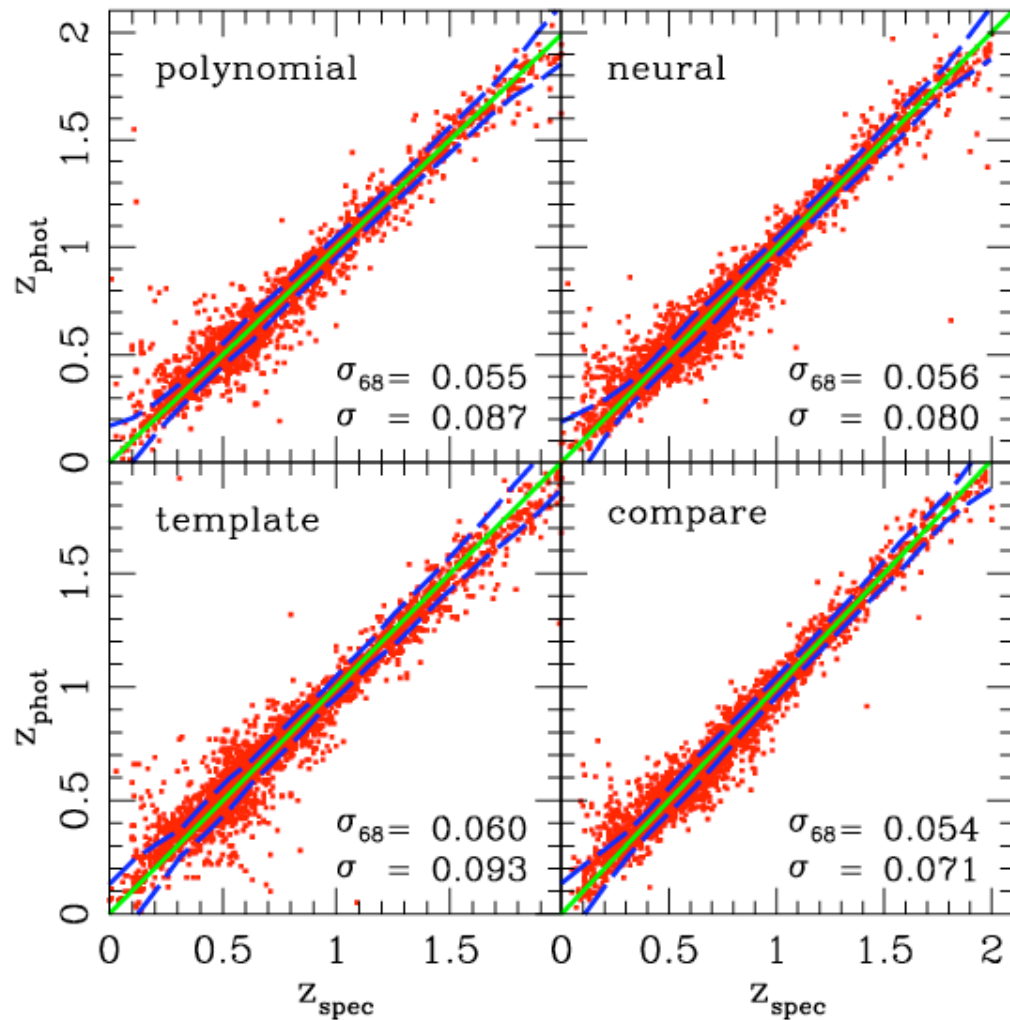
Photo-z methods: Best results

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DES + VISTA grizYJHKs filters

Limiting Magnitudes

Y	22.45
J	22.15
H	21.65
Ks	21.15

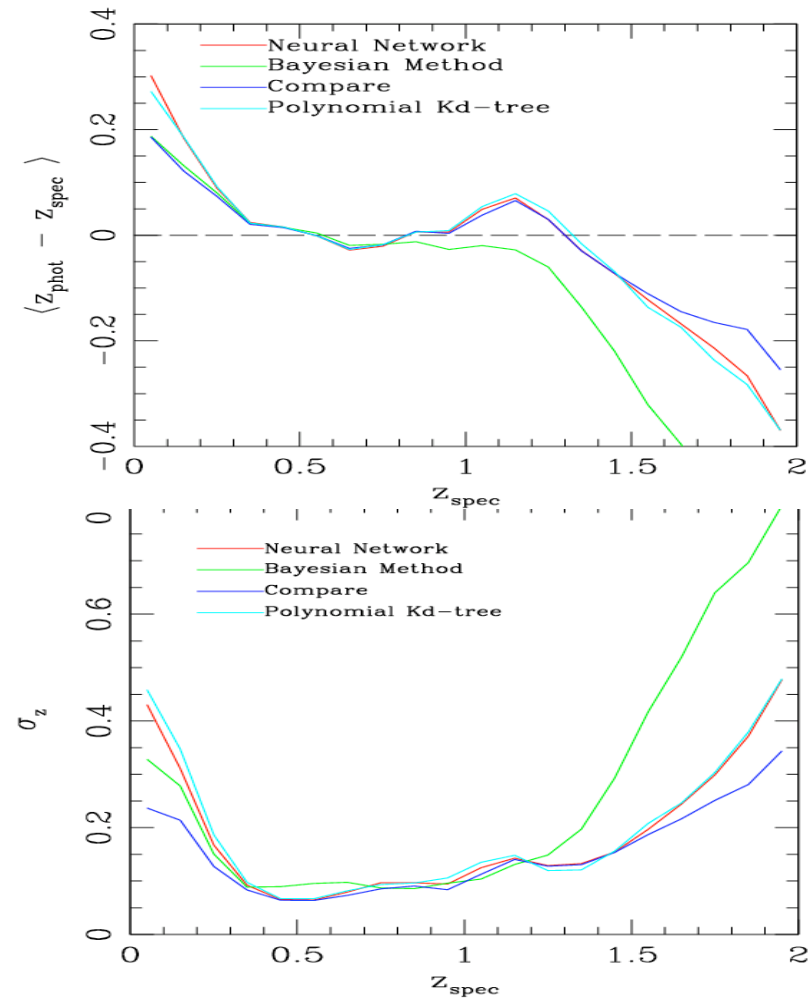




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Bias and dispersion

- **Bias:** Filter coverage, magnitude errors, distribution of training set, constraining of allowed redshift range, template library.
- **Dispersion:** Magnitude errors, intrinsic dispersion in shape of $z(m, C)$ hypersurface, template library...





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Bias and dispersion: Improvement Prospects

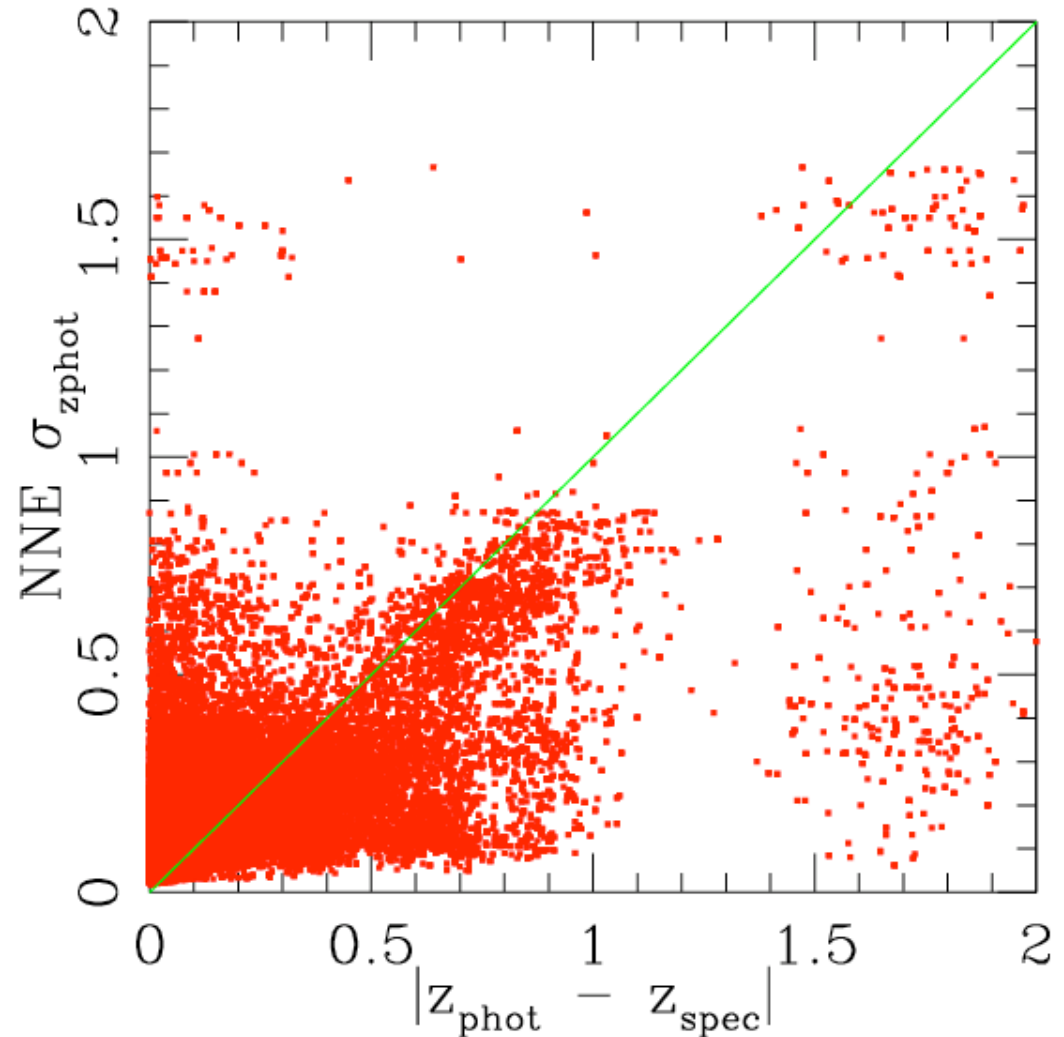
- Training set methods are close to the limit.
- Template methods need to catch up.
- Can add other parameters to help break the degeneracies: morphological type, psf, ...
- Can remove bad points.



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Error estimation

- **Errors** are **uncertainties** in z_{phot} , not $|z_{\text{phot}} - z_{\text{spec}}|$.
- **Catastrophic objects**: objects for which error estimators fail.





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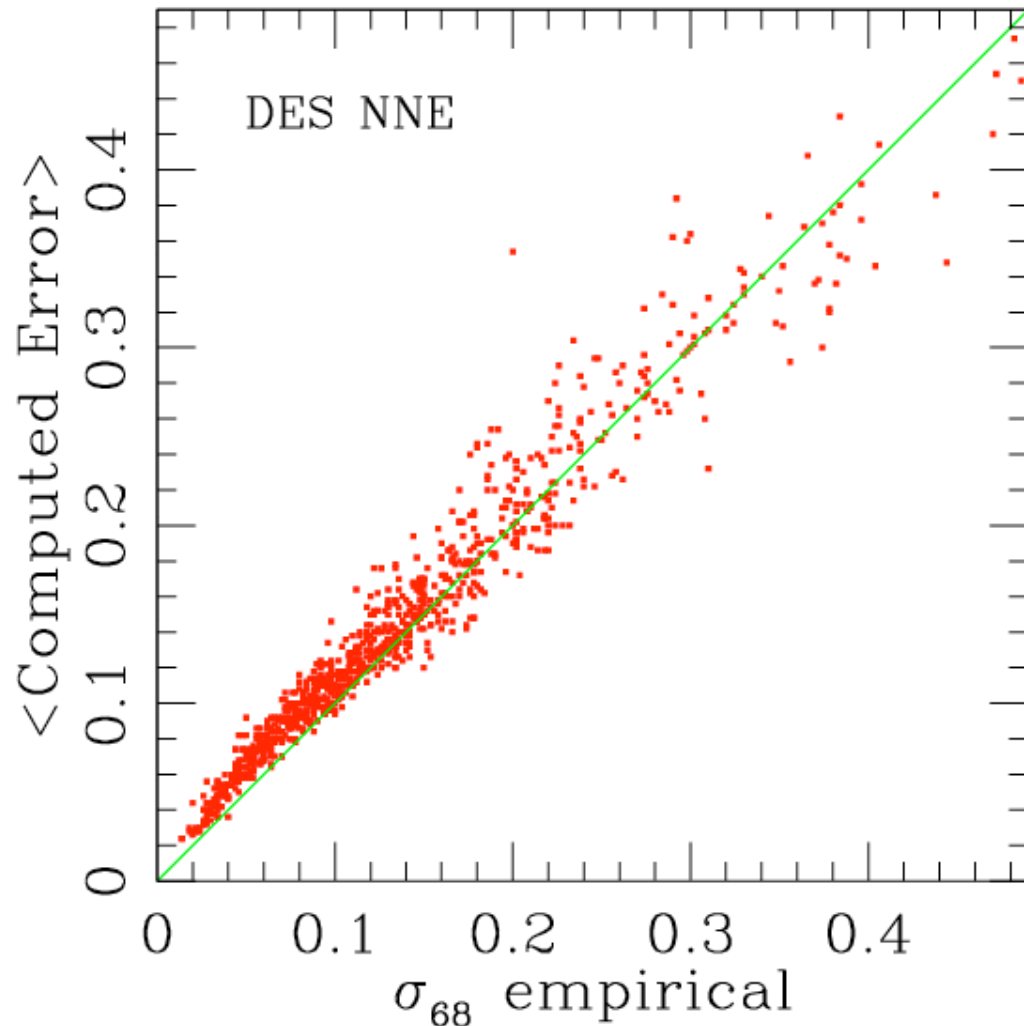
Error Estimation

Computed Error:

- Nearest Neighbor:
 σ_{68} of $(z_{\text{phot}} - z_{\text{spec}})$
distribution of nearby
training set objects in
magnitude space.

Empirical (“True”) Error:

- Given objects in a
computed σ_{68} bin, find the
“true” σ_{68} of that bin.

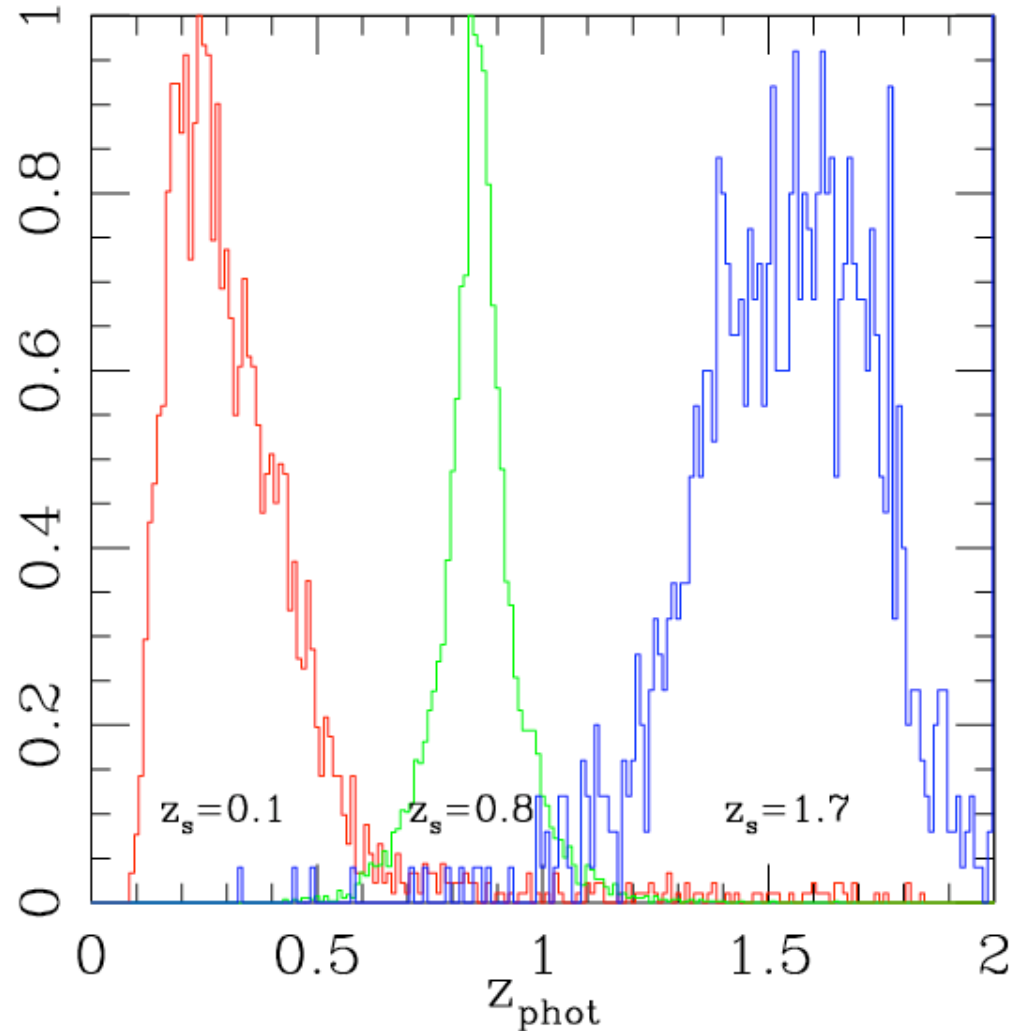




Modelling the z_{phot} distribution

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- Not Gaussian.
- How “stable” are these shapes? → Bootstrap





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Bonus material





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Bonus material

