Photo-z's for LSST using Machine Learning

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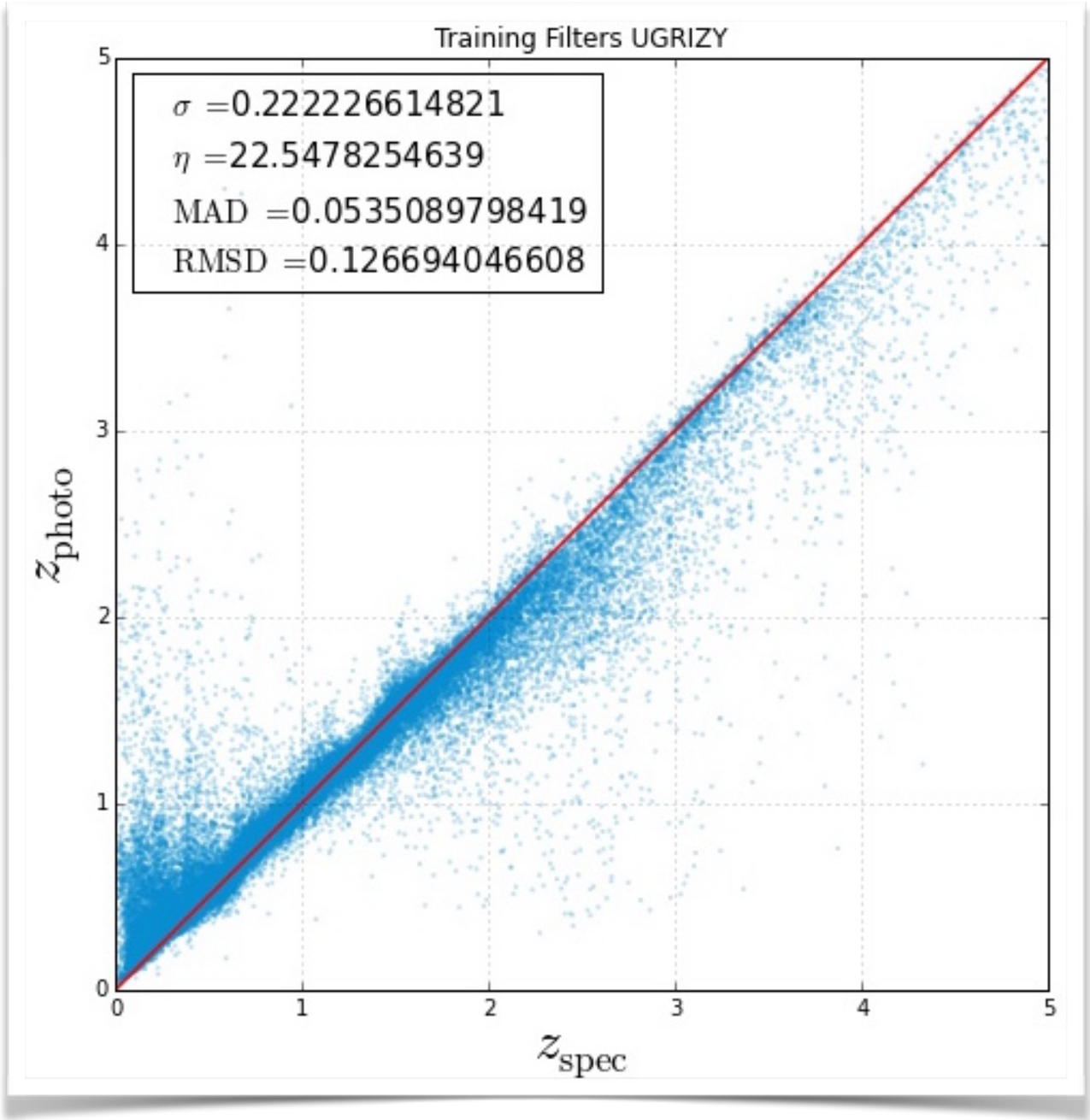
8th Feb16

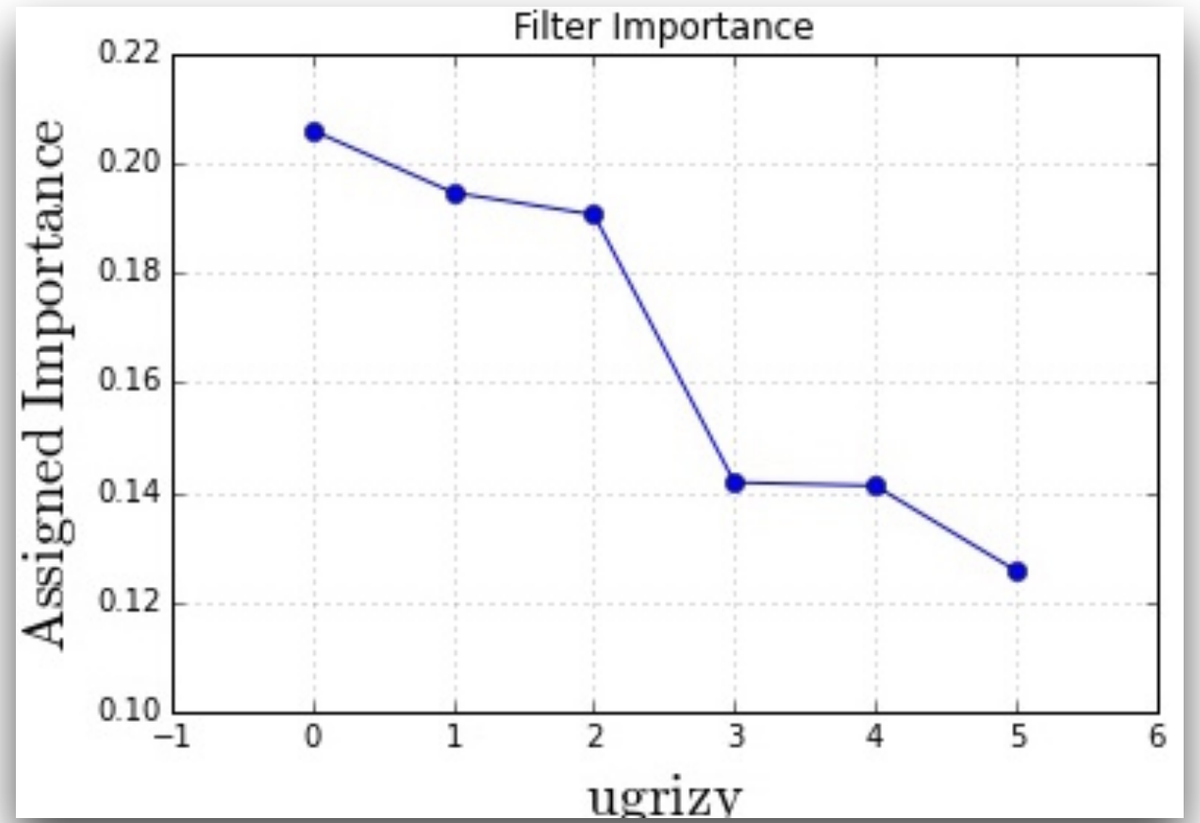
Key Points

- Five parameters assessed
- σ - Standard Deviation
- η - % of outliers ($\Delta z > 0.05$)
- MAD- Median Absolute Deviation
- RMSD - Root Mean Square Deviation
- Importance plot show the significance of filters (or colors) individually for each scenario.
- 80% data used for training, 20 % for testing.

Photo-z estimations



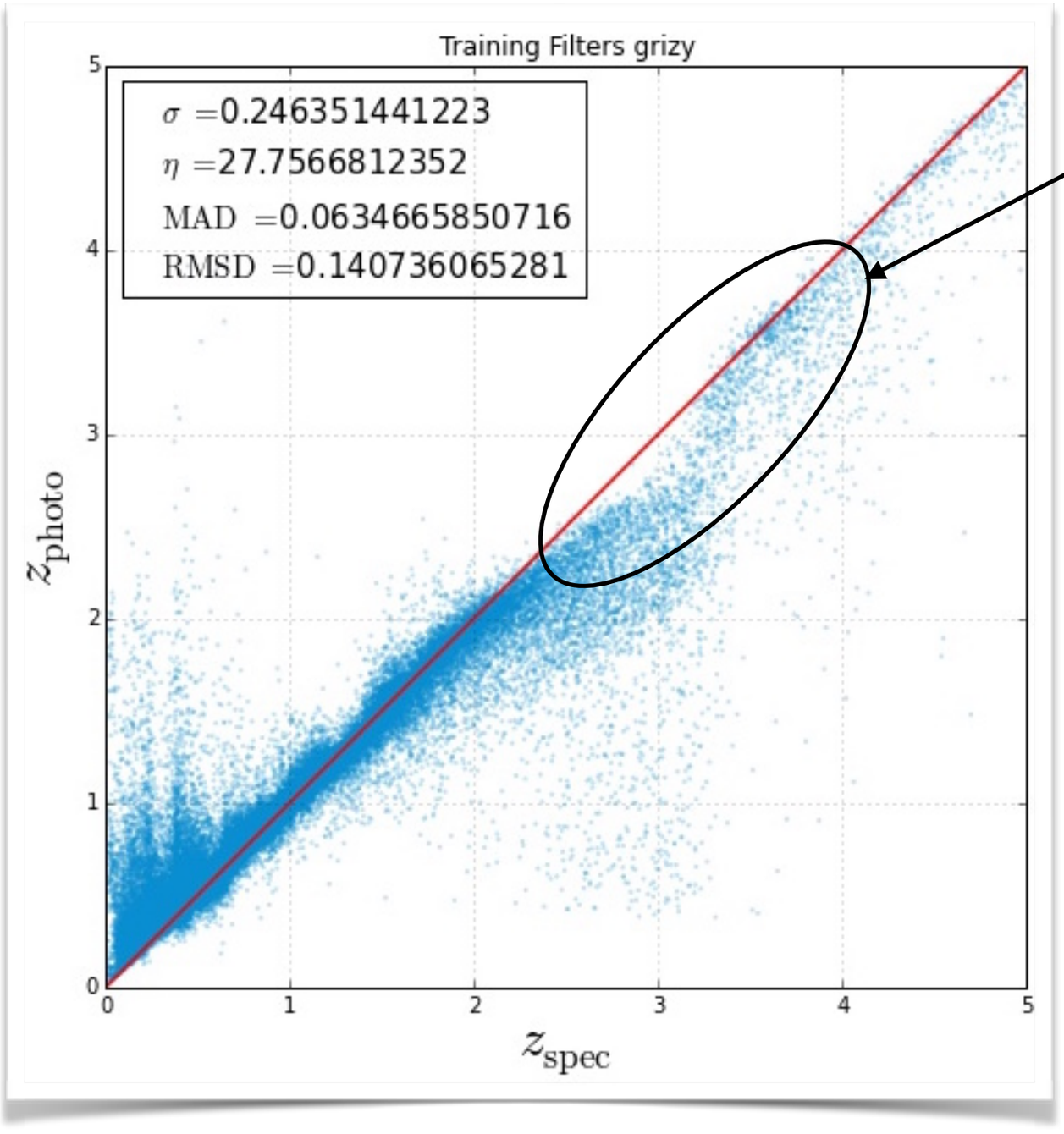
Random Forest Regression using Scikit-learn Pedregosa et al., JMLR 12, pp. 2825-2830, 2011



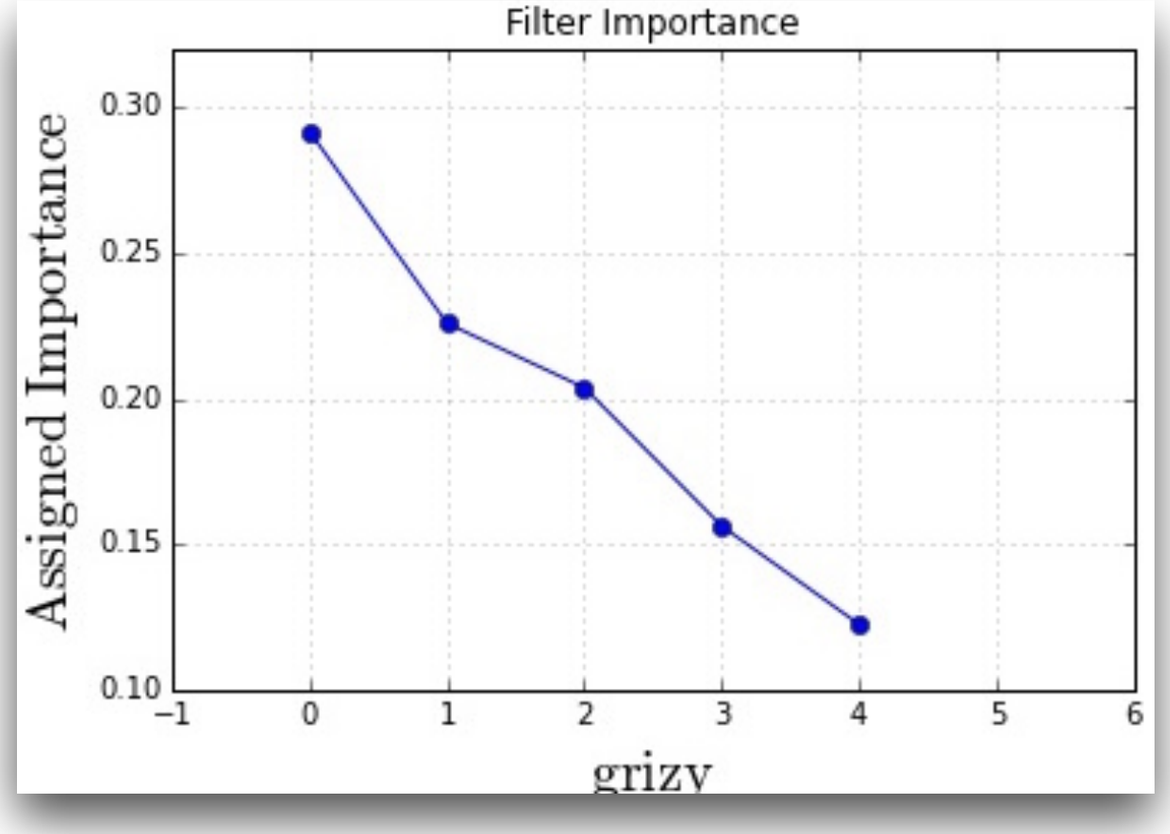
Mock objects from

Brownmocks_weighted_from_izt_gold_head.out

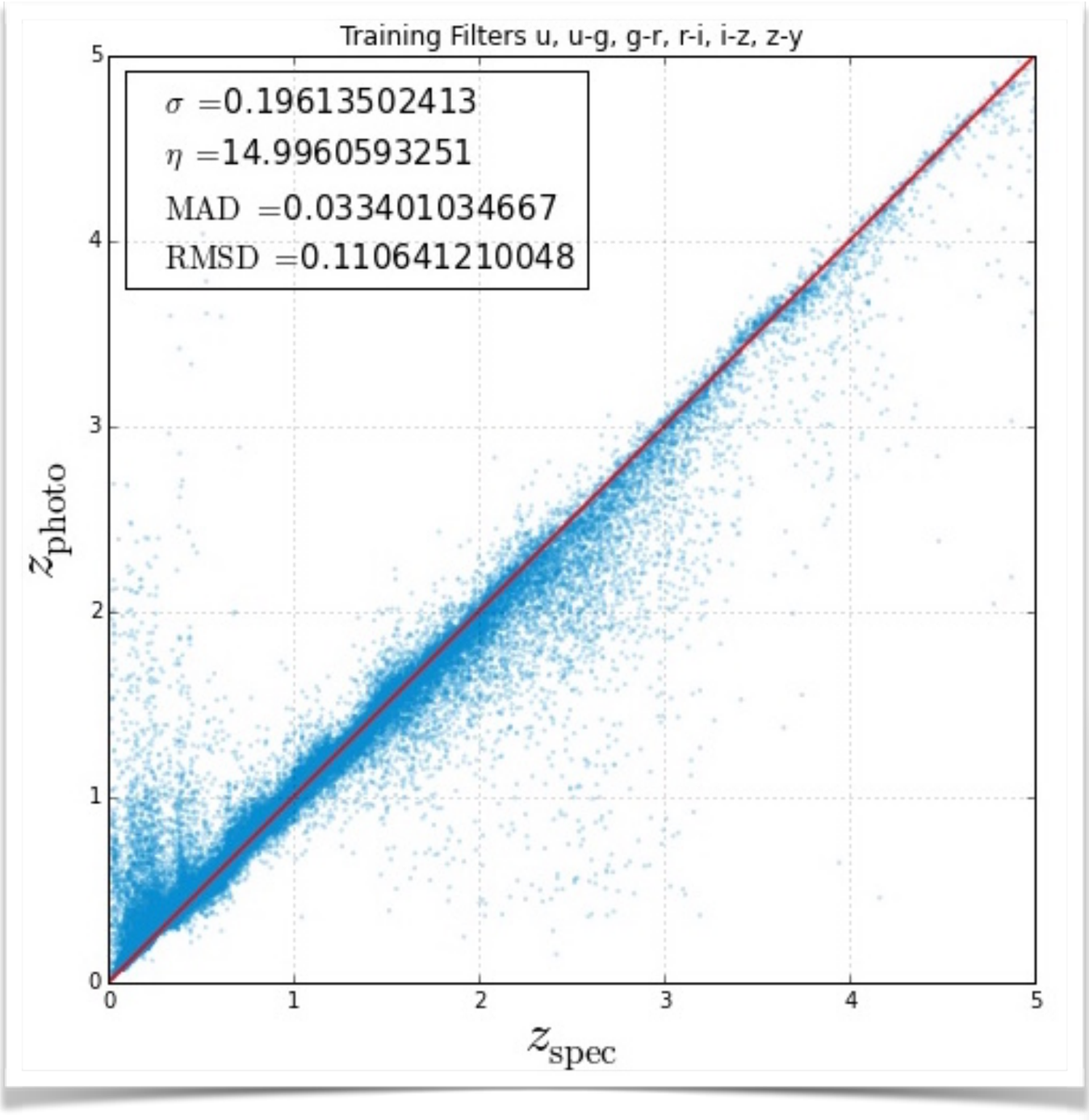
Weighing bands



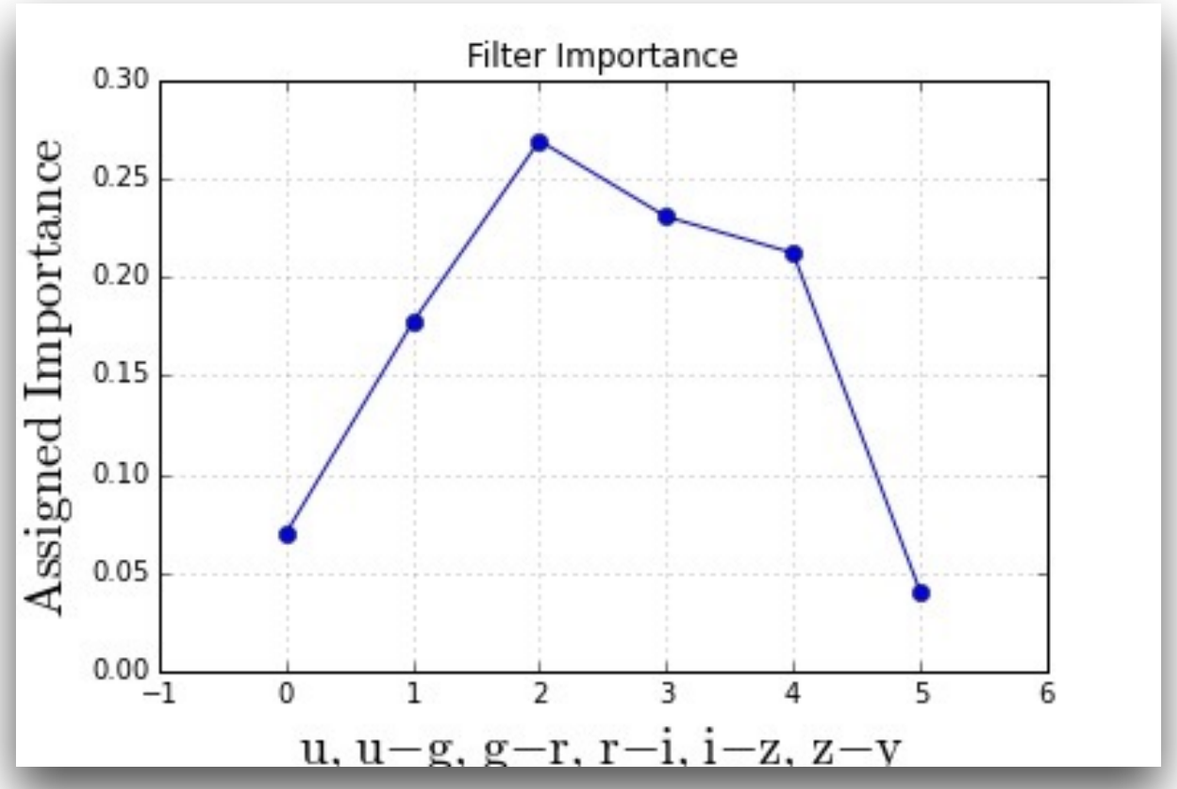
Leaving out U-band



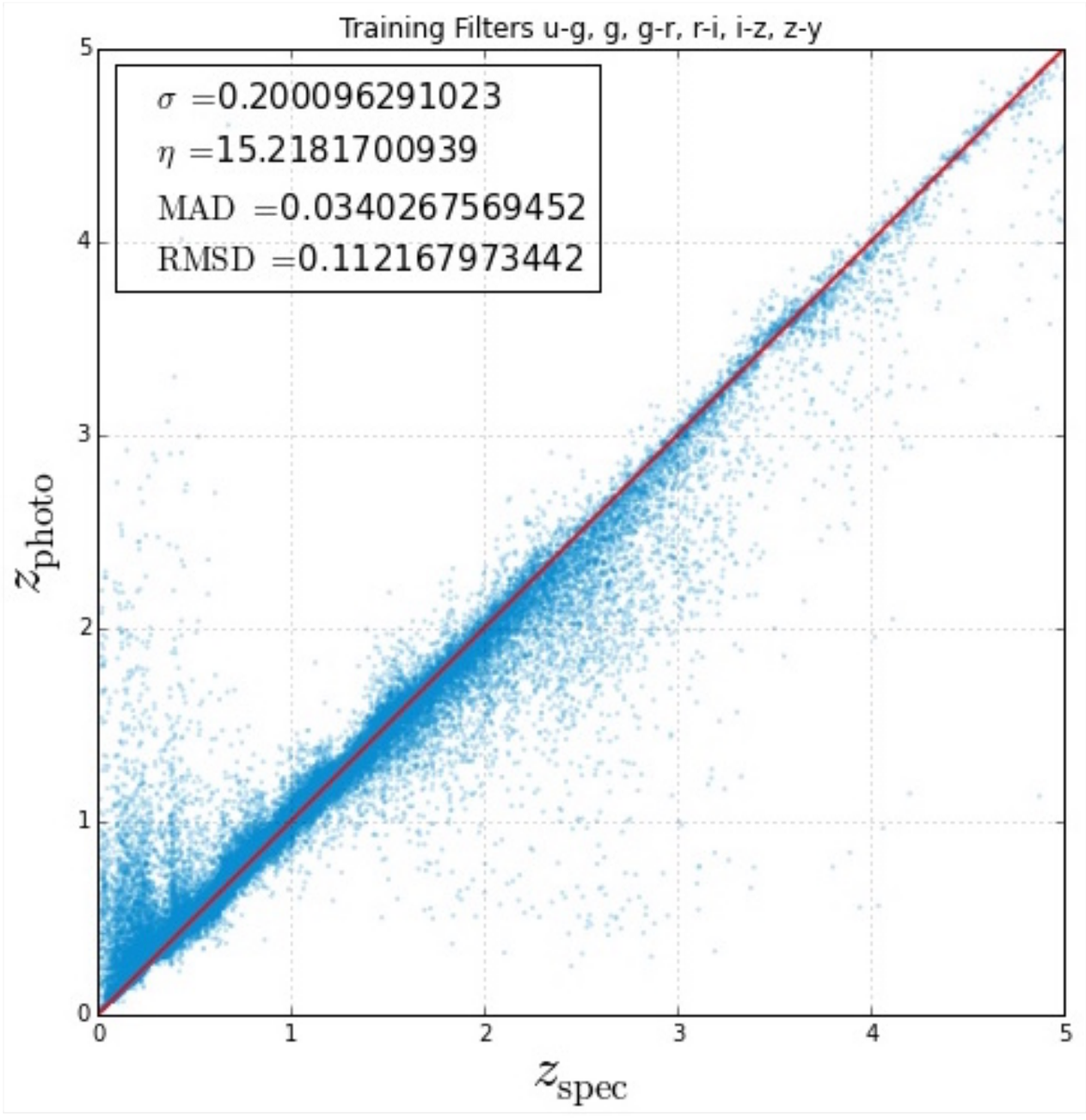
Better results with colors



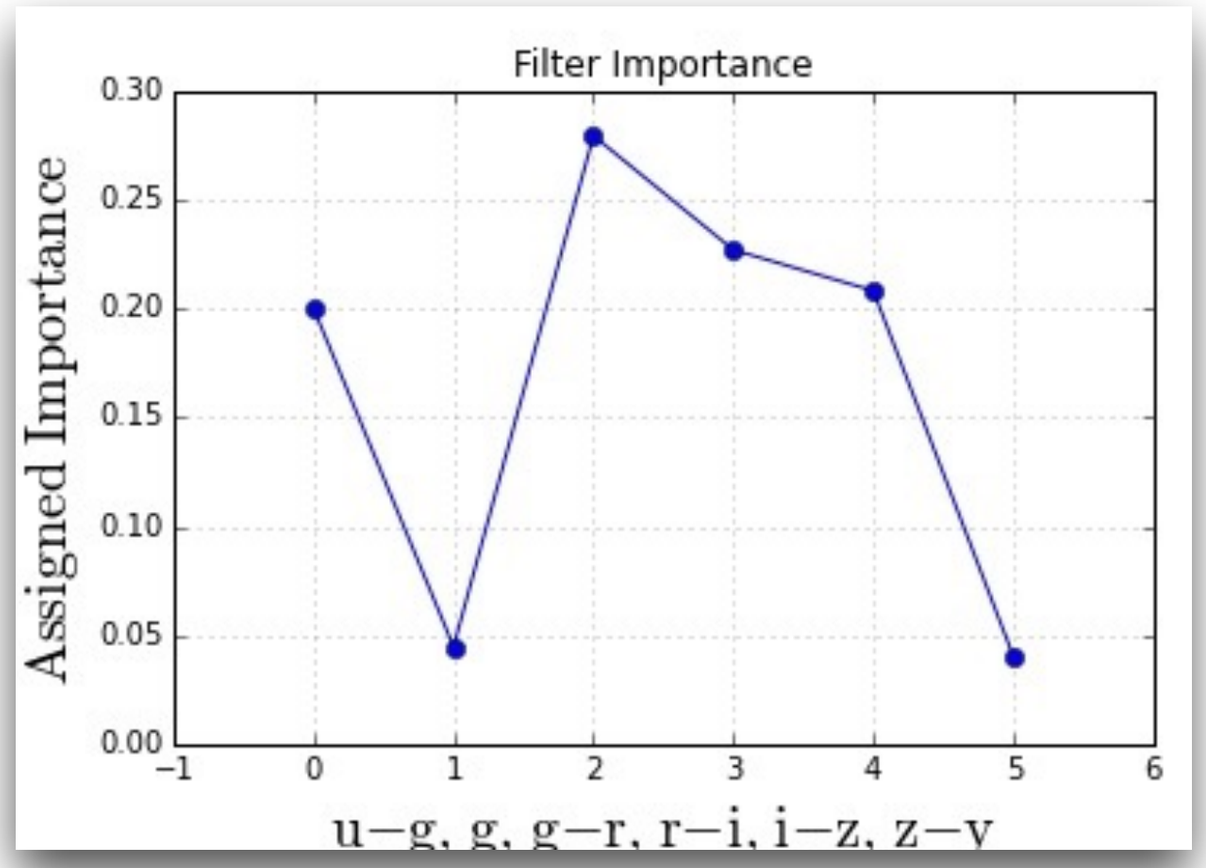
Color	u	u-g	g-r	r-i	i-z	z-y
Weight	0.057	0.192	0.278	0.229	0.204	0.041



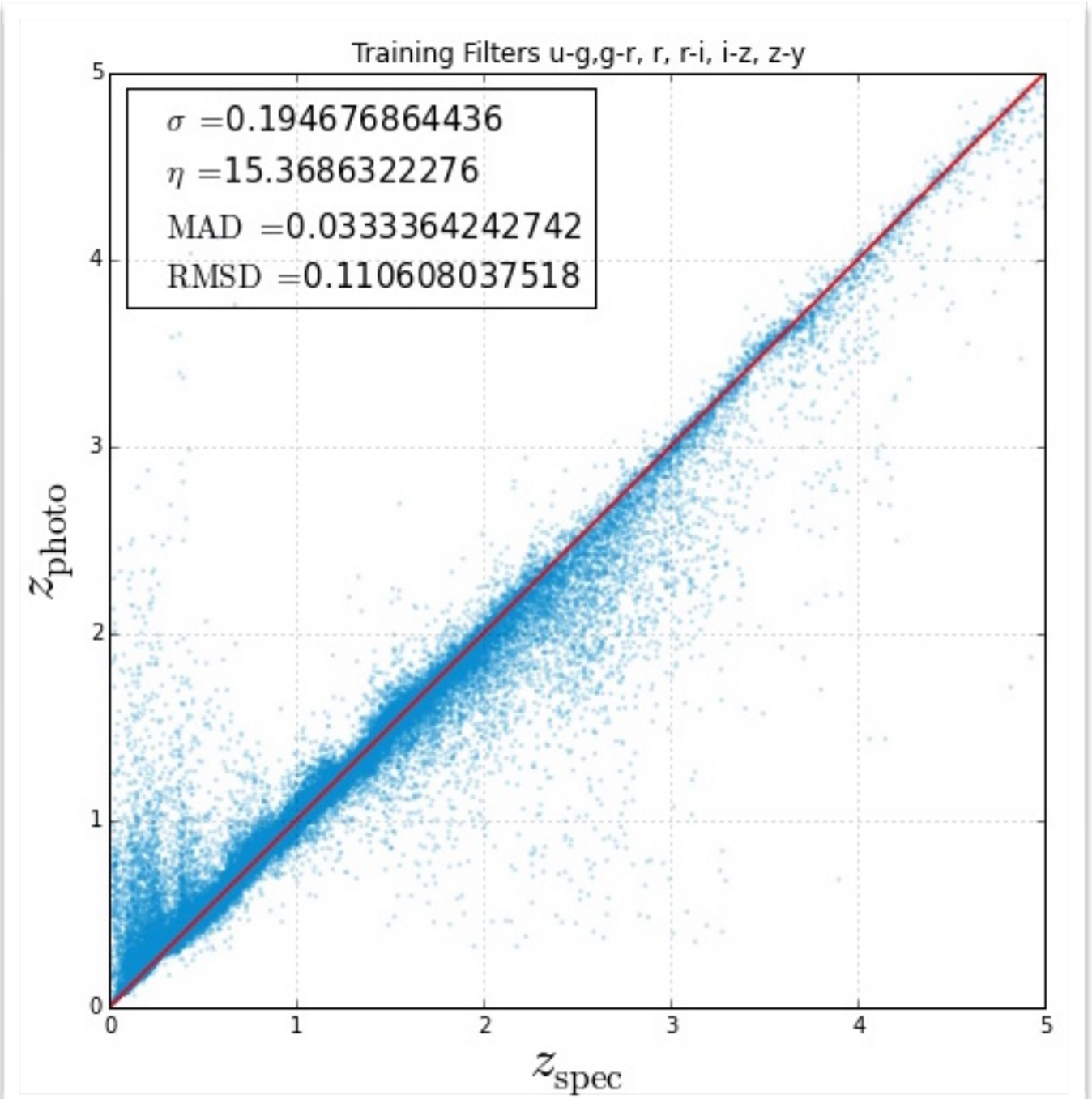
Better results with colors



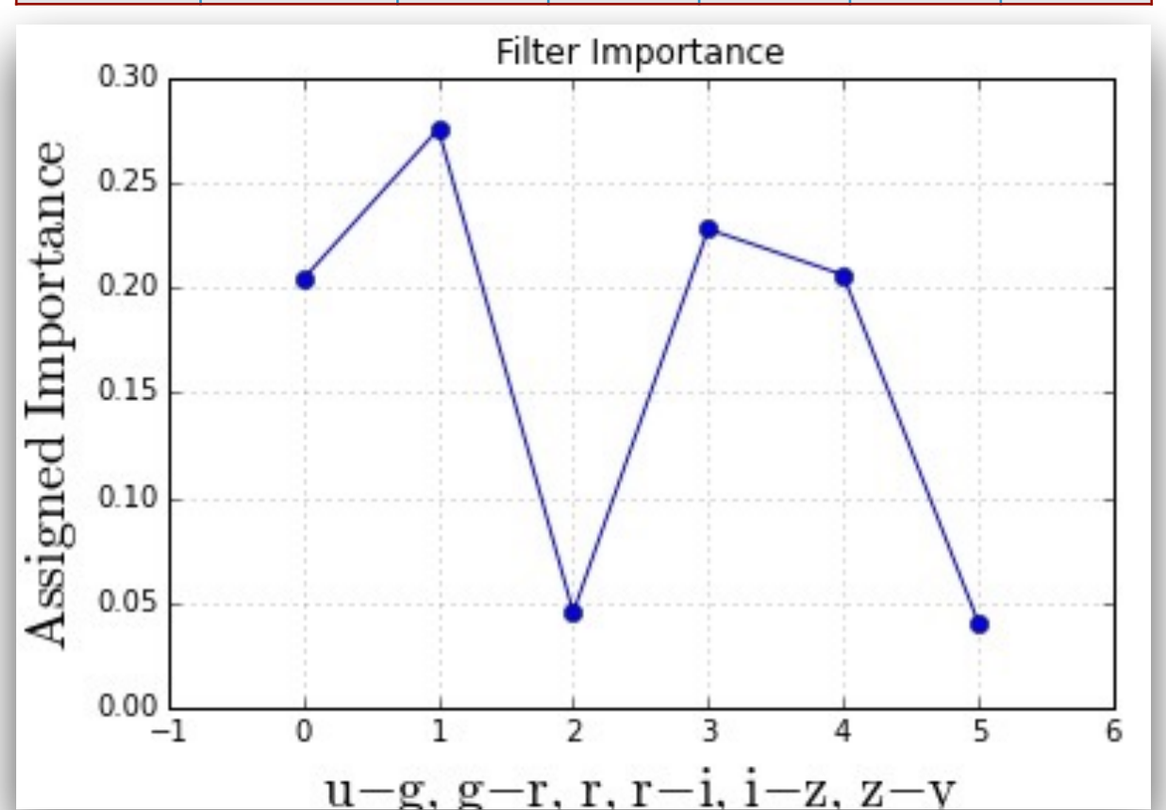
Color	u-g	g	g-r	r-i	i-z	z-y
Weight	0.200	0.044	0.276	0.232	0.208	0.040



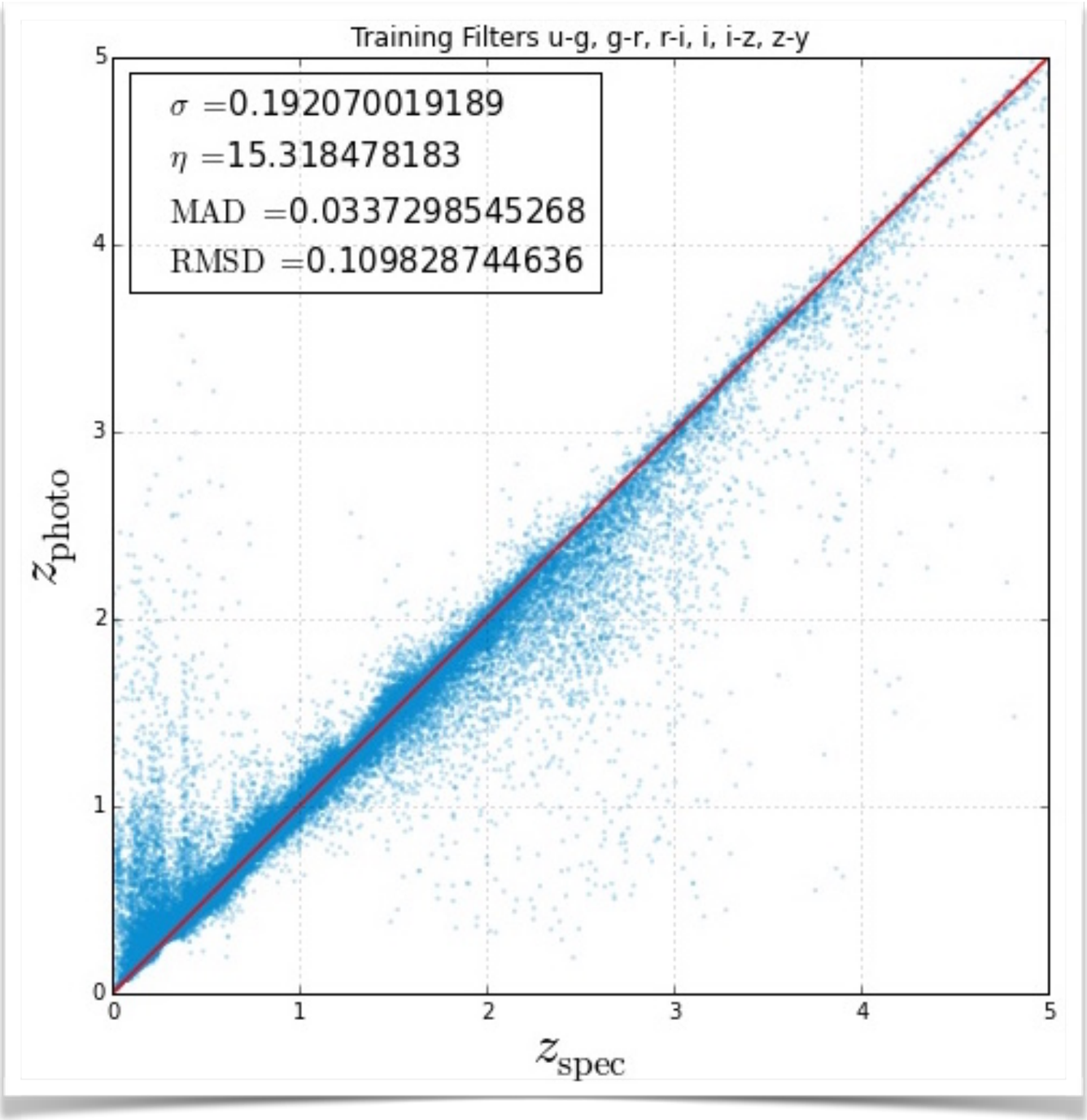
Better results with colors



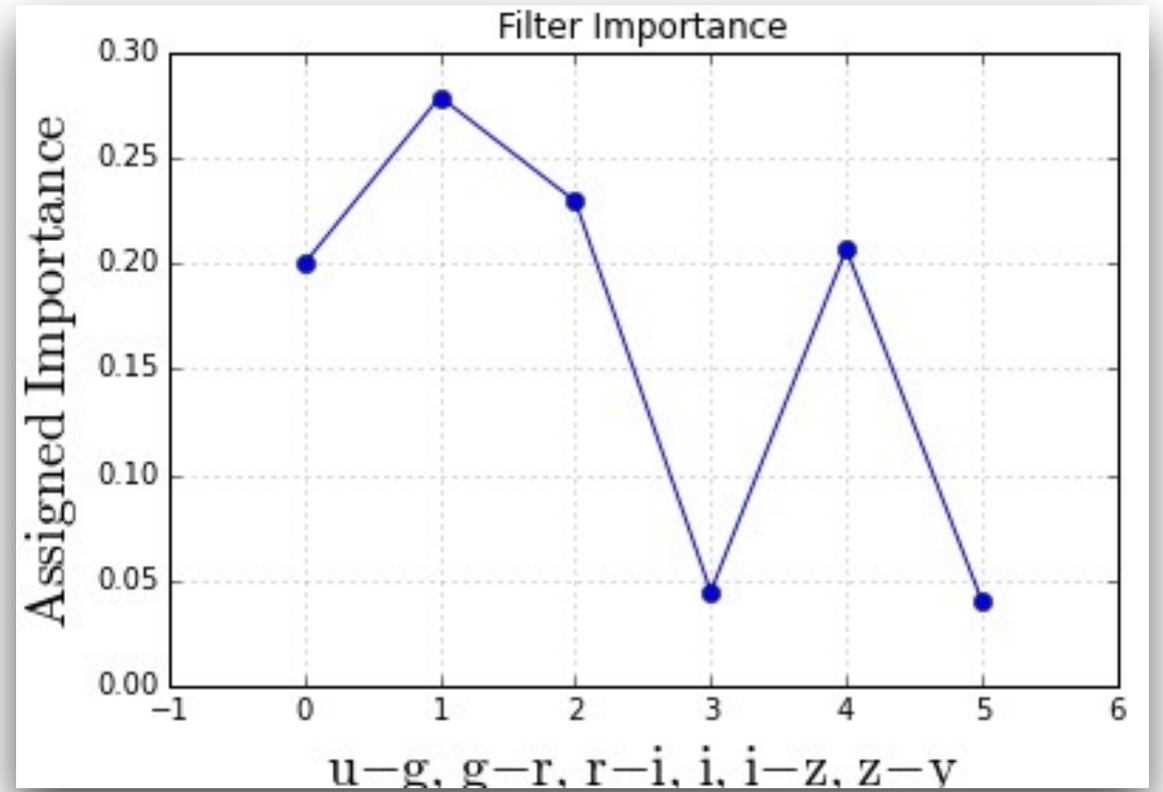
Color	u-g	g-r	r	r-i	i-z	z-y
Weight	0.200	0.279	0.047	0.221	0.212	0.040



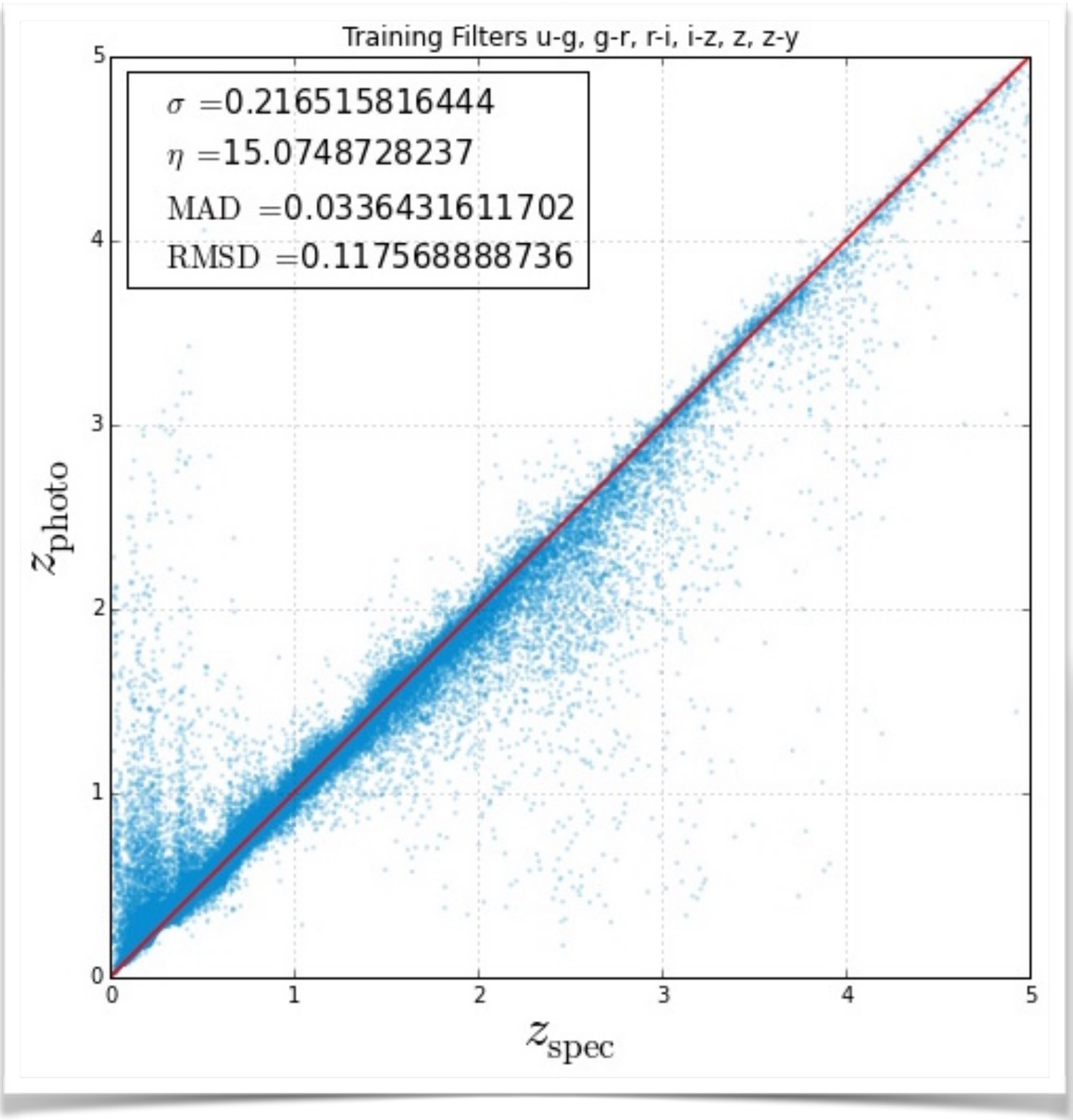
Better results with colors



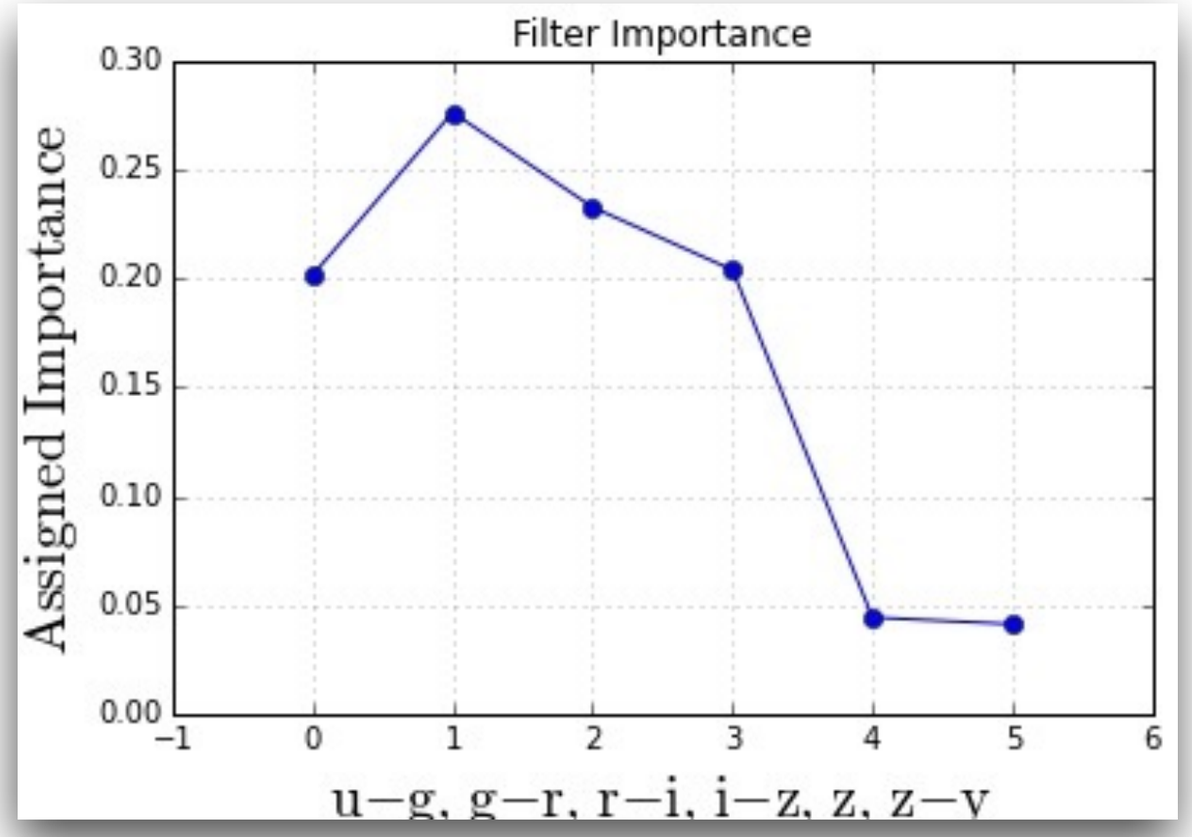
Color	u-g	g-r	r-i	i	i-z	z-y
Weight	0.200	0.287	0.224	0.044	0.206	0.040



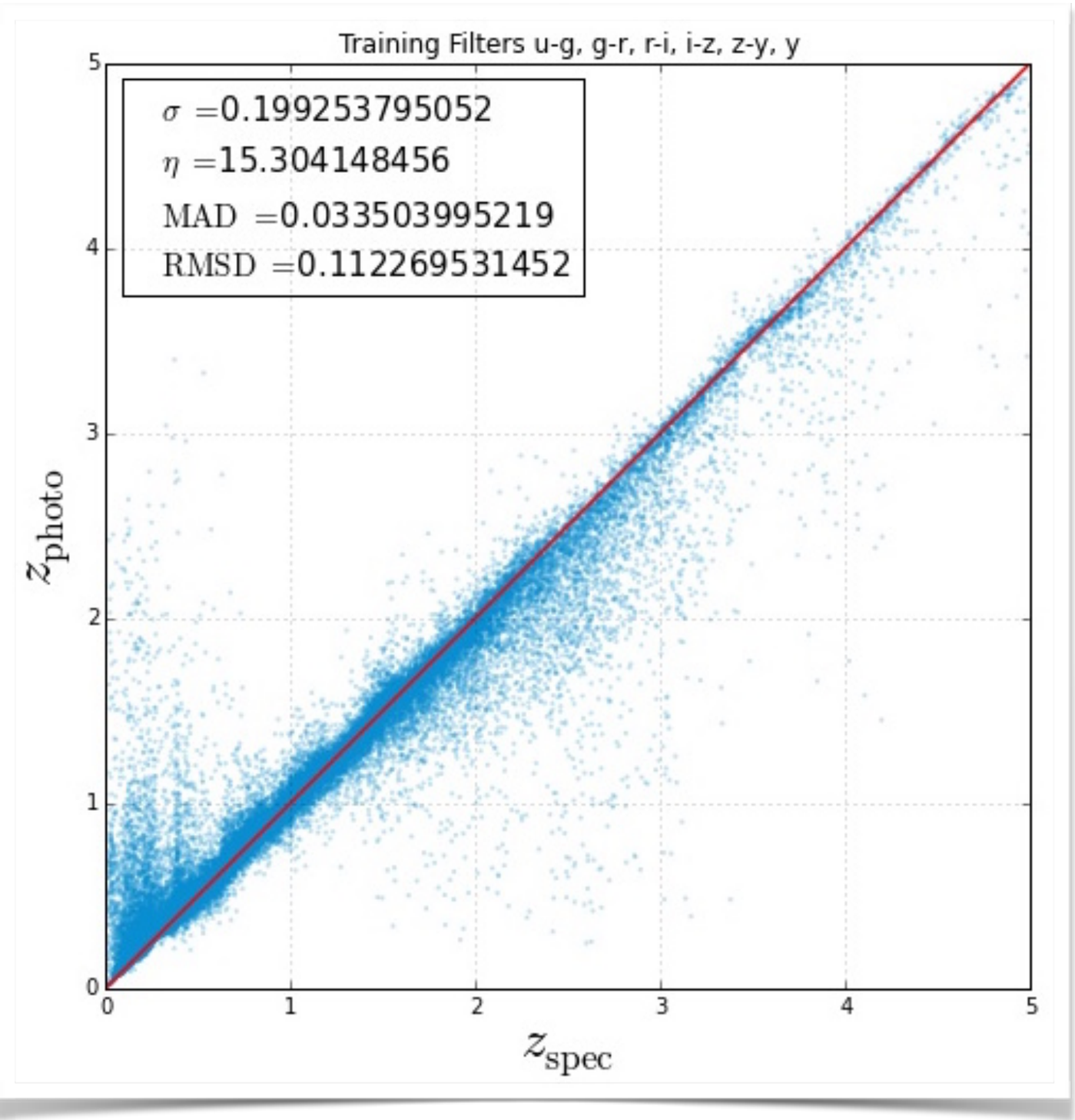
Better results with colors



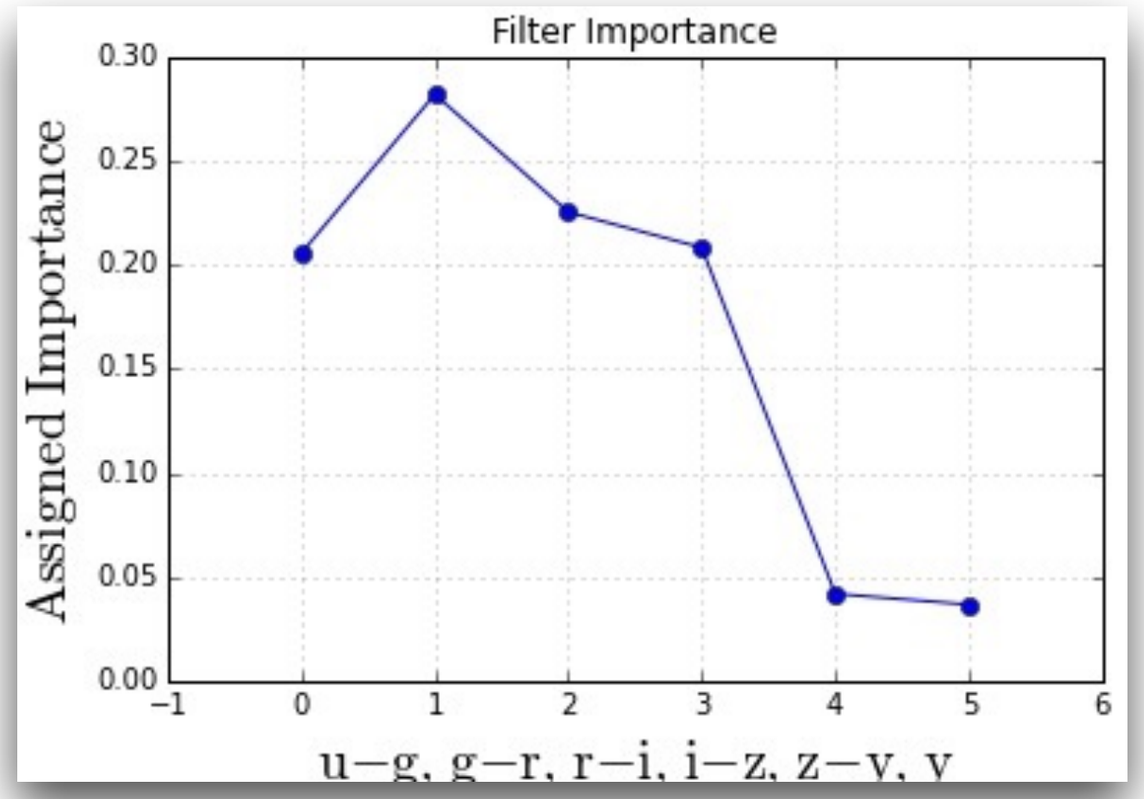
Color	u-g	g-r	r-i	i-z	z	z-y
Weight	0.198	0.283	0.223	0.210	0.044	0.041



Better results with colors



Color	u-g	g-r	r-i	i-z	z-y	y
Weight	0.203	0.278	0.235	0.206	0.042	0.036



Summary

- Training with color improves photo-z estimation.
- RMSD ~ 0.11 (Normalized by 1+*z*)
- *z-y* color not playing significant role in training.

RMSD	MAD	Eta	u-g	g-r	r-i	i-z	z-y	u	g	r	i	z	y
0.1306	0.054	22.55						0.204	0.197	0.188	0.144	0.144	0.124
0.1106	0.033	14.99	0.192	0.278	0.229	0.204	0.041	0.057					
0.1122	0.034	15.22	0.200	0.276	0.232	0.208	0.040		0.044				
0.1106	0.033	15.37	0.200	0.279	0.221	0.212	0.040			0.047			
0.1098	0.034	15.32	0.200	0.287	0.224	0.206	0.040				0.044		
0.1175	0.034	15.07	0.198	0.283	0.223	0.210	0.041					0.044	
0.1122	0.034	15.30	0.203	0.278	0.235	0.206	0.042						0.036

Zero-point calculations

- Training with Colors and testing the models with colors perturbed by +/-0.1 and calculating zero-point for photo-z.
- In one case calculating w.r.t spec-z, other case both photo-z estimations (+/- 0.1)

Filter	Δ z	Δ mag	Δ z /Δ mag	Δ z_{spec}	Δ mag	Δ z_{spec} /Δ mag
u	0.08	0.2	0.4	0.1	0.1	1
g	0.17	0.2	0.88	0.165	0.1	1.65
r	0.296	0.2	1.48	0.234	0.1	2.34
u	0.274	0.2	1.37	0.211	0.1	2.11
z	0.15	0.2	0.77	0.145	0.1	1.45
y	0.058	0.2	0.29	0.083	0.1	0.83