Probing the QSOs distribution within the Virtual Observatory

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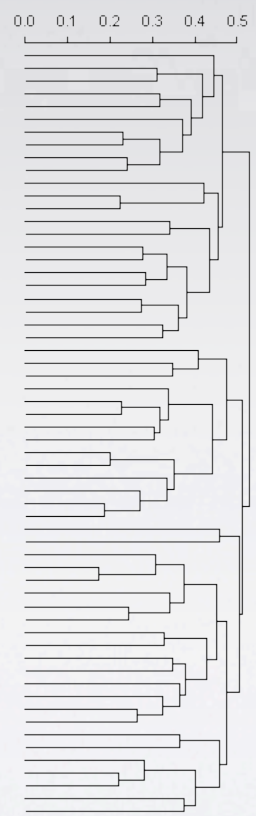
Candidate QSOs

Parameter space

Clustering algorithm

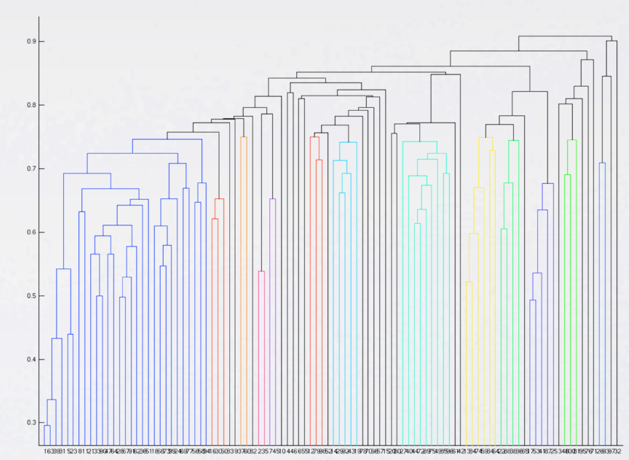
Raw distribution of points in the parameter space (PS).

Parameter space with clusters



Clusters in the PS

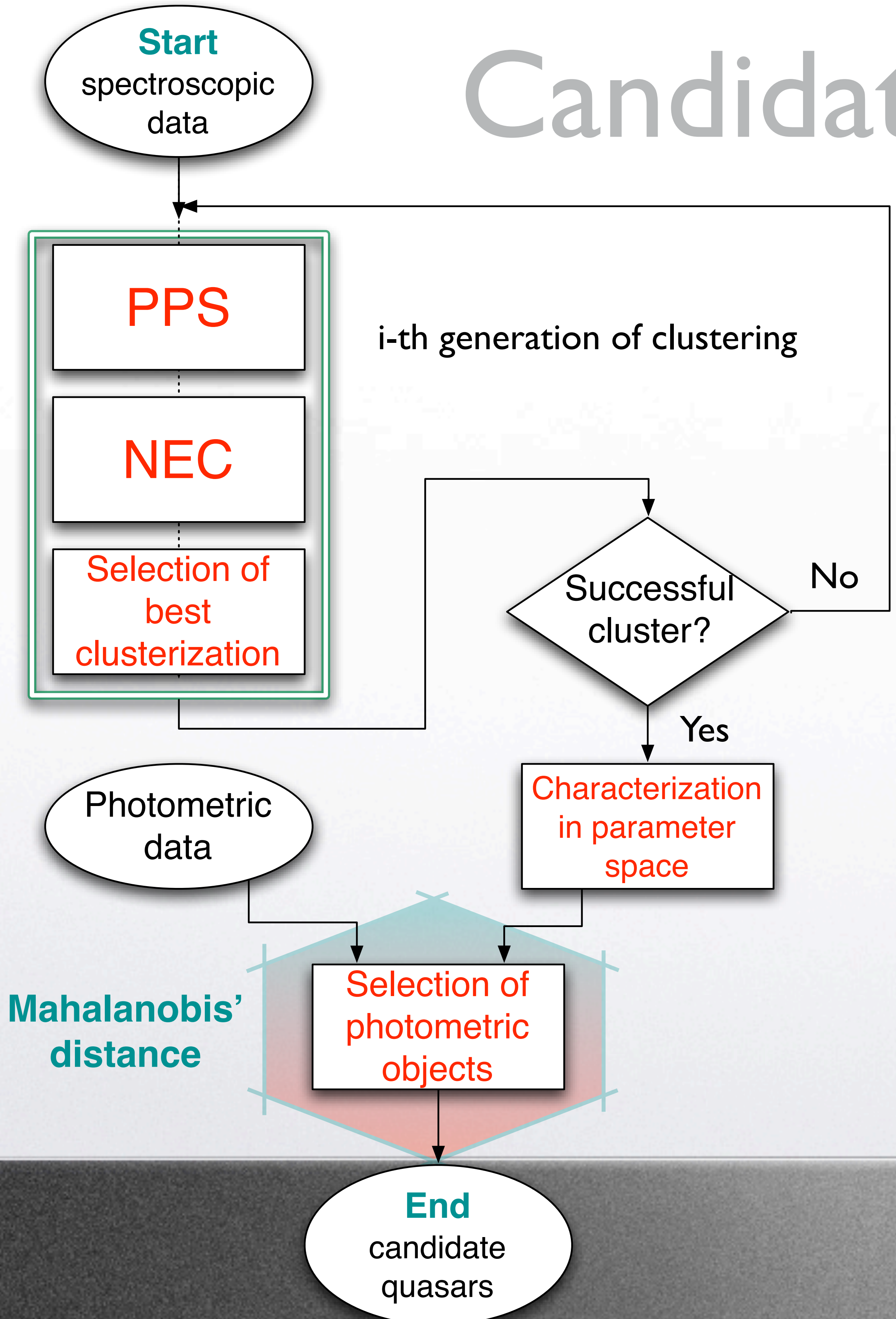
Parameter space with "labelled" clusters



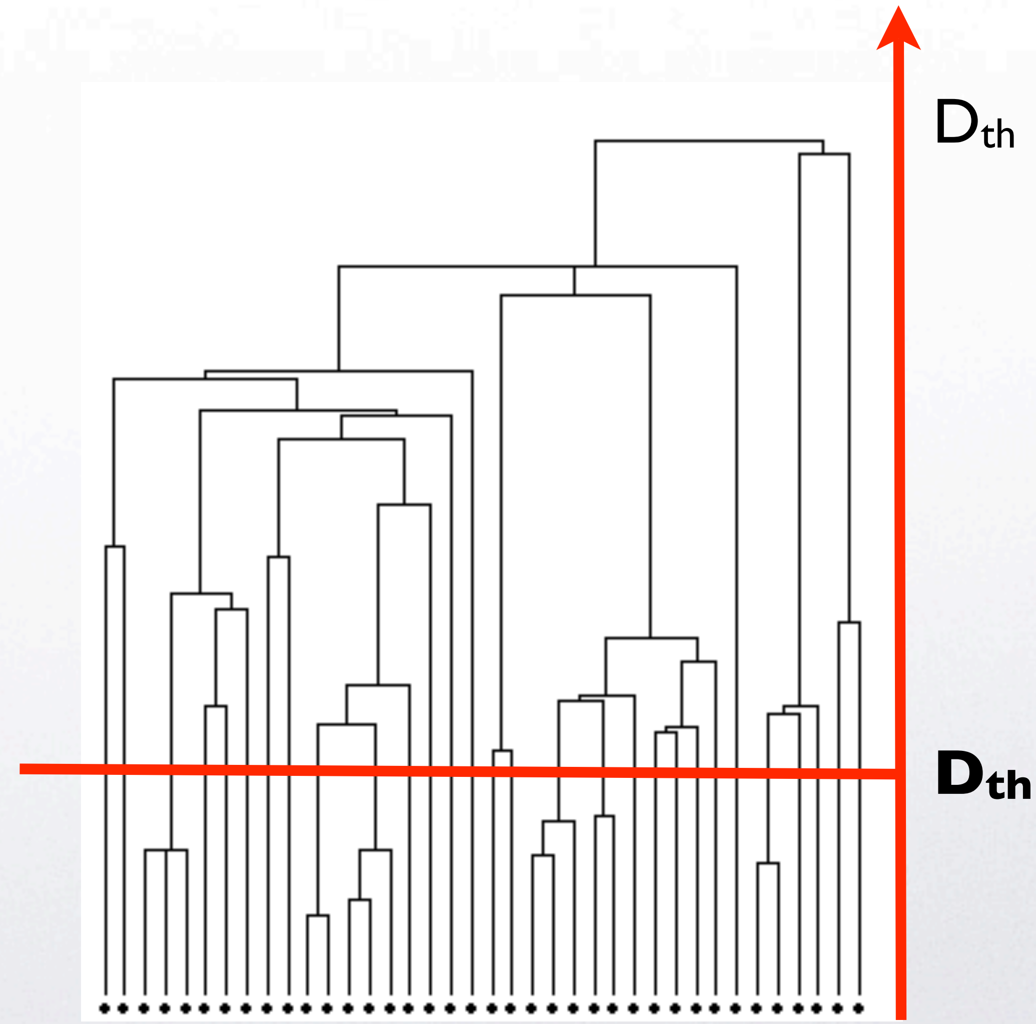
Labelled clusters in the PS

(D'Abrusco et al., sub. to MNRAS)

Candidates QSOs selection



The selection of candidates from photometric catalogues of stellar sources exploits the determined clustering in the PS and a specific distance (Mahalanobis' distance).



Photometric redshifts

Multicolour photometry maps physical parameters:

$$\begin{matrix} \text{luminosity } L \\ \textbf{redshift } \mathbf{z} \\ \text{spectral type } T \end{matrix} \xrightarrow{f} \text{observed fluxes}$$

If the relation can be inverted then:

$$u,g,r,i,z,H,J,K,\ldots \xrightarrow{f^{-1}} \mathbf{z}, L, T$$

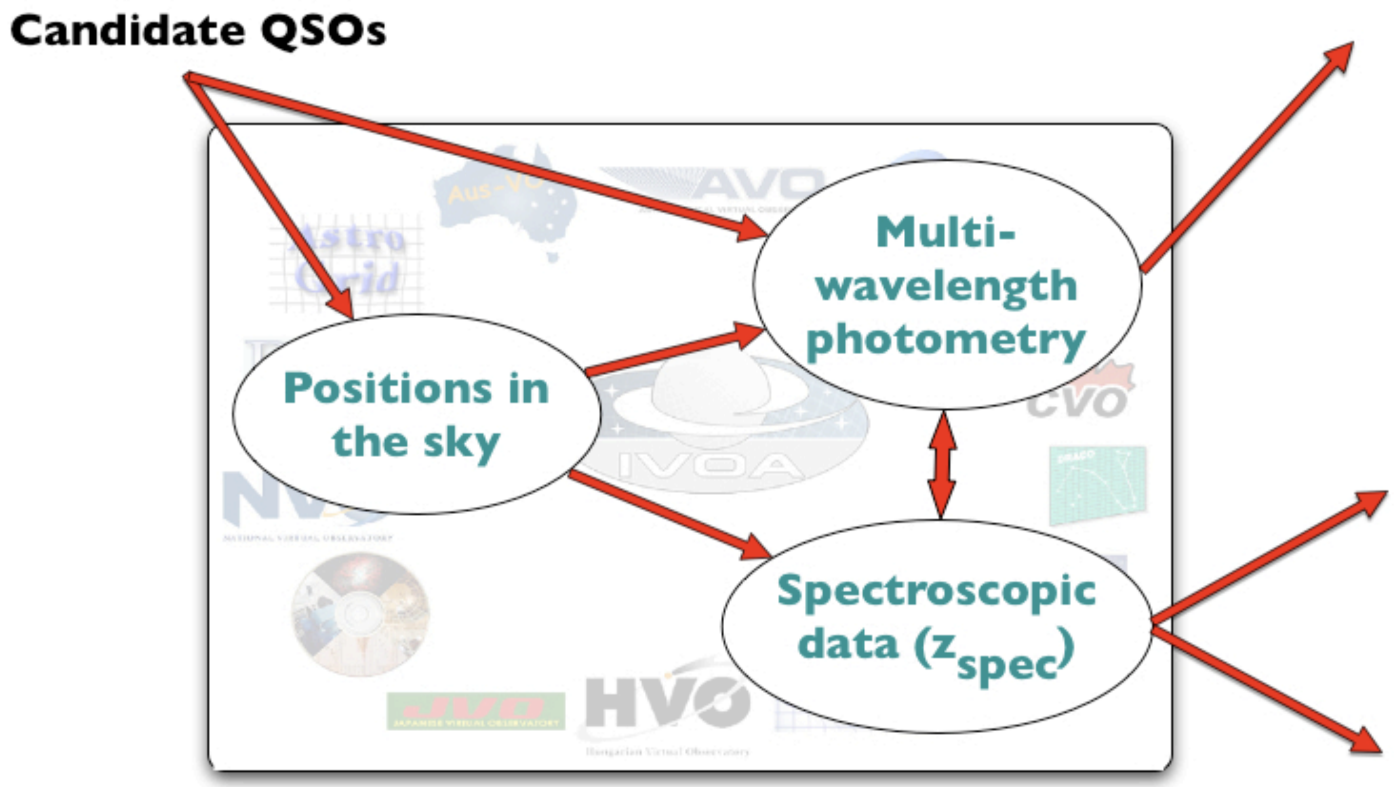
The function f^{-1} can be approximated by regression in the photometric parameter space using the NNs trained on a set of sources for which the z_{spec} are available.

The ingredients for z_{phot}

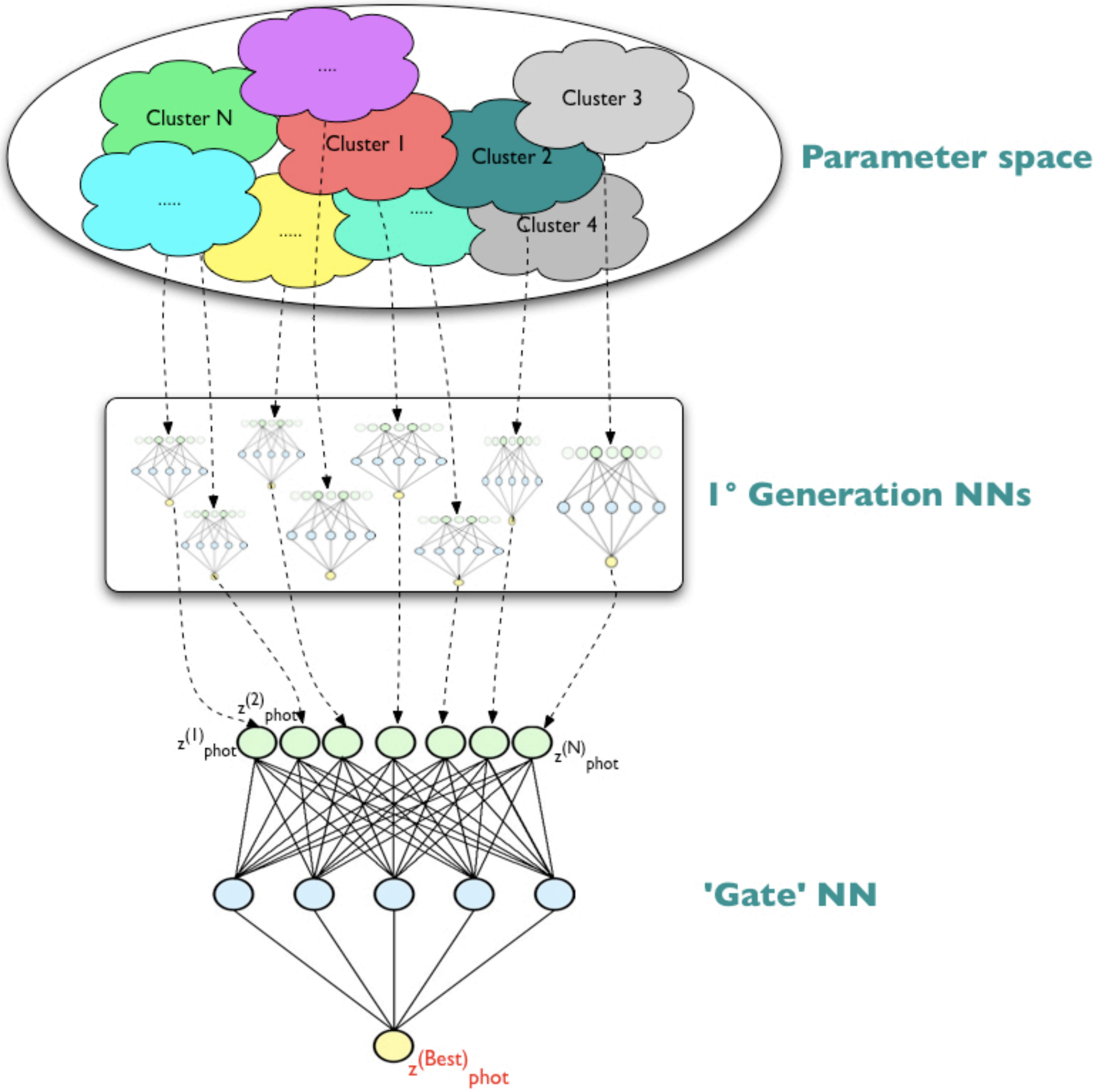
Generalization of the approach described in D'Abrusco et al., 2007 for machine learning-based QSOs z_{phot} reconstruction.

- VO capability of gathering and crossmatching multiwavelength data.
- Unsupervised fuzzy clustering algorithm (k-means).
- Neural Networks (MLP architecture).
- A criterion: maximization of z_{phot} accuracy.

The recipe for z_{phot}

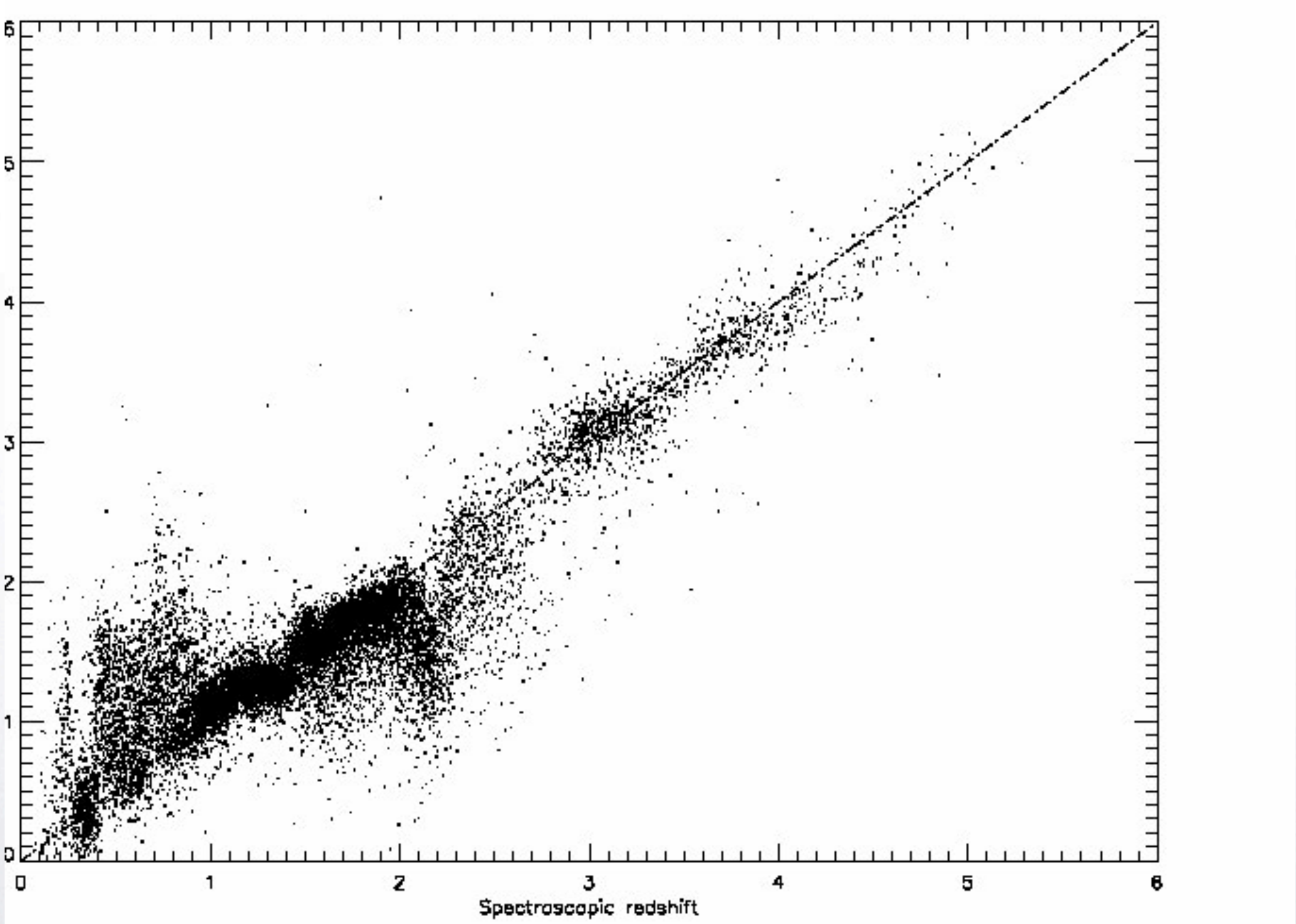


Data gathering



Data processing

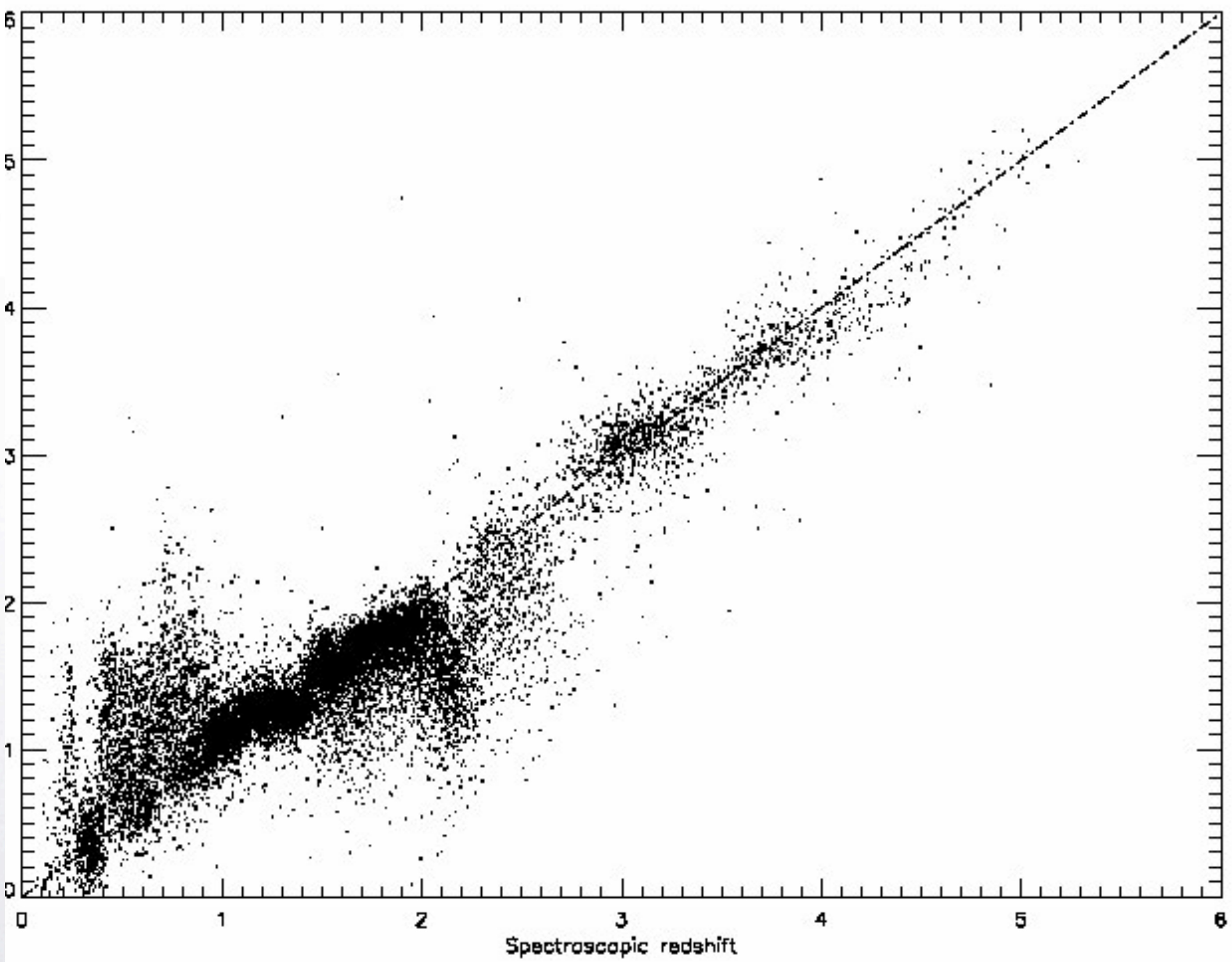
Optical candidates

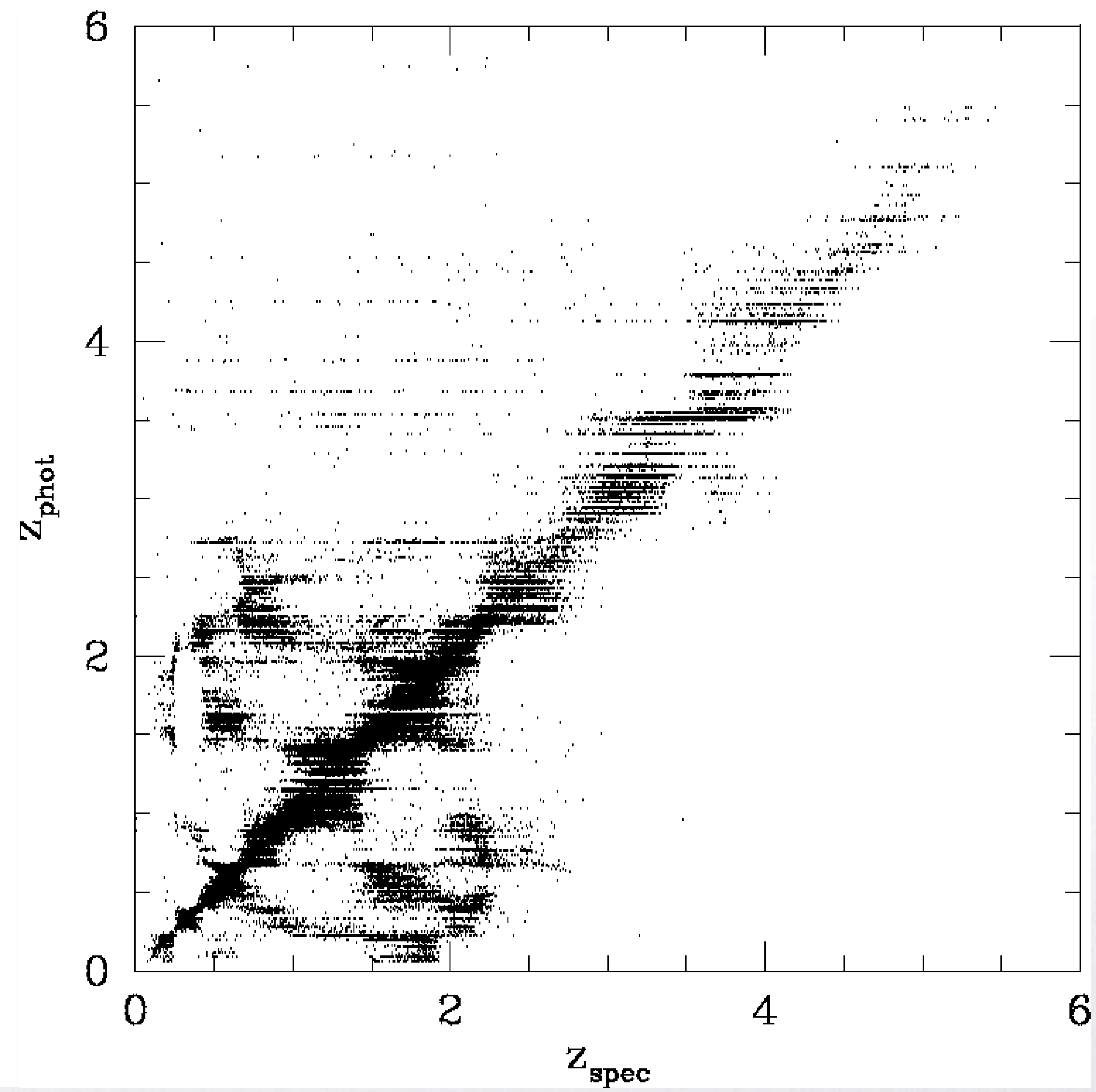


z_{spec} vs z_{phot} scatter plot for QSOs candidates (D'Abrusco et al. 2009 ∩ Richards et al. 2008) using optical colours (SDSS).

- Optical colours (u-g,g-r,r-i,i-z)
- z_{spec} from SDSS-DR6
- Optimal number of clusters: 4
- Robust sigma σ_{rob} = 0.27
- Outliers < 5%

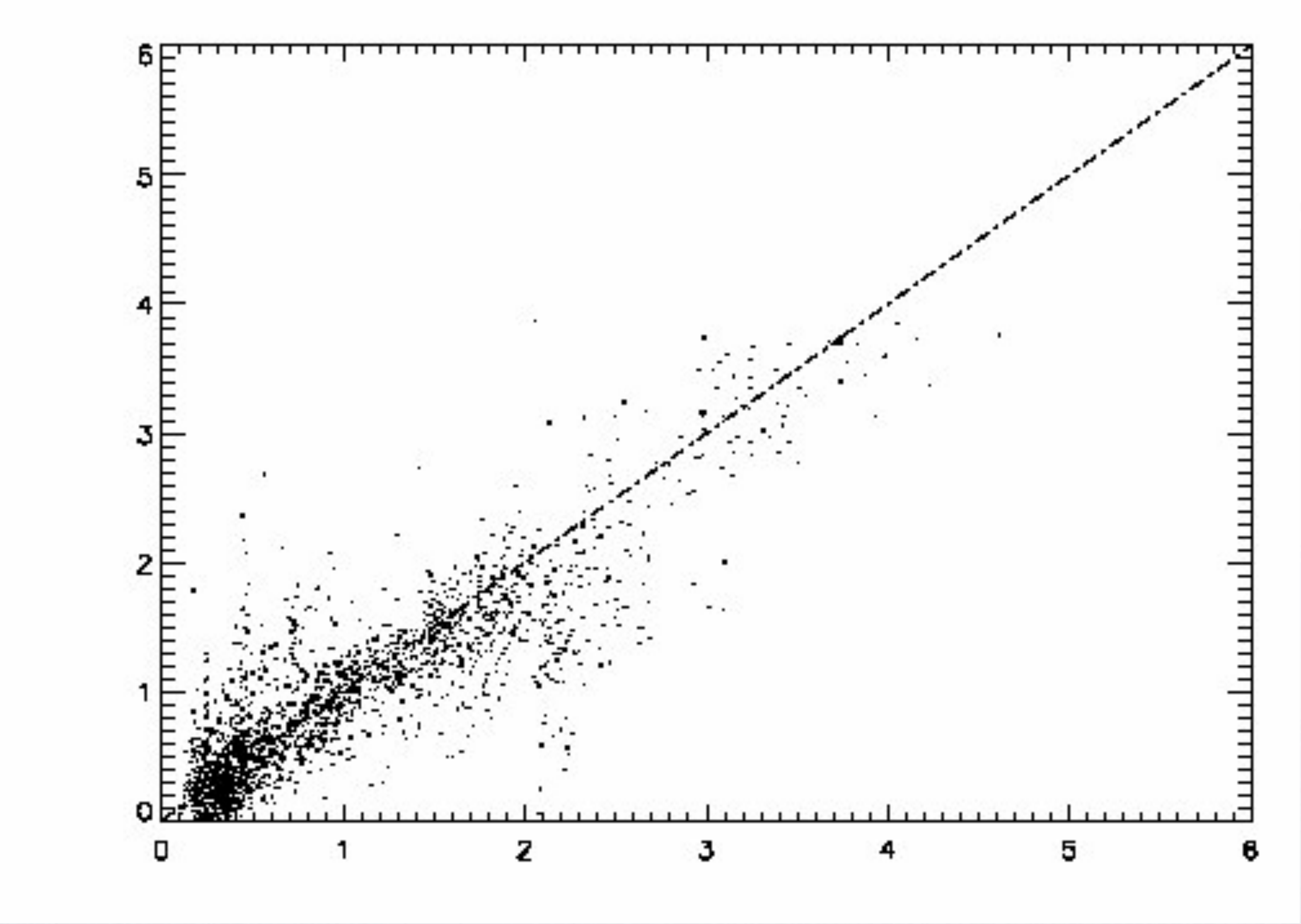
Optical candidates





z_{spec} vs z_{phot} scatter plot for QSOs candidates (D'Abrusco et al. 2009 ∩ Richards et al. 2008) using optical colours (SDSS).

Optical + NIR candidates



z_{spec} vs z_{phot} scatter plot for QSOs candidates (D'Abrusco et al. 2009) using optical (SDSS) and near infrared colours (UKIDSS).

- Optical + NI colours (u-g,g-r,r-i,i-z,Y-J,J-H,H-K)
- z_{spec} from SDSS-DR6
- Optimal number of clusters: 6
- Robust sigma σ_{rob} = 0.21
- Outliers < 3 %

Conclusions

- Working on uncertainty of z_{phot} estimates.
- Applications: LF and CF of candidate QSOs.
- This method achieves better results than those found in the literature for QSOs z_{phot}.
- QSOs extraction and z_{phot} estimation methods are strictly complementary and data-mining/VO oriented.
- Web application: **http://dame.na.infn.it**