Light Curves Classifier

Martin Vo

Masaryk University
Department of Theoretical Physics and Astrophysics
Czech Republic

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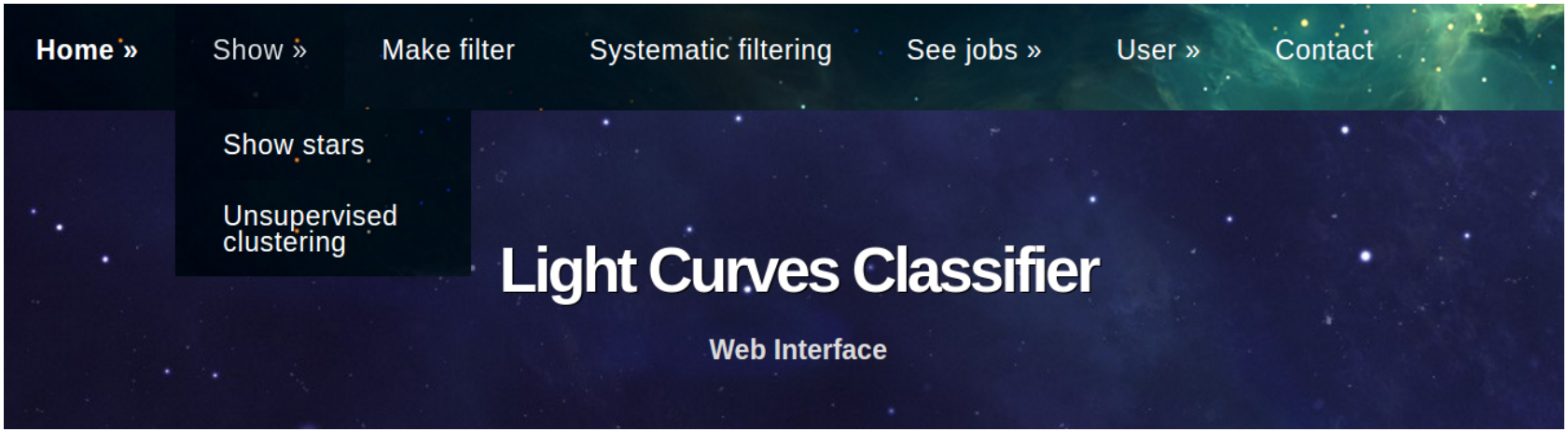
Light Curves Classifier

Package for tasks realated to classification of light curves



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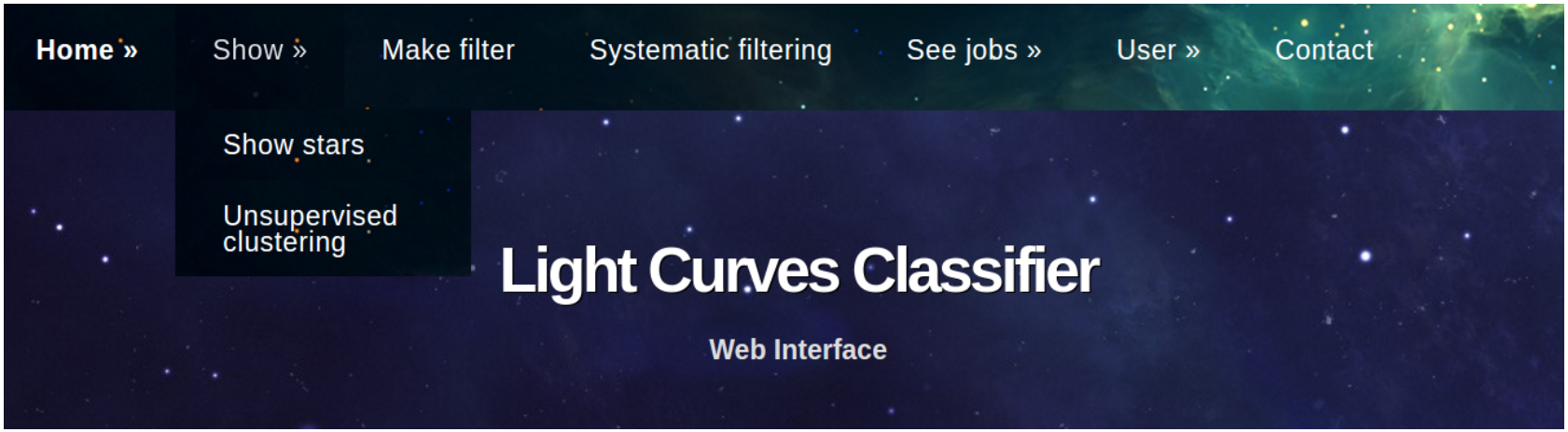

Using options:

1. Python package (github.com/mavrix93/LightCurvesClassifier)
2. Web Interface (vocloud-dev.asu.cas.cz/lcc)
3. Command line UI

Motivation

Workflow of classification tasks is very similar

1. Get data
2. Get features
3. Train classifiers
4. Evaluate methods
5. Find new objects

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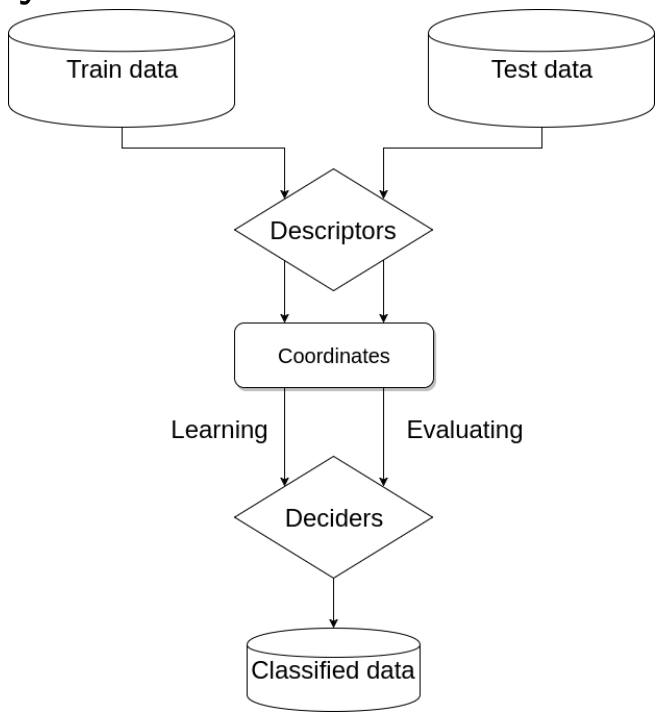
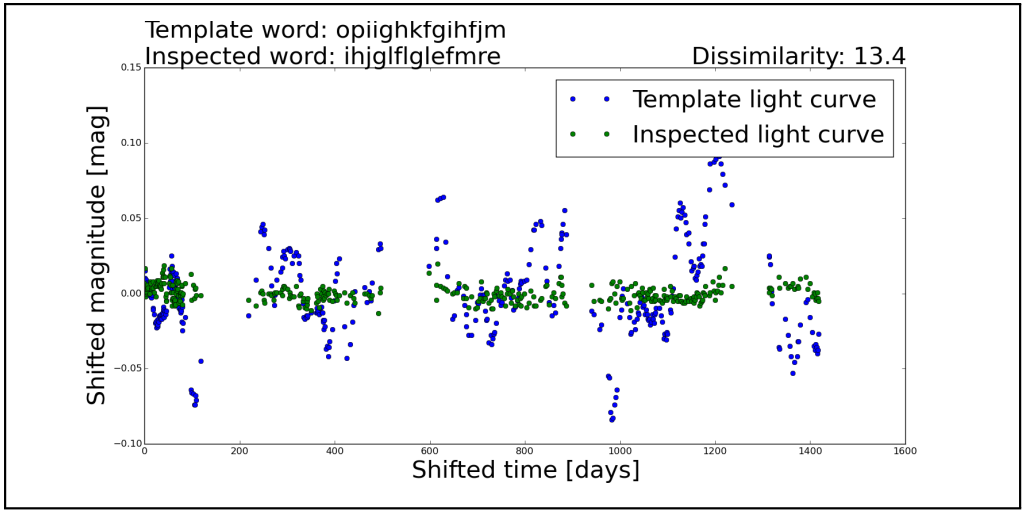


Light curves

How to describe light curves?



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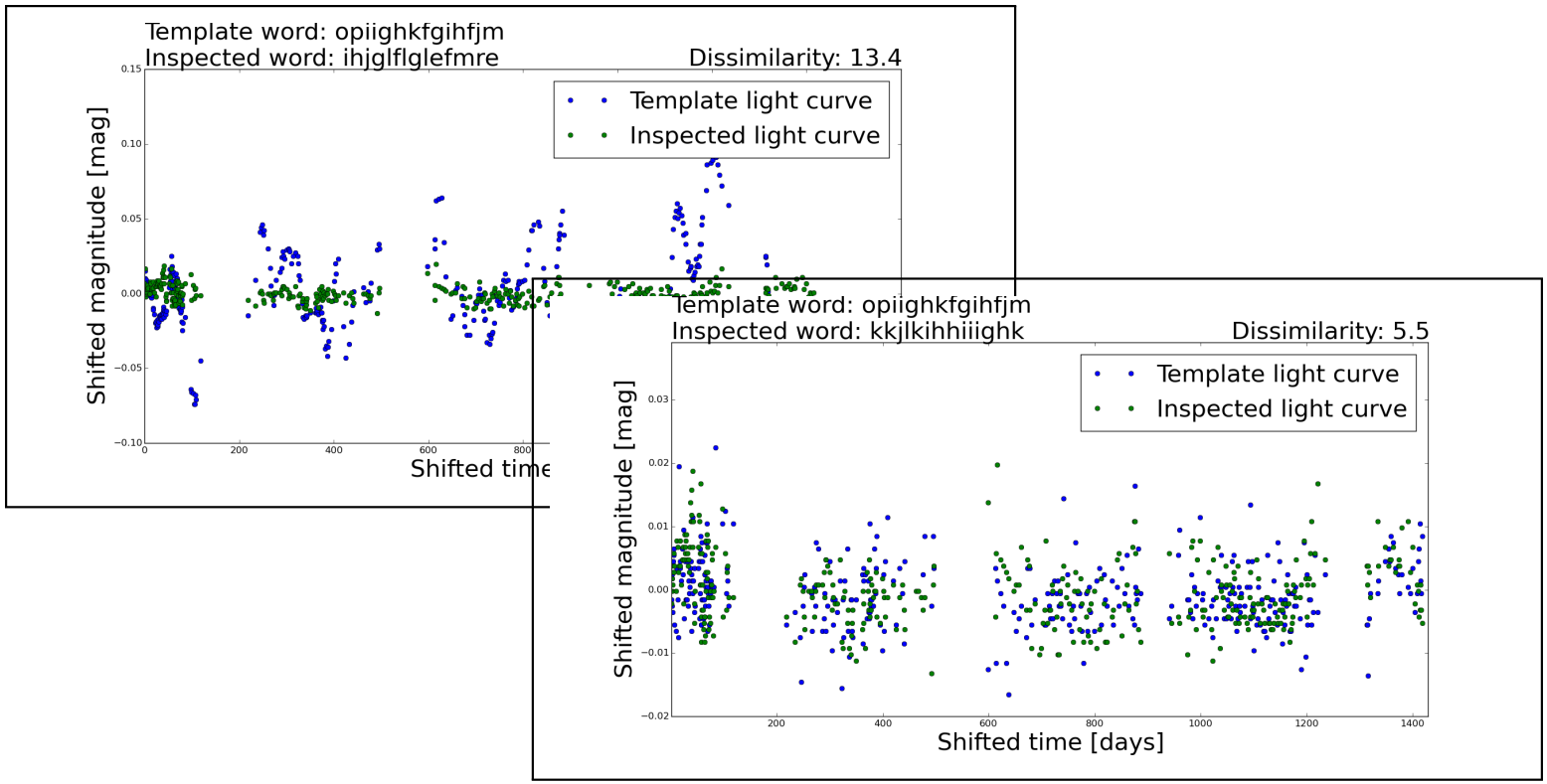
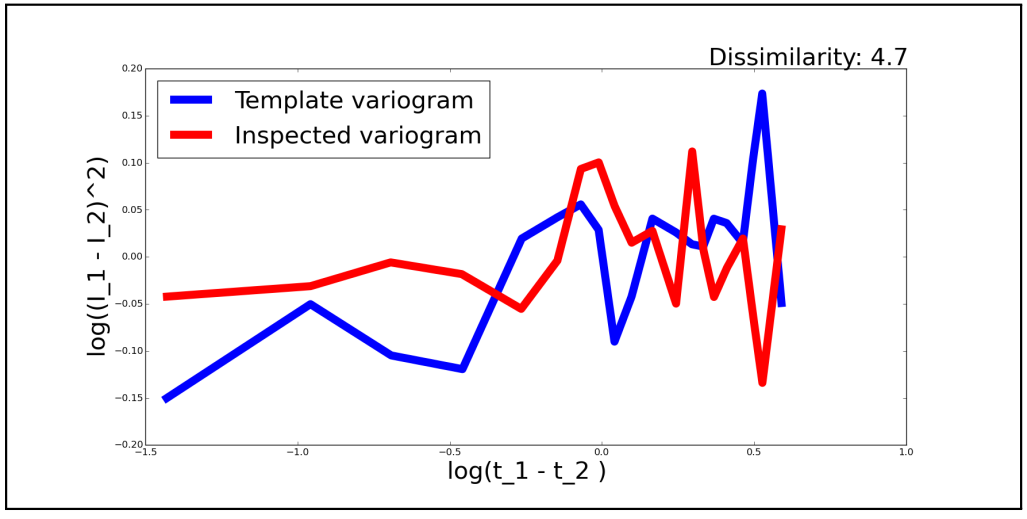


Variograms

Variograms



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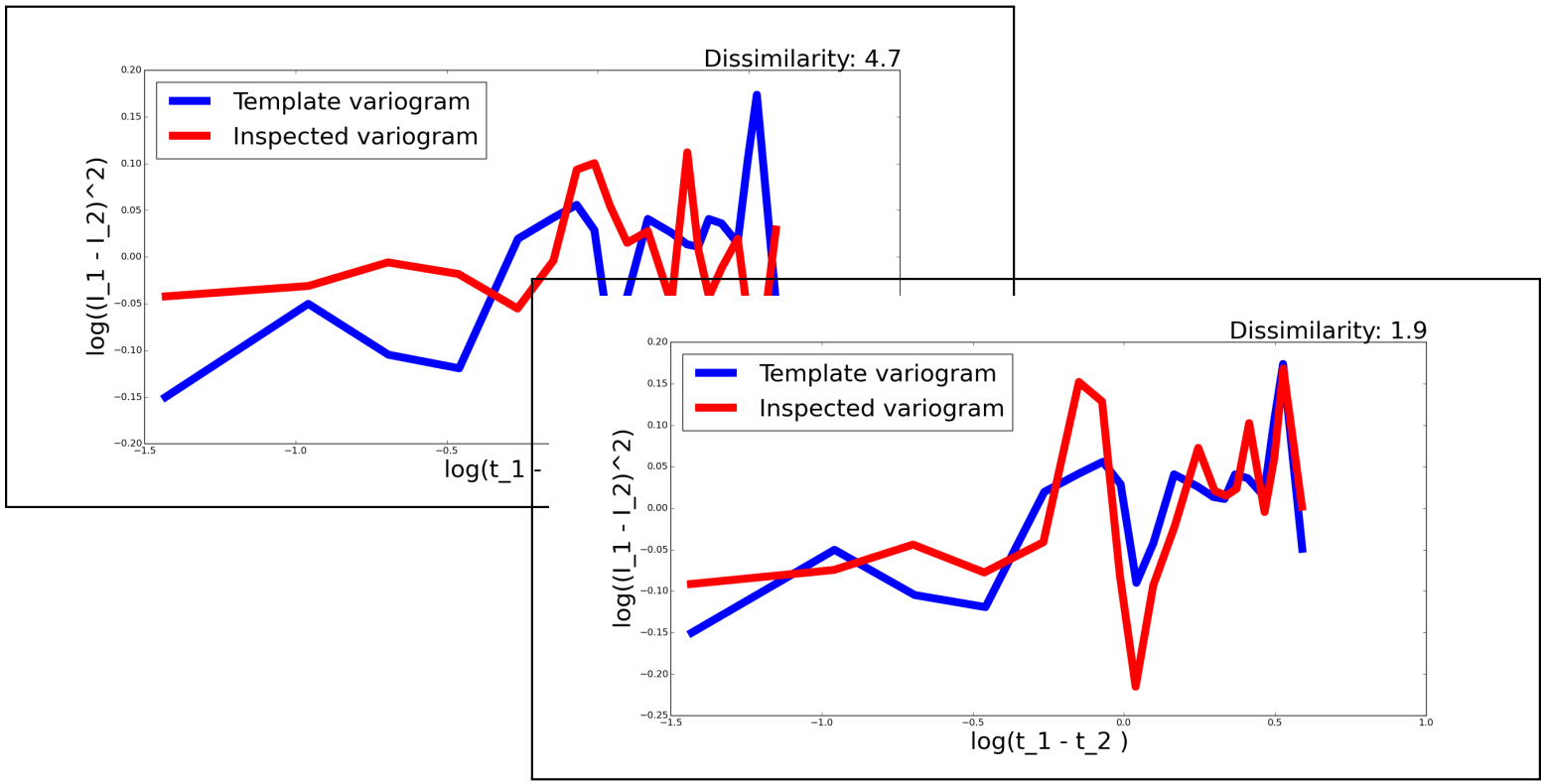
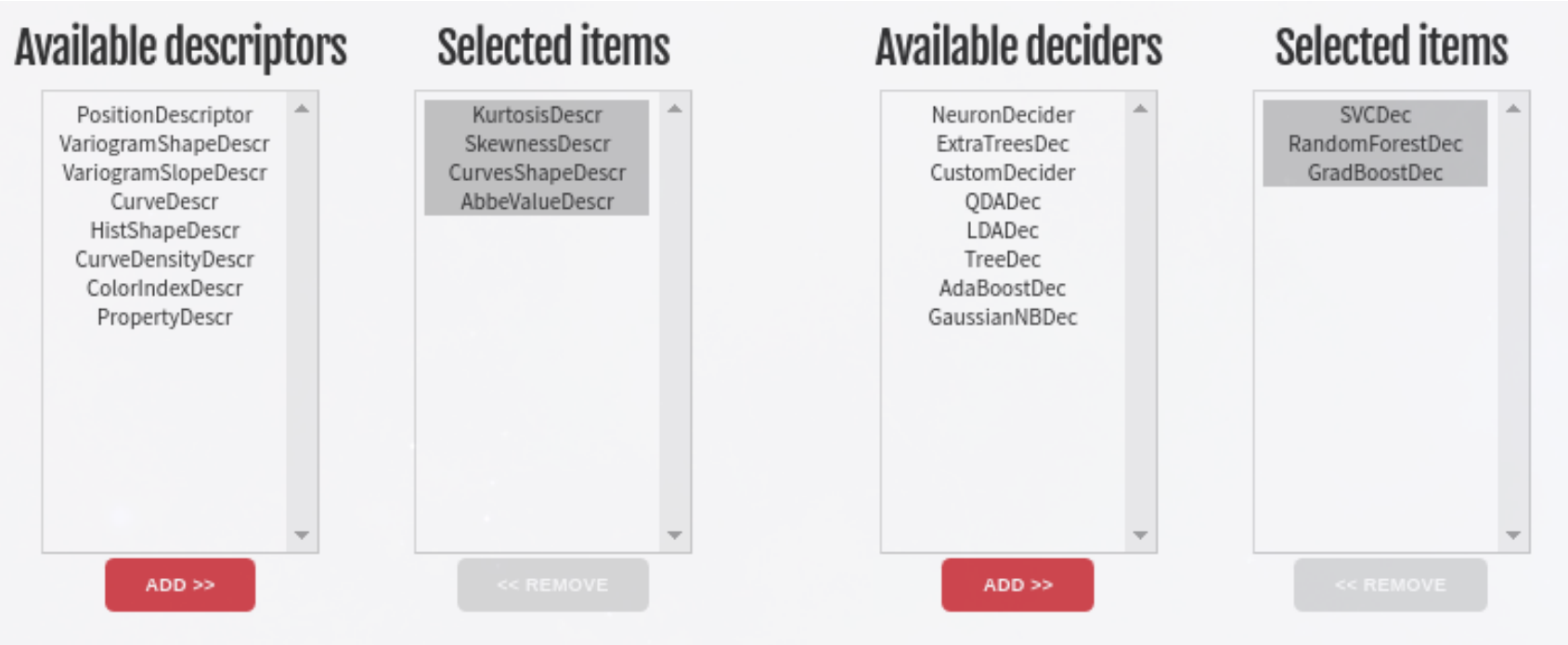
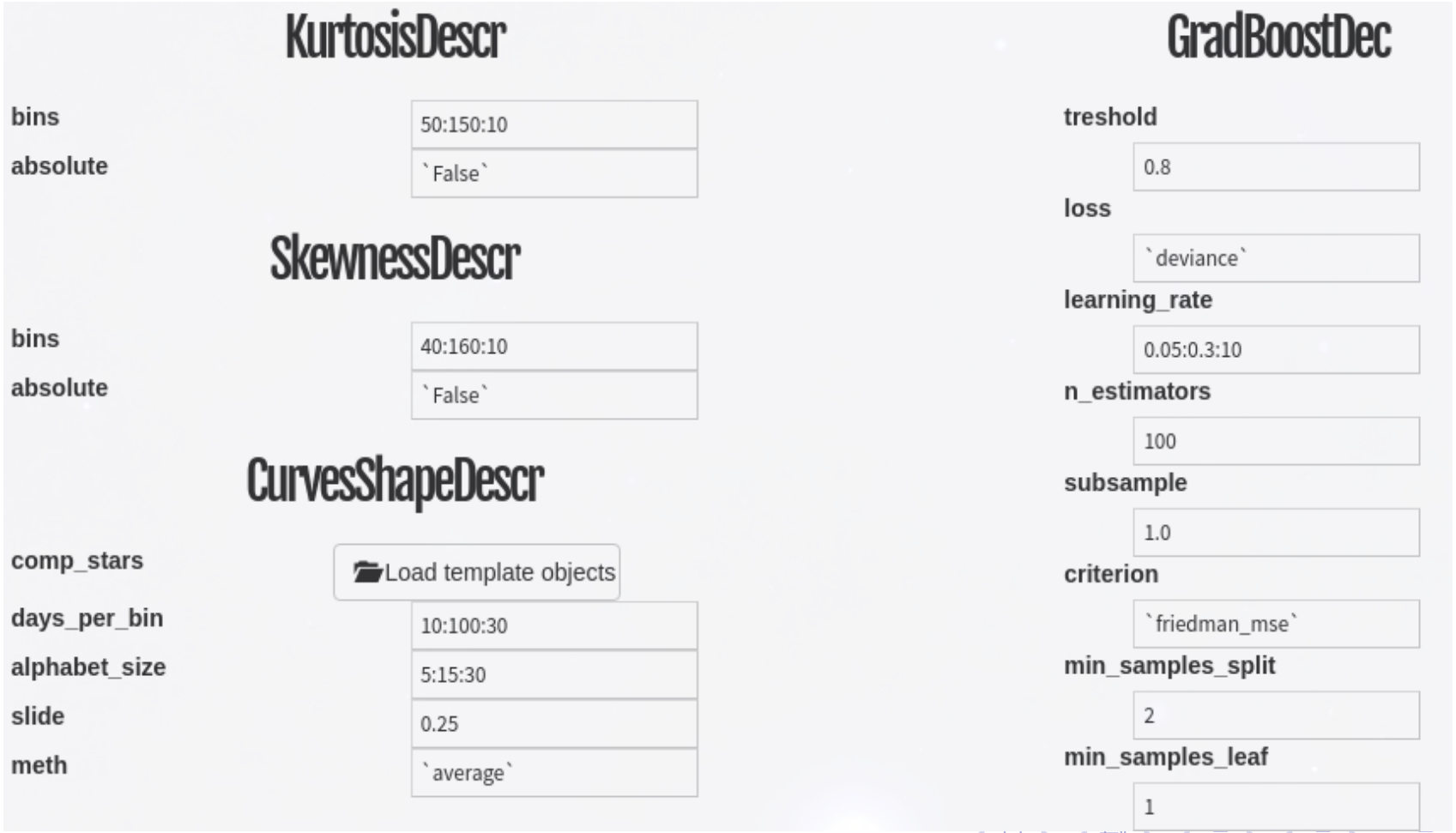


Classification

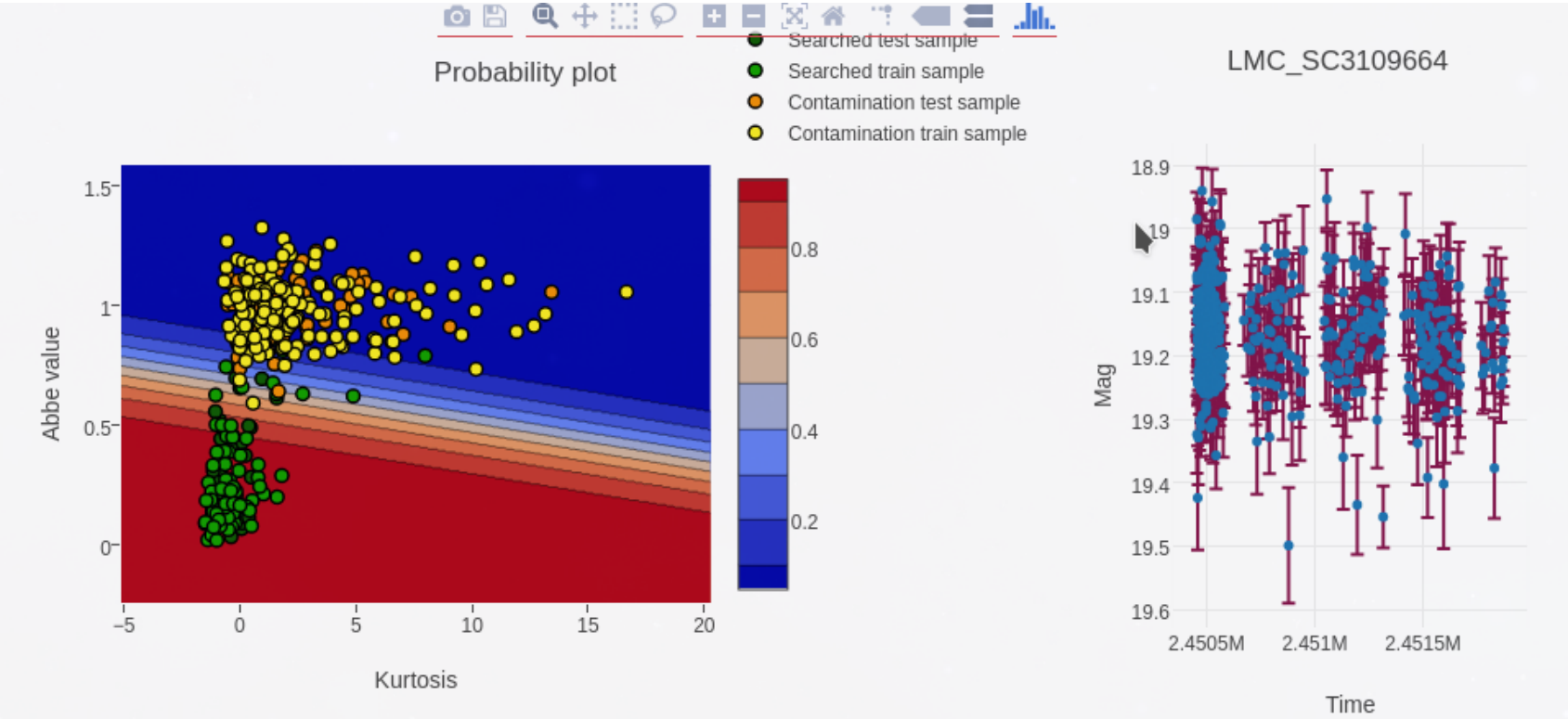


Classification



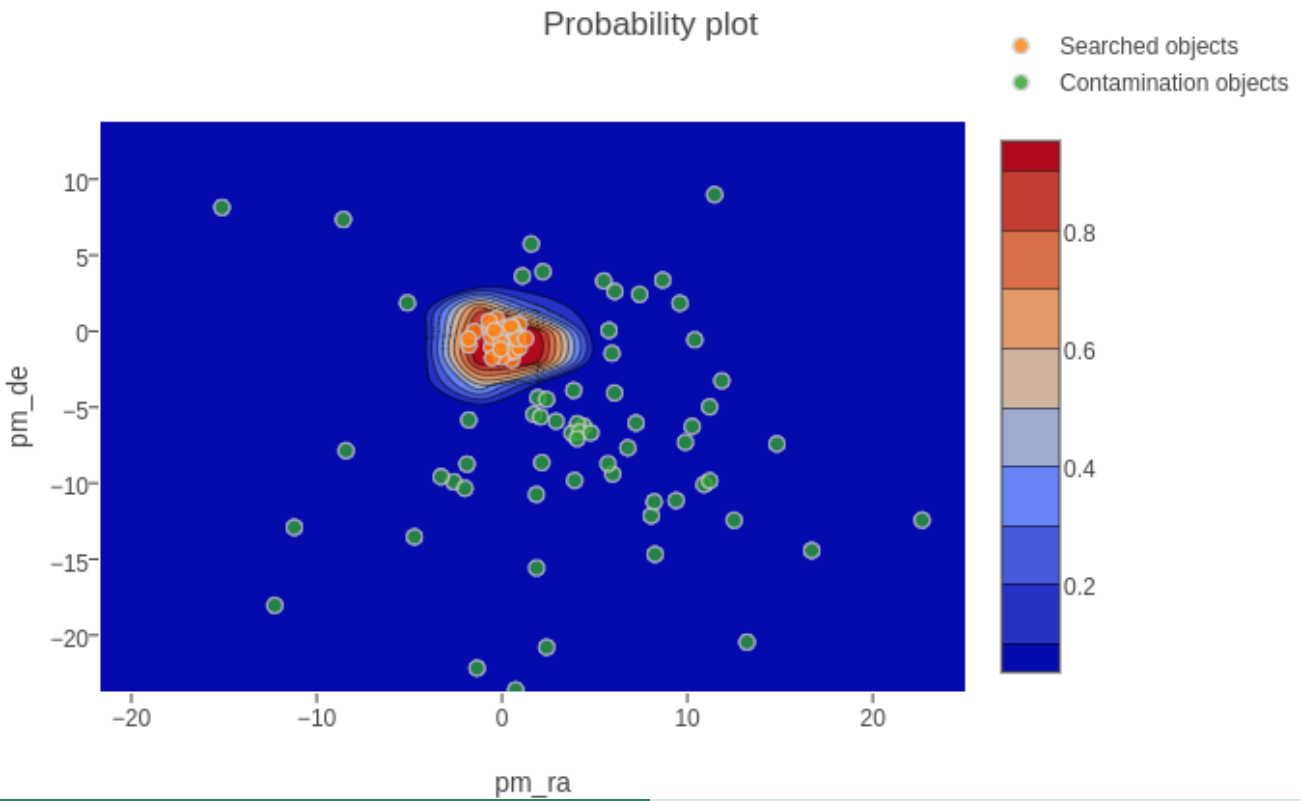
Classification

Qso vs non variable stars described by kurtosis and Abbe value



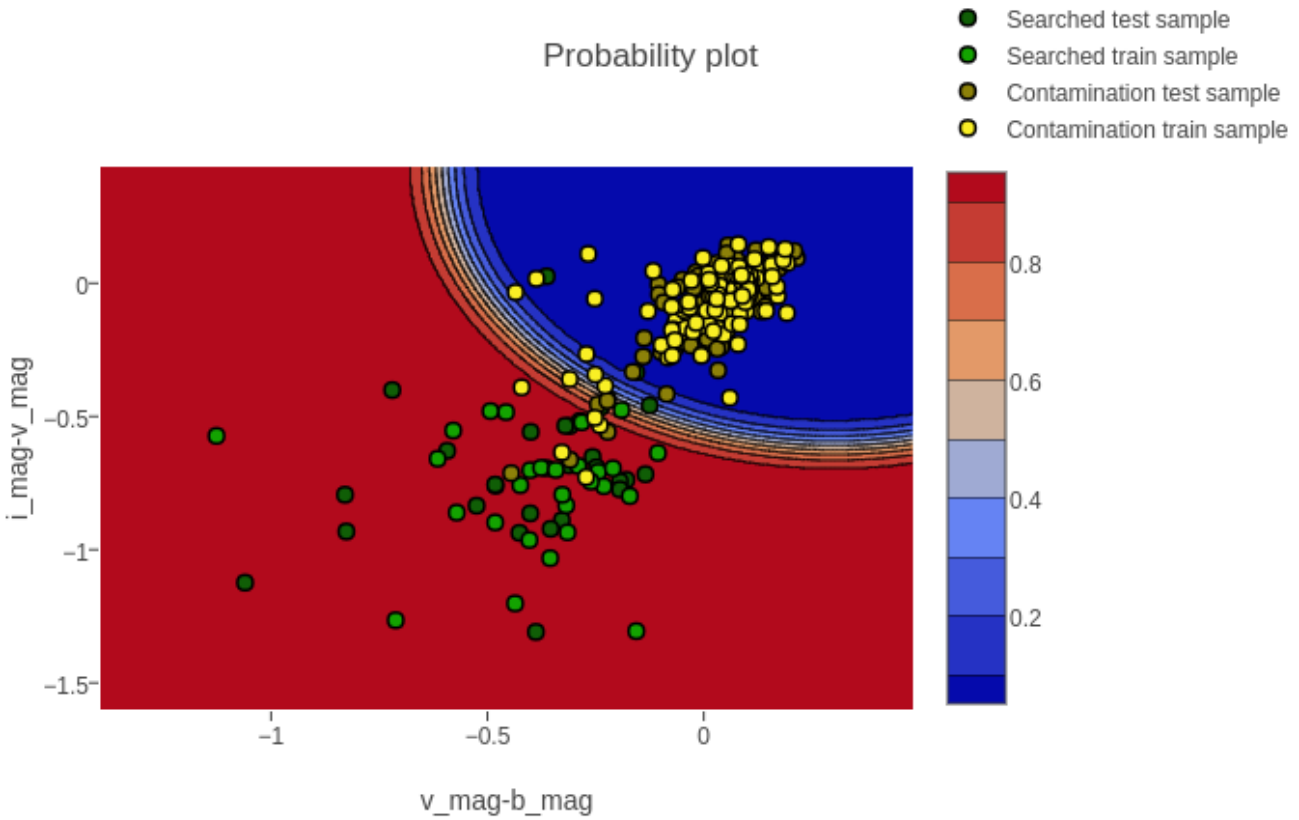
Classification

Members vs non-members of a star cluster described by proper motions



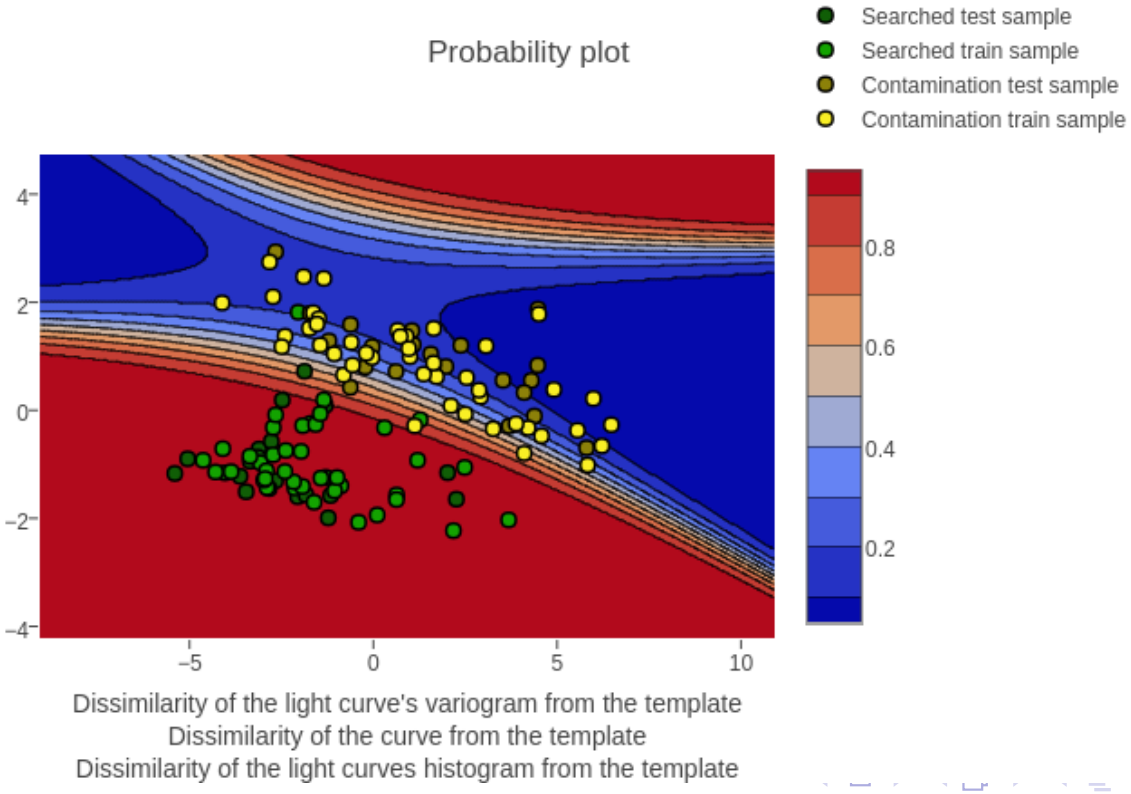
Classification

Qso vs Be Stars described by color indexes



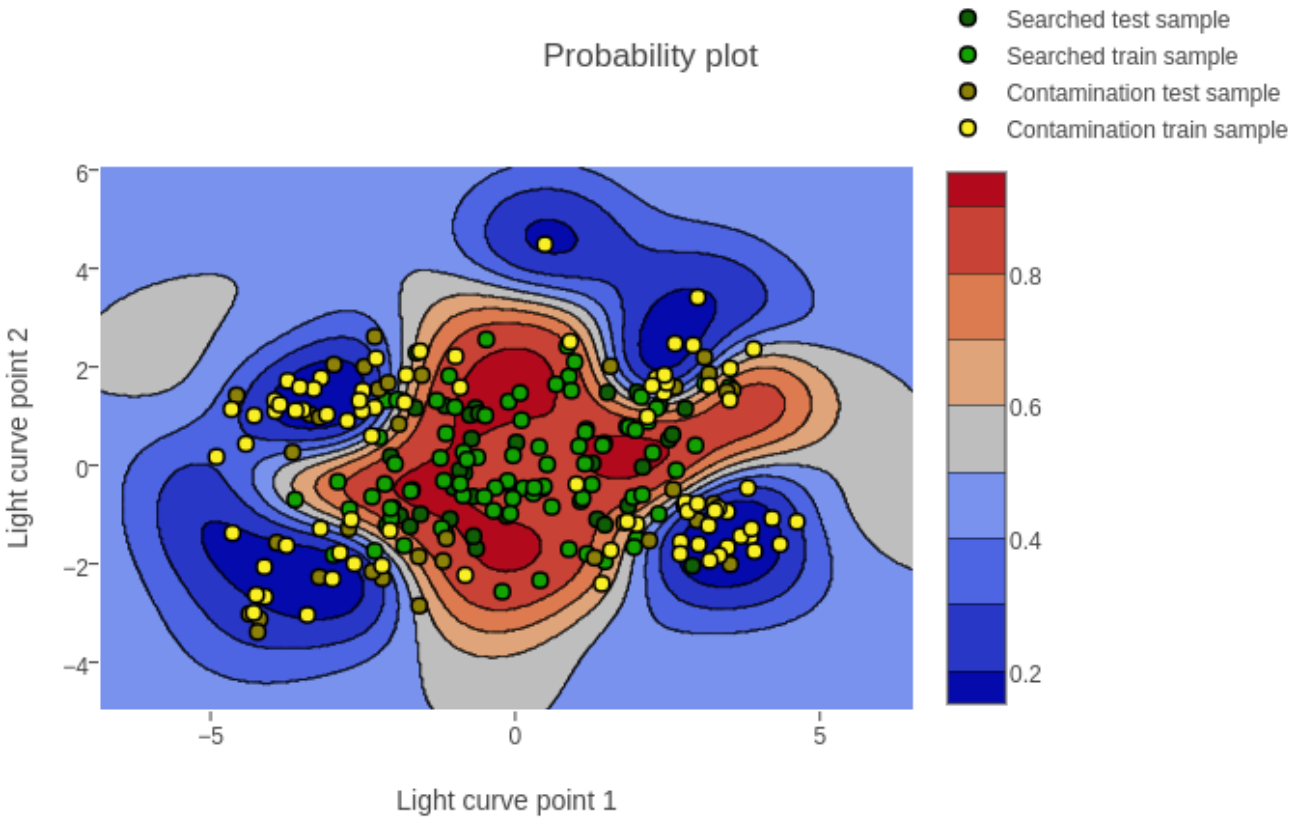
Classification

Qso vs periodic variable stars described by dissimilarity of light curves, histograms and variograms in symbolic space

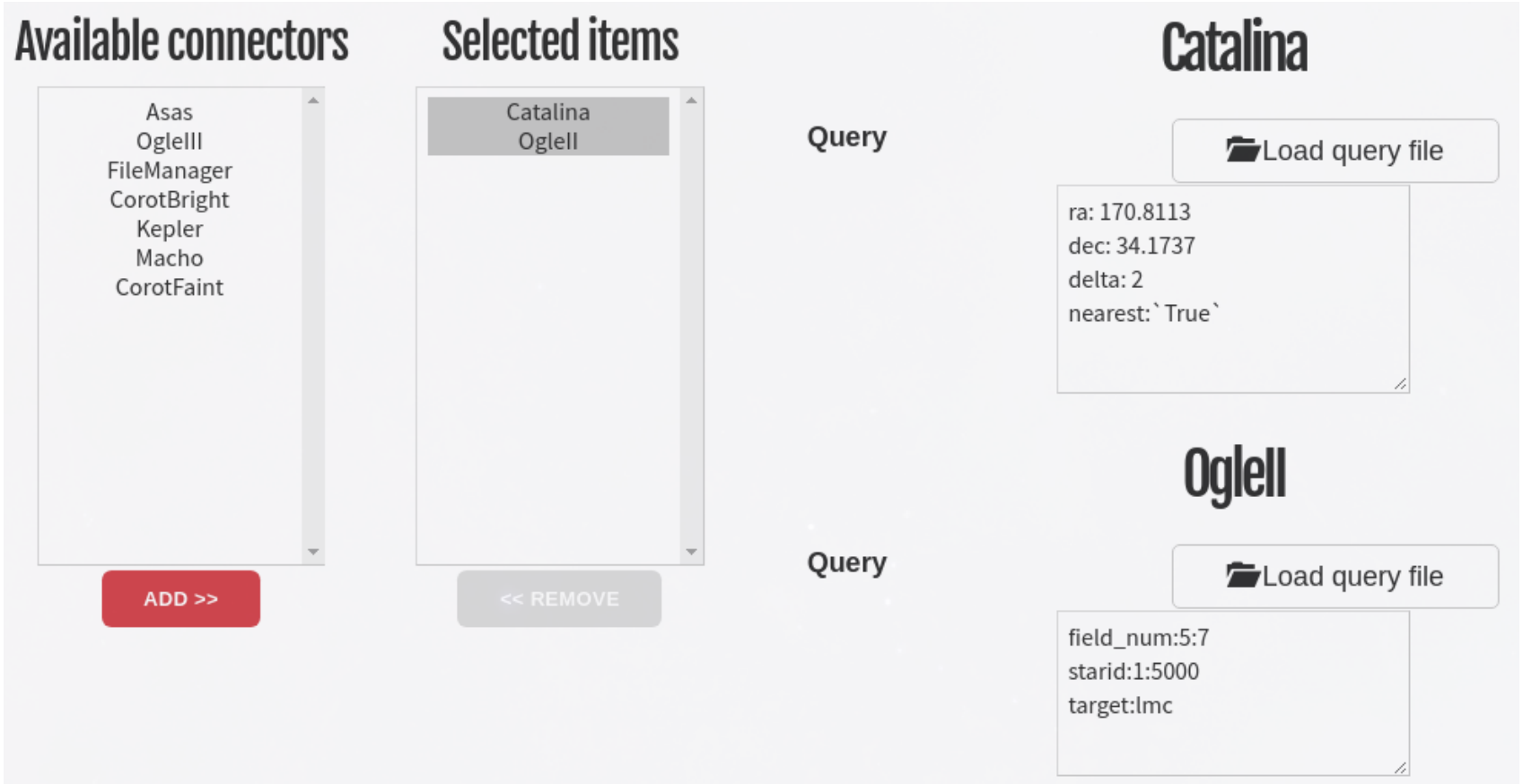


Classification

Qso vs Be Stars described by reduced light curves by using PCA



Systematic searching



Getting stars

```
queries = [{"ra": 297.8399, "dec": 46.57427,
            "delta": 10},
           {"kic_num": 9787239}]

client = StarsProvider.getProvider("Kepler",
                                   queries)
stars = client.getStars()
```

Listing 1: Getting stars from Kepler

Filtering

```
filt = StarsFilter([AbbeValueDescr(bins=150),
                    KurtosisDescr(bins=90)],
                   [TreeDec(treshold=0.8)])
filt.learn(searched_stars,
           contam_stars)
passed_stars = filt.filterStars(inspected_stars)
```

Listing 2: Filtering

Tuning parameters

```
estim = ParamsEstimator(searched_stars,
                        contamination_stars,
                        descriptors,
                        deciders,
                        tuned_params)
estim.fit()
```

Listing 3: Tuning parameters

Implementing own modules

```
class StdDesc(BaseDescriptor):

    def getFeatures(self, star):
        """
        Get standart deviation of magnitudes
        """
        return np.std(star.lightCurve.mag)
```

Listing 4: Custom descriptor

Uploading methods

```
PackageReader.appendModules("descriptors",
                    "some_path/my_descriptors")
```

Listing 5: Uploading methods

Uploading methods

```
PackageReader.appendModules("descriptors",
                    "some_path/my_descriptors")
```

Listing 6: Uploading methods

In Web Interface

Own connectors

```
class MachoDb(VizierTapBase, LightCurvesDb):
    """
    Client for MACHO database

    EXAMPLES:
    ---------
        queries = [{"Field": 1 , "Tile": 3441, "Seqn": 25}]
        client = StarsProvider.getProvider(obtain_method="Macho",
                                           obtain_params=queries)
        stars = client.getStars()
    """

    TABLE = "II/247/machovar"
    LC_URL = "http://cdsarc.u-strasbg.fr/viz-bin/nph-Plot/w/Vgraph/txt?II%2f247%2f.%2f{macho_name}&F=b%2

    NAME = "{Field}.{Tile}.{Seqn}"
    LC_FILE = ""

    LC_META = {"xlabel": "Time",
               "xlabel_unit": "MJD (JD-2400000.5)",
               "origin": "MACHO"}

    IDENT_MAP = {"MachoDb":  ("Field", "Tile", "Seqn")}
    MORE_MAP = collections.OrderedDict((("Class", "var_type"),
                                        ("Vmag", "v_mag"),
                                        ("Rmag", "r_mag"),
                                        ("rPer", "period_r"),
                                      ("bPer", "period_b")))
```

Conclusion

- Many "ready to use" methods
- Connectors to most of the largest databases of light curves
- Possibility to easily implement new methods and connectors
- Executing jobs in cloud (for web servise)
- Easy to tune parameters of methods
- Powerful library for development