skfda.preprocessing.registration.elastic_registration

skfda.preprocessing.registration.elastic_registration(*fdatagrid, template=None, *, lam=0.0, eval_points=None, fdatagrid_srsf=None, template_srsf=None, grid_dim=7, **kwargs*) [source]

Align a FDatagrid using the SRSF framework.

Let f be a function of the functional data object wich will be aligned to the template g. Calculates the warping wich minimises the Fisher-Rao distance between g and the registered function $f^*(t) = f(\gamma^*(t)) = f \circ \gamma^*$.

$$\gamma^* = argmin_{\gamma \in \Gamma} d_\lambda(f \circ \gamma, g)$$

Where d_λ denotes the extended Fisher-Rao distance with a penalty term, used to control the amount of warping.

$$d_\lambda^2(f \circ \gamma, g) = \|SRSF(f \circ \gamma)\sqrt{\dot{\gamma}} - SRSF(g)\|_{\mathbb{L}^2}^2 + \lambda \mathcal{R}(\gamma)$$

In the implementation it is used as penalty term

$$\mathcal{R}(\gamma) = \|\sqrt{\dot{\gamma}} - 1\|_{\mathbb{L}^2}^2$$

Wich restrict the amount of elasticity employed in the alignment.

The registered function $f^*(t)$ can be calculated using the composition $f^*(t) = f(\gamma^*(t))$.

If the template is not specified it is used the Karcher mean of the set of functions under the elastic metric to perform the alignment, wich is the local minimum of the sum of squares of elastic distances. See `elastic_mean()`.

In [SK16-4-2] are described extensively the algorithms employed and the SRSF framework.

Parameters:

- **fdatagrid** (`FDataGrid`) – Functional data object to be aligned.
- **template** (`FDataGrid` , optional) – Template to align the curves. Can contain 1 sample to align all the curves to it or the same number of samples than the fdatagrid. By default it is used the elastic mean.
- **lam** (*float*, *optional*) – Controls the amount of elasticity. Defaults to 0.
- **eval_points** (*array_like*, *optional*) – Set of points where the functions are evaluated, by default uses the sample points of the fdatagrid.
- **fdatagrid_srsf** (`FDataGrid` , optional) – SRSF of the fdatagrid, may be passed to avoid repeated calculation.
- **template_srsf** (`FDataGrid` , optional) – SRSF of the template, may be passed to avoid repeated calculation.
- **grid_dim** (*int*, *optional*) – Dimension of the grid used in the alignment algorithm. Defaults 7.
- ****kwargs** – Named arguments to be passed to `elastic_mean()` .

Returns:

FDatagrid with the samples aligned to the template.

Return type:

(`FDataGrid`)

Raises:

`ValueError` – If functions are multidimensional or the number of samples are different.

References

[SK16-4-2] Srivastava, Anuj & Klassen, Eric P. (2016). Functional and shape data analysis. In *Functional Data and Elastic Registration* (pp. 73-122). Springer.