

skfda.preprocessing.registration.elastic_registration_warping

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

Calculate the warping to align a FDataGrid using the SRSF framework.

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

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

Where d_λ denotes the extended amplitude 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

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

Which restricts 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
 Fisher-Rao metric to perform the alignment, which is the local minimum of the sum of squares of
 elastic distances. See `elastic_mean()`.

In [\[SK16-4-3\]](#) 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: Warping to align the given fdatagrid to the template.

Return type: (`FDataGrid`)

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

References

[SK16-4-3] Srivastava, Anuj & Klassen, Eric P. (2016). Functional and shape data analysis. In *Functional Data and Elastic Registration* (pp. 73-122). Springer.