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Elastic Functional Data Analysis (EFDA)

While the need for analyzing functional data is growing in all areas of research and applications, the corresponding methodology has lagged far behind. The most prominent challenge in modeling and analyzing functional data is phase-amplitude separation (also termed registration, matching, etc). Another challenge is, of course, modeling functional variables, and ensuing problems of estimating, testing, and general inferences. Most of the current FDA literature deals with these two challenges – separation and statistical analysis – independently, without much regard for their interdependency! Furthermore, many of these off-the-shelf methods for registration are limited from both theoretical and practical viewpoints. For instance, some models minimize the pinching effect by restricting the search space (truncating representations) or by adding extraneous penalties, leading to uninterpretable results.

Elastic FDA is a comprehensive framework for *joint registration and statistical analysis* of functional data with both attractive theoretical and computational properties. In this talk, I will illustrate this framework for: (1) Elastic phase-amplitude separation, (2) Elastic FPCA, (3) Elastic functional regression models, (4) Elastic trend estimation models, and (5) Elastic shape analysis of objects.