TEMPLE UNIVERSITY

Department of Mathematics

Analysis Seminar

Room 617 Wachman Hall

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Constrained Shape Analysis Through Flows of Diffeomorphisms

by Sylvain Arguillère

Center for Imaging Science,
Department of Applied Mathematics and Statistics
Johns Hopkins University

Abstract: The general purpose of shape analysis is to compare different shapes in a way that takes into account their geometric properties, such as smoothness, number of self-intersection points, convexity? One way to do this is to find a flow of diffeomorphisms that brings one (template) shape as close as possible to the other (target) shape while minimizing a certain energy. This is the so-called LDDMM method (Large Deformation Diffeomorphic Metric Matching).

Finding this minimizing flow requires solving an optimal control problem that can be seen as looking for (sub-)Riemannian geodesics on the infinite dimensional group of diffeomorphisms with respect to a right-invariant (sub-)Riemannian structure, creating a framework reminiscent of fluid mechanics, and opening the door to some new and exciting infinite dimensional geometries.

In this talk, I will introduce all these concepts, and give the geodesic equations for such structures. Then, I will extend this framework to the case where constraints are added to the shape, in order to better describe the objects they represent, and give some applications in computational anatomy.