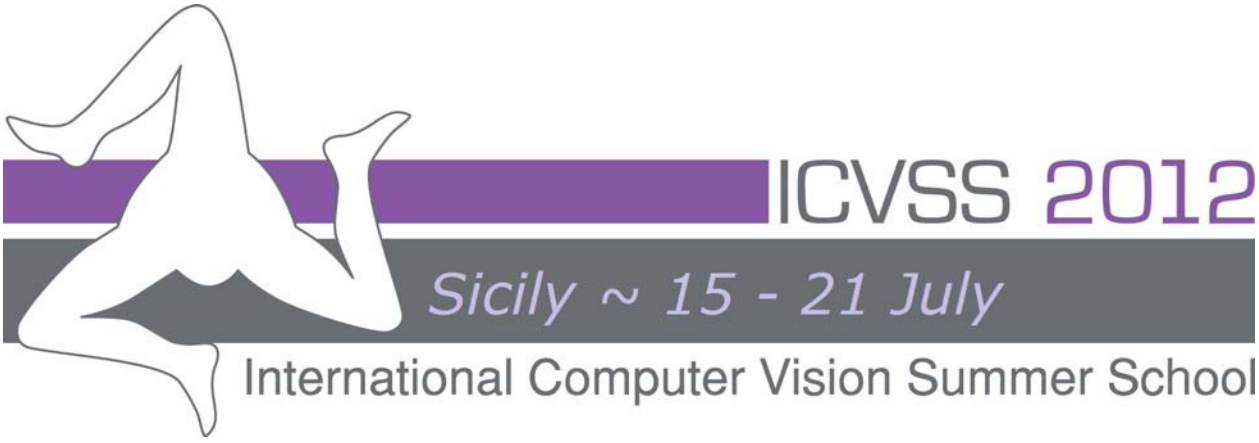

Metric and Diffusion Geometry in Shape Analysis

Michael Bronstein
Università della Svizzera Italiana, CH

Abstract

Deformable objects are ubiquitous in the world surrounding us, on all levels from micro to macro. The need to study such shapes and model their behaviour arises in a wide spectrum of applications, ranging from medicine to security. In recent years, non-rigid shapes have attracted a growing interest, which has led to rapid development of the field, where state-of-the-art results from very different sciences - theoretical and numerical geometry, optimization, linear algebra, graph theory, machine learning and computer graphics, to mention a few - are applied to find solutions.

The purpose of the tutorial is to overview some state-of-the-art methods in the field of shape analysis through a consistent and rigorous mathematical framework.

The first part of the tutorial will focus on metric geometry approaches to shape analysis. Modeling shapes as metric spaces provides a common denominator for many problems in shape analysis. We will consider two archetype problems of similarity and correspondence.

The second part of the tutorial will focus on diffusion geometry, arising from the geometric formulation of heat diffusion processes on manifolds. Diffusion geometry provides ways to construct robust global structures (metrics) and local structures (feature descriptors) for shape analysis.

Keywords: deformation-invariant correspondence and similarity, metric geometry, diffusion geometry