Computational optimal transport: mature tools and open problems

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Optimal transport is a fundamental tool to deal with discrete and continuous distributions of points [1, 2]. We can understand it either as a generalization of **sorting** to spaces of dimension $D > 1$, or as a **nearest neighbor projection** under a mass preservation constraint. Over the last decade, a sustained research effort on numerical foundations has led to a $\times 1,000$ speed-up for most transport-related computations. This has opened up a wide range of research directions in geometric data analysis, machine learning and computer graphics.

This talk will discuss the consequences of these game-changing numerical advances from a **user's perspective**. We will focus on:

1. Mature libraries and **software tools** that can be used as of 2022 [3, 4, 5, 6, 7, 8], with a clear picture of the current state-of-the-art [9].
2. New ranges of applications in **3D shape analysis**, with a focus on population analysis [10] and point cloud registration [11].
3. **Open problems** that remain to be solved by experts in the field.

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