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Transport metrics in image and shape processing

Optimal shapes of branched transport networks

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Abstract: Complex systems of transportation networks are ubiquitous in nature and engineering, e. g. the cardiovascular system, street networks, etc. There are two major variational models for such networks, an urban planning and a branched transport model, in which the degree of network complexity and ramification is governed by a small parameter $\varepsilon > 0$. As opposed to classical optimal transport, ε encodes how much more efficient it is to transport mass in bulk than in single pieces. Smaller ε leads to finer ramification patterns, and we analyse how optimal network patterns in a particular geometry behave as $\varepsilon \to 0$. We furthermore point out a close relation of network optimisation to Mumford–Shah image segmentation, which results in the interesting fact that the two-dimensional network optimisation problems actually admit a convex reformulation. (Joint work with Alessio Brancolini)