Convex Relaxation Techniques for Functions with Values in a Riemannian Manifold

D. Cremers[a], **E. Strekalovskiy**[a] and **J. Lellmann**[b]

[a]Departments of Computer Science and Mathematics
Technische Universitaet Muenchen
85748 Garching, Germany
cremers@tum.de,evgeny.strekalovskiy@in.tum.de

[b]Department of Applied Math and Theoretical Physics
University of Cambridge
CB3 0WA, Cambridge, UK
j.lellmann@damtp.cam.ac.uk

Since their introduction in 2008, convex multilabel formulations have become a popular framework to solve a large variety of orginally non-convex variational problems. The key idea is to add an additional dimension representing the space of feasible values (functional lifting) and subsequently perform a convex relaxation. While this leads to optimal or near-optimal solutions for many non-convex problems, it comes at the sacrifice that solutions take on values which tend to lie on the finite set chosen to discretize the space of feasible values.

In my talk, I will introduce a more general convex relaxation technique which improves over previous approaches in several ways: Firstly, it allows to treat functions which take values in an aribtrary Riemannian manifold. Secondly, the primal-dual formulation exploits the local structure of the Riemannian manifold in a way that gives rise to solutions which show less diretional bias and less grid bias (sub-label precision). Numerous experiments on problems with convex and non-convex data and regularity terms (denoising, inpainting, optical flow) show that the computed solutions take on values which may lie in between the grid points selected to discretize the manifold.