Balanced Infinity Laplacian Applied to Depth Completion on Graphs

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Abstract

Depth map images are an essential source of information for applications such as robotics, autonomous vehicles, 3D cinema post-production, video games, and many others. Depth maps can be acquired by sensors such as LiDAR or time-of-flight cameras, but often, the acquired data present large areas without information (or holes) or data with low-confidence values. Filling in these holes is crucial for robotics and other applications, which helps, for instance, robots avoid obstacles or path planning. In order to complete the depth data, we solve the variation of the infinity Laplacian guided by a color reference image of the considered scene. We associate the image grid to a graph and given the image domain Ω, and a metric d_{xy} we created a manifold $M = (\Omega, d_{xy})$, where we solve the infinity Laplacian. Our implementation on a GPU significantly decreases processing time. The contribution of this work is three-fold i) we use a graph-based approach, ii) we tested different metrics, and ii) we proposed a variation of the infinity Laplacian. Results show that our proposal outperforms other contemporary models and performs similarly to approaches based on infinity Laplacian. Our implementation is a fast and easy-implementing model which represents a low-cost tool for many computer vision applications. Future work will consider the use of different metrics and a more contemporary interpolation model.