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The Least Squares Klein Bottle for Image Patches

Bradley Nelson¹, Gunnar Carlsson²

¹*Institute for Computational and Mathematical Engineering, Stanford University*

²*Department of Mathematics, Stanford University*

It has been observed that an important subspace of high-contrast image patches has the topology of the Klein bottle. In this work, we offer a simple explanation why the Klein bottle appears when modeling edges in images, derived from properties of odd and even functions, and in doing so show that there are many Klein bottles that one may consider. We consider the task of inferring the best Klein bottle to fit a given set of image patches from a family of possibilities, and compare the ability of our proposed method to represent image patches to other dimension reduction techniques.