

## THE RADON SIGNED CUMULATIVE DISTRIBUTION TRANSFORM AND ITS APPLICATIONS IN CLASSIFICATION OF SIGNED IMAGES

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**Abstract.** Here we describe a new image representation technique based on the mathematics of transport and optimal transport. The method relies on the combination of the well-known Radon transform for images and a recent signal representation method called the Signed Cumulative Distribution Transform. The newly proposed method generalizes previous transport-related image representation methods to arbitrary functions (images), and thus can be used in more applications. We describe the new transform, and some of its mathematical properties and demonstrate its ability to partition image classes with real and simulated data. In comparison to existing transport transform methods, as well as deep learning-based classification methods, the new transform more accurately represents the information content of signed images, and thus can be used to obtain higher classification accuracies. The implementation of the proposed method in Python language is integrated as a part of the software package PyTransKit [12]

### 1. Introduction

Finding useful mathematical formulas for representing signal and image data can be critical for solving important engineering and scientific problems. Fourier representation methods, for example, can dramatically simplify the solution of shift invariant linear systems of equations (e.g. convolutions), and thus are extensively used to filter sound and other types of signals, in optics and image processing (e.g. deconvolution) and other important problems. Localized sparse representations (e.g. short time Fourier transforms, Wavelets) have been extensively utilized in signal compression, denoising,

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