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PDE-based CNNs with Morphological Convolutions

Convolutional neural networks have found wide adoption and great success in image processing yet have drawbacks such as needing huge augmented datasets for training, optimization over a large parameter space and a lack of model interpretability. The recent inclusion of Lie group geometry has gone a long way in dealing with the problem of augmenting training data which shows the utility of introducing geometric priors to CNNs.

Building on this we introduce a geometric PDE-based model on Lie groups for describing CNNs that retains the equivariance property, introduces equivariant morphological convolutions and gives the network geometric model interpretability. The trainable parameters in this setting are then seen as the geometrically meaningful coefficients of the PDE.

During the talk I will give an overview of the main elements of this model and end with a first preliminary application to retinal segmentation to show the benefit of this approach.