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## Symmetry-adapted representation learning

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## Abstract

In this paper, we propose the use of data symmetries, in the sense of equivalences under signal transformations, as priors for learning symmetryadapted data representations, i.e., representations that are equivariant to these transformations. We rely on a group-theoretic definition of equivariance and provide conditions for enforcing a learned representation, for example the weights in a neural network layer or the atoms in a dictionary, to have the structure of a group and specifically the group structure in the distribution of the input. By reducing the analysis of generic group symmetries to permutation symmetries, we devise a regularization scheme for representation learning algorithm, using an unlabeled training set. The proposed regularization is aimed to be a conceptual, theoretical and computational proof of concept for symmetry-adapted representation learning, where the learned

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