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In image and audio signal classification, a major problem is to build stable representations that are invariant under rigid motions and, more generally, to small diffeomorphisms. Translation invariant representations of signals are of particular importance. The existence of such representations is intimately related to classical invariant theory, inverse problems in compressed sensing and deep learning. We construct low dimensional representations of signals that are invariant under finite unitary group actions, as a special case we establish the existence of low-dimensional set of measurements which separates the orbits of any cyclic group action, of which translation is one example. Furthermore our map is Lipschitz with respect to the natural metric on the space of orbits. Our construction is closely related to methods use in phase retrieval, so we will give an overview of these methods. (Received August 24, 2019)