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Almost invariant vectors of a unitary representation

Definition. Almost invariant vectors in a unitary representation

Consider a unitary representation

$$\pi : G \rightarrow U(\mathcal{H}_\pi)$$

of a [locally compact Hausdorff topological group](#) G . The representation π has **almost invariant vectors** if for every $\epsilon > 0$ and $K \subseteq G$ compact there is a unit vector $v \in S(\mathcal{H}_\pi)$ such that

$$\forall g \in K, \|\pi^g v - v\|_{\mathcal{H}_\pi} < \epsilon$$

That is, for

$$\begin{aligned} \mathcal{H}_\pi^{\epsilon,K} &:= \left\{ v \in \mathcal{H}_\pi \mid \forall g \in K, \|\pi^g v - v\|_{\mathcal{H}_\pi} < \epsilon \right\} \\ \mathcal{H}_\pi^K &:= \{ v \in \mathcal{H}_\pi \mid \forall g \in K, \pi^g v = v \} \end{aligned}$$

we have

$$\mathcal{H}_\pi^{\epsilon,K} \cap S(\mathcal{H}_\pi) \neq \emptyset$$

$$\bigcap_{\epsilon>0} \mathcal{H}_\pi^{\epsilon,K} = \mathcal{H}_\pi^K$$

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