



### Why

Given a vector  $x \in \mathbf{R}^n$  and a subspace  $S \subset \mathbf{R}^n$ , what is the closest point in  $S$  to  $x$ .

### Result

**Proposition 1.** *Suppose  $U \in \mathbf{R}^{n \times k}$  with  $U^\top U = I$ . Then*

$$\text{proj}_U(x) = UU^\top x$$



