Formulas

Formulas and Theorem

Expansion in Orthogonal Basis

If we have an Orthogonal Basis $\{\vec{u}_1, \ldots, \vec{v}_n\}$ in $\mathbb{R}^n$ then for any $\vec{w} \in \mathbb{R}^n$,

$$\vec{w} = c_1\vec{u}_1 + \cdots + c_n\vec{v}_n$$

C_q can be found using $c_q = \frac{\vec{w}\cdot\vec{u}_q}{\vec{u}_q\cdot\vec{u}_q}$

Orthogonal Projection

Let non-zero $\vec{u} \in \mathbb{R}^n$, and $\vec{y} \in \mathbb{R}^n$. The orthogonal projection of $\vec{y}$ onto $\vec{u}$ is the vector in the span of $\vec{u}$ that is closest to $\vec{y}$.

$$\text{proj}_{\vec{u}}\vec{y} = \frac{\vec{y}\cdot\vec{u}}{\vec{u}\cdot\vec{u}}\vec{u}$$
