

An aerial photograph of a city, likely Madison, Wisconsin, taken from a high vantage point looking down at the city and the surrounding water. The sun is setting behind a hill in the background, creating a warm, golden glow over the entire scene. The city is densely packed with buildings, and the water is filled with numerous sailboats. A large, semi-transparent rectangular box is overlaid on the center of the image, containing the course title in large, bold, black text.

CS/ECE/ME 532 Matrix Methods in Machine Learning

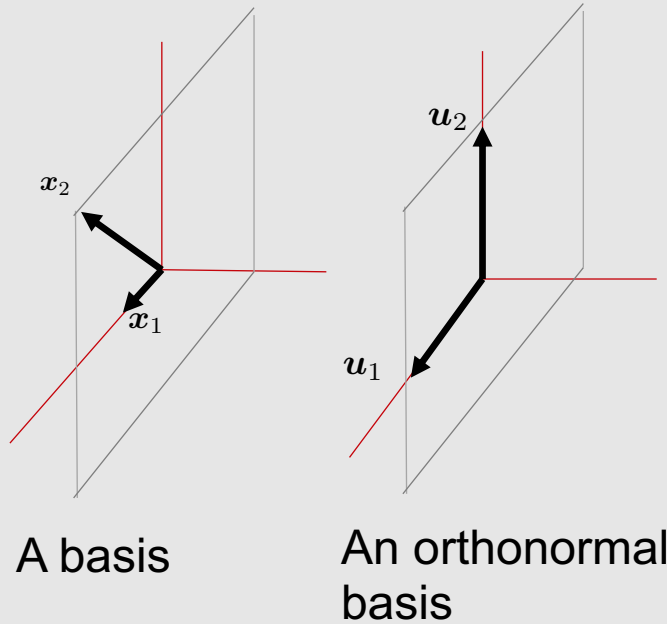
Welcome!



Activity 7

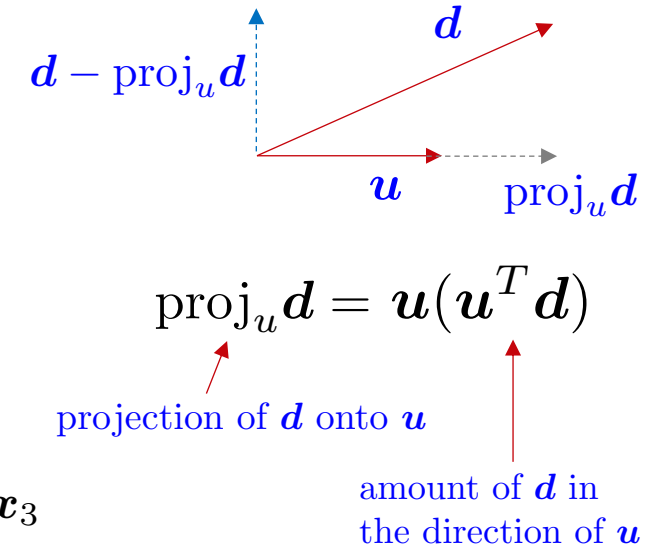


Matt Malloy
(lecture 2.9)



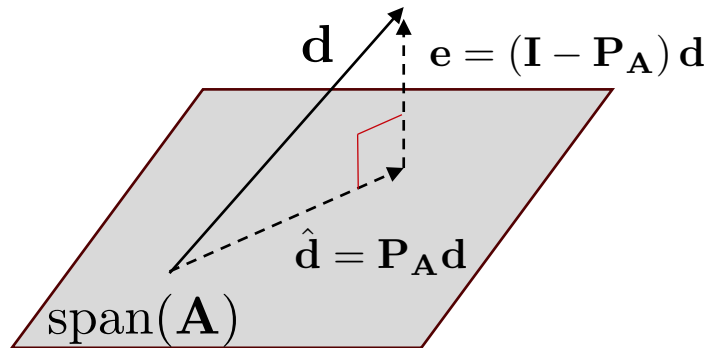
Gram-Schmidt Orthogonalization

1. set $\tilde{u}_1 = x_1$
2. normalize: $u_1 = \frac{\tilde{u}_1}{\|\tilde{u}_1\|_2}$
3. set $\tilde{u}_2 = x_2 - \text{proj}_{u_1} x_2$
4. normalize: $u_2 = \frac{\tilde{u}_2}{\|\tilde{u}_2\|_2}$
5. set $\tilde{u}_3 = x_3 - \text{proj}_{u_1} x_3 - \text{proj}_{u_2} x_3$
- \vdots



$$d = Aw$$

$$\begin{matrix} | & & | \\ & p & \\ | & & | \end{matrix} = n \quad \boxed{A}$$



How can we leverage an orthonormal basis?:

$$\hat{d} = Aw = A(A^T A)^{-1} A^T d = P_A d$$

Today
↓

$$= UU^T d = P_U d$$

Key fact: $U^T U = I$