HW3 Part 1

1. PCA Eigenvector Orthogonality

$$A\vec{x} = \lambda_1 \vec{x}$$

$$A\vec{y} = \lambda_2 \vec{y}$$

where A is a symmetric matrix, $\vec{x}$ and $\vec{y}$ are the eignvectors that correspond, respectively, to eigenvalues $\lambda 1$ and $\lambda 2$. Show mathematically that $\vec{x}$ and $\vec{y}$ must be orthogonal if the eigenvalues are different

$$\lambda_1 \vec{u_1} = A\vec{u_1}$$

$$\lambda_2 \vec{u_2} = A\vec{u_2}$$

$$\lambda_1 \vec{u_1}\vec{u_2} = \vec{u_1}A\vec{u_2} = \vec{u_1}\lambda\vec{u_2}$$

$$(\lambda_1 - \lambda_2) * \vec{u_1}\vec{u_2} = 0$$

$$\vec{u_1}\vec{u_2} = 0$$