EXAM 1
Thursday, September 28, 2017

- This is a CLOSED BOOK exam. You may use one sheet (front and back) of handwritten notes.
- No calculators are permitted. You need not simplify explicit numerical expressions.
- There are a total of 60 points in the exam. Each problem specifies its point total. Plan your work accordingly.
- You must SHOW YOUR WORK to get full credit.

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Name: ____________________________________________
Possibly Useful Formulas

Minkowski Norm
\[ \| \vec{x} - \vec{\mu} \|_p = (|x_1 - \mu_1|^p + \ldots + |x_D - \mu_D|^p)^{1/p} \]

Gaussians
\[ \mathcal{N}(\vec{x}; \vec{\mu}, \Sigma) = \frac{1}{(2\pi)^{D/2}|\Sigma|^{1/2}} e^{-\frac{1}{2}(\vec{x} - \vec{\mu})^T \Sigma^{-1} (\vec{x} - \vec{\mu})} \]

\[ \Sigma = U\Lambda U^T \]
\[ \Sigma^{-1} = U\Lambda^{-1} U^T \]
\[ U^T \Sigma U = \Lambda \]
\[ U^T U = I \]

Mahalanobis Distance and PCA
\[ d^2_{\Sigma}(\vec{x}, \vec{\mu}) = \sqrt{(\vec{x} - \vec{\mu})^T \Sigma^{-1} (\vec{x} - \vec{\mu})} = \vec{y}^T \Lambda \vec{y} \]
\[ \vec{y} = U^T (\vec{x} - \vec{\mu}) \]

Bayesian Classifier
\[ \hat{y} = \arg \max p_{y|\vec{x}}(y|\vec{x}) \]