# Lecture Three

February 25, 2016

## 1 Gaussian Classifiers

$$(\vec{x} - \vec{u})(\frac{1}{N}\sum(\vec{x} - \vec{\mu})(\vec{x} - \vec{\mu})^T)(\vec{x} - \vec{\mu}) \tag{1}$$

$$(\vec{x} - \vec{\mu})\Sigma^{-1}(\vec{x} - \vec{\mu})^T \tag{2}$$

Multi-dimensional Gaussian distribution

$$P(\vec{x}) = \frac{1}{\sqrt{||2\pi\Sigma||}} e^{-\frac{1}{2}(\vec{x}-\vec{\mu})^T\Sigma^{-1}(\vec{x}-\vec{\mu})} \tag{3}$$

Steps for developing a gaussian classifier

1. Center the data
2. Compute the covariance matrix

Projection of the Mean Value

$$\frac{1}{N}\sum_{i=1}^{N}(\vec{x}^T\vec{a}) = (\frac{1}{N}\sum\vec{x_i})^T\vec{a} = \vec{\mu}^T\vec{a} \tag{4}$$

Projection of the Variance

$$\sigma^2 = \frac{1}{N}\sum_{i=1}^{N}(\vec{a}^T\vec{x_i} - \vec{a}^T\vec{\mu})(\vec{x_i}^T\vec{a} - \vec{\mu}^T\vec{a}) \tag{5}$$

## 2 Homework 2

- Part A: Redo Homework 1
  - Use Gaussian Classifiers
- Part B: Do the cancer problem in the book and apply subset selection
  - Redraw Chapter 3 Fig. 3.5 with the data from the book for the cancer set selection.

– prostate cancer example

If the covariance matrix is not invertable then you can add a piece of the identity matrix to make the matrix more invertible.

$$(\Sigma + \lambda I)^{-1} \tag{6}$$