# Stat 13 Lecture 18
# Bayes theorem

- How to update probability of occurrence?
- Prior probability ( $\pi_i$= prior for theory i)
- Posterior probability (updated probability for theory i )
- Tumor classification
- Handwritten digit/character recognition ( data / feature)
- Prob (data | class i ) = (often given by experiments or by reasoning); suppose D is observed; denote prob by f(data=D | class= i ); then
- Prob (class i | data=D)= posterior for class i
- = $\pi_i$ f(data=D | class = i ) / sum of $\pi_j$ f(data=D| class j ) ; where j goes from 1 to k; k is the total number of classes

# HIV test

- Prob (Positive|HIV)=.98
- Suppose Tom is tested positive. What is the chance that he has HIV ?

- .98 ????

- What other information is needed ?

Enzyme-linked immunosorbent assay assay (ELISA) test : gives a quantity called MAR (mean absorbance ratio for HIV antibodies)

| MAR | Healthy donor | HIV patients |
|---|---|---|
| < 2 | 202 | 0 |
| 2- 2.99 | 73 | 2 |
| 3- 3.99 | 15 | 7 |
| 4 -4.99 | 3 | 7 |
| 5 -5.99 | 2 | 15 |
| 6-11.99 | 2 | 36 |
| 12+ | 0 | 21 |
| total | 297 | 88 |

Pro(positivel Healthy)= false positive rate =22/297=.074