**INFO 7390 Assignment 6 Bharat Parwani**

Bayesian Computation

**Breast Cancer Example –**

1% of women have breast cancer

The mathematical equation can be written as P(breast\_cancer) = 0.01

And, the probability of not having breast cancer is P(NO\_breast\_cancer) = 0.99

The true positive value is 80% which is the percentage of mammograms that detect breast cancer when it is there (Given = 80% in the slide)

The value of false positive is 9.6% which is the percentage of mammograms that detect breast cancer when it is not there (Given = 9.6% in the slide)

Thus, the mathematical equation can be written as,

P(positive | breast\_cancer) = 0.8

P(negative | breast\_cancer) = 0.2

P(positive | NO\_breast\_cancer) = 0.096

P(negative | NO\_breast\_cancer) = 0.904

**Bayes Computation –**

The equations can be written as –

P(breast\_cancer | positive) = P(positive | breast\_cancer) x P(breast\_cancer) / P(positive)

And

P(positive) = P(positive & breast\_cancer) + P(positive & not\_breast\_cancer)

= P(breast\_cancer) \* P(positive | breast\_cancer) + P(NO\_breast\_cancer) \*

P(positive | NO\_breast\_cancer)

= (0.01) \* (0.8) + (0.99) \* (0.096)

= 0.10304

Substituting the above value in the first equation, we get –

P(breast\_cancer | positive) = P(positive | breast\_cancer) x P(breast\_cancer) / P(positive)

P(breast\_cancer | positive) = (0.8) \* (0.01) / (0.10304) = 0.07763 ~ 8%

Thus, if the mammogram test result is positive, there are 8% chances of having cancer.

Computing probability of the disease if symptoms 1 and 2 are given : P(D | S1, S2)

P(D) = probability of having a disease

P(S1) = probability of symptom 1

P(S2) = probability of symptom 2

Taking values we get,

P(D) = 0.02

P(not D) = 0.98

P(S1 | D) = 0.8

P(not S1 | D) = 0.2

P(S1 | not D) = 0.01

P(not S1 | not D) = 0.99

P(S2 | D ) = 0.8

P(not S2 | D) = 0.2

P( S2 | not D) = 0.01

P(not S2 | not D ) = 0.99

Putting the values in the equation we get,

P(D|S1&S2) = [P(S2|D)\*P(S1|D)\*P(D)] / [P(S2|D)\*P(S1|D)\*P(D)] + [P(not D)\*P(S1|not D)\*P(S2|not D)]

= [(0.8)\*(0.8)\*(0.02)] / [(0.8)\*(0.8)\*(0.02)] + [(0.98)\*(0.01)\*(0.01)]

= [0.0128] / [0.0128] + [0.000098]

= [0.0128] / [0.012898]

= 0.992 ~ 99%

**Conclusion –**

Probability of having disease in association with the given symptom 1 and 2 is 99%

**GeNIe Output –**

