CSCI567 2013 Homework Assignment 6

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1 Bayes Net

1.1 Causal Reasoning

P(JohnCalls = True | Burglary = True) = 0.849017

1.2 Diagnostic Reasoning

P(Burglary = True | JohnCalls = True) = 0.016193

1.3 Explaining Away

1.3.1

$$P(Earthquake = True|Alarm = True) = P(Earthquake = True, Alarm = True)/P(Alarm = True) \quad (1)$$

Now,
$P(Earthquake = True, Alarm = True) = P(Burglary = True, Earthquake = True, Alarm = True) + P(Burglary = False, Earthquake = True, Alarm = True)$

$$\Rightarrow 0.001 * 0.002 * 0.95 + 0.999 * 0.002 * 0.29 = 0.00058132$$

Also,
$P(Alarm = True) = P(Burglary = True, Earthquake = True, Alarm = True) + P(Burglary = False, Earthquake = True, Alarm = True) + P(Burglary = True, Earthquake = False, Alarm = True) + P(Burglary = False, Earthquake = False, Alarm = True)$

$$\Rightarrow 0.001 * 0.002 * 0.95 + 0.999 * 0.002 * 0.29 + 0.001 * 0.998 * 0.94 + 0.999 * 0.998 * 0.001 = 0.002516442$$

So, now by putting values in (1) we get

$$P(Earthquake = True|Alarm = True) = 0.231008701968891$$

1.3.2

$P(Earthquake = True|Alarm = True, Burglary = True) = P(Earthquake = True, Alarm = True, Burglary = True)/P(Alarm = True, Burglary = True)$
Now,

$$P(Earthquake = True, Alarm = True, Burglary = True) = 0.001 * 0.002 * 0.95 = 1.9e - 06$$

Also,
$P(Alarm = True, Burglary = True) = P(Burglary = True, Earthquake = True, Alarm = True) + P(Burglary = True, Earthquake = False, Alarm = True)$

$$\Rightarrow 0.001 * 0.002 * 0.95 + 0.001 * 0.998 * 0.94 = 0.00094002$$

So, now by putting values we get

$$P(Earthquake = True|Alarm = True, Burglary = True) = 0.0021$$

So we can see here that $P(Earthquake = True|Alarm = True, Burglary = True)$ is less than $P(Earthquake = True|Alarm = True)$. We can conclude that when given some extra evidence reduces the likelihood of the event. Here we are given $Burglary = True$ as an extra evidence and we can see the affect.