TDT4171 - Assignment 2

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1 PART A

- Unobserved variable: rain
- Observable variable: umbrella
- $P(X_t|X_{t-1}) = 0.7, P(E_t|X_t) = 0.9$
- Dynamic model: $\begin{bmatrix} 0.7 & 0.3 \\ 0.3 & 0.7 \end{bmatrix}$
- Observational model: $\begin{bmatrix} 0.9 & 0.1 \\ 0.2 & 0.8 \end{bmatrix}$
- Assumptions:

  1.Stationary process: Probability of raining on a certain day is only dependant ONLY on whether or it rained the day before.

  2.Sensor Markov assumption: $P(E_t|X_{1:t}, E_{1:t-1}) = P(E_t|X_t)$ and the probability is constant and not change over time.

  3.1st order Markov process: $P(X_t|X_{0:t-1}) = P(X_t|X_{t-1})$
- Are assumptions reasonable? The stationary assumption is not accurate. Weather is highly dependant on the time of the year. 1st order Markov process modelling is too simple. The information about whether it rained the day before is not enough to accurately predict weather conditions the day after. A higher order Markov process could be more accurate. Sensor Markov assumption is not very good assumption as well. Since our sensor a person, and his habit of bringing an umbrella could be highly weather dependant, but it could also be influenced by other factors.

2 PART B

- Probability of rain at day 2:

  f0 = [0.5000,0.5000]

f1 = [0.8182,0.1818]

f2 = [0.8834,0.1166]

$P(x_2|e_{1:2}) = 0.8834$

- Probability of rain at day 5:

  f0 = [0.5000,0.5000]

  f1 = [0.8182,0.1818]

  f2 = [0.8834,0.1166]

  f3 = [0.1907,0.8093]

  f4 = [0.7308,0.2692]

  f5 = [0.8673,0.1327]

  $P(x_5|e_{1:5}) = 0.8673$

3 PART C

- Backward messages:

  b6 = [1,1]

  b5 = [0.6900,0.4100]

  b4 = [0.4593,0.2437]

  b3 = [0.0906,0.1503]

  b2 = [0.0661,0.0455]

  b1 = [0.0444,0.0242]

- $P(x_1|e_{1:5}) = 0.8873$