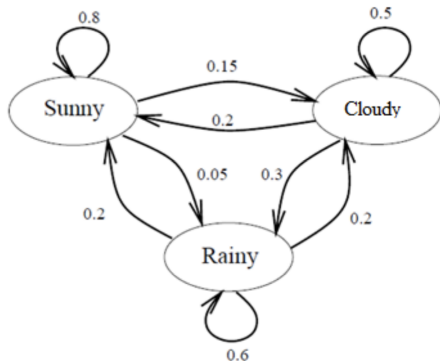


# Machine Learning

## Markov Model

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# Markov Model



$$\left. \begin{aligned} P(\text{Sunny}|\text{Sunny}) &= 0.8 \\ P(\text{Rainy}|\text{Sunny}) &= 0.05 \\ P(\text{Cloudy}|\text{Sunny}) &= 0.15 \end{aligned} \right\} 1$$

$$\left. \begin{aligned} P(\text{Sunny}|\text{Rainy}) &= 0.2 \\ P(\text{Rainy}|\text{Rainy}) &= 0.6 \\ P(\text{Cloudy}|\text{Rainy}) &= 0.2 \end{aligned} \right\} 1$$

$$\left. \begin{aligned} P(\text{Sunny}|\text{Cloudy}) &= 0.2 \\ P(\text{Rainy}|\text{Cloudy}) &= 0.3 \\ P(\text{Cloudy}|\text{Cloudy}) &= 0.5 \end{aligned} \right\} 1$$

# Markov Model

Le modèle est estimé par “comptage” des transitions d'états

1 : ATGCGATCTATCGCTAGCCGCGCTATACGCA

2 : GATTATAGCTAGCTCGCGCTATATCGCTAGCTAGCTAGCTAGC

$$P(A|T) = \frac{\#TA}{\#TA + \#TC + \#TG + \#TT}$$

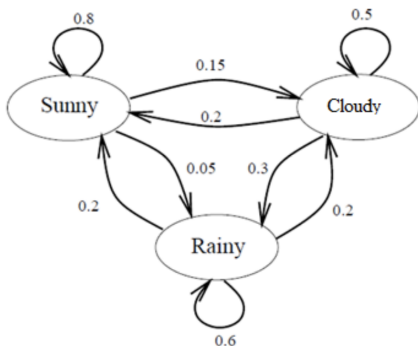
$$P(A|C) = \frac{\#CA}{\#CA + \#CC + \#CG + \#CT}$$

...

# Markov Model

Utilisations :

- Modèle génératif de séquence
- Prédiction de classe : un modèle par classe
- Découverte de pattern



$$\left. \begin{array}{l} P(\text{Sunny}|\text{Sunny}) = 0.8 \\ P(\text{Rainy}|\text{Sunny}) = 0.05 \\ P(\text{Cloudy}|\text{Sunny}) = 0.15 \end{array} \right\} 1$$

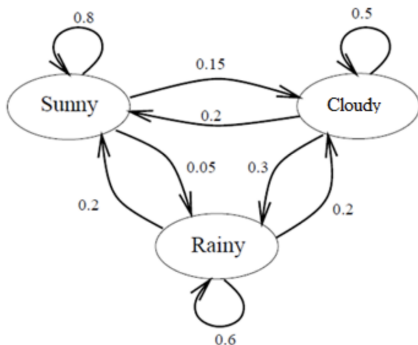
$$\left. \begin{array}{l} P(\text{Sunny}|\text{Rainy}) = 0.2 \\ P(\text{Rainy}|\text{Rainy}) = 0.6 \\ P(\text{Cloudy}|\text{Rainy}) = 0.2 \end{array} \right\} 1$$

$$\left. \begin{array}{l} P(\text{Sunny}|\text{Cloudy}) = 0.2 \\ P(\text{Rainy}|\text{Cloudy}) = 0.3 \\ P(\text{Cloudy}|\text{Cloudy}) = 0.5 \end{array} \right\} 1$$

# Markov Model

Des applications où c'est efficace (malgrès des limitations évidentes) :

- Premières approximations météo
- Thermodynamique
- Théorie des files d'attente (télécommunication)
- ...



$$\left. \begin{array}{l} P(\text{Sunny}|\text{Sunny}) = 0.8 \\ P(\text{Rainy}|\text{Sunny}) = 0.05 \\ P(\text{Cloudy}|\text{Sunny}) = 0.15 \end{array} \right\} 1$$

$$\left. \begin{array}{l} P(\text{Sunny}|\text{Rainy}) = 0.2 \\ P(\text{Rainy}|\text{Rainy}) = 0.6 \\ P(\text{Cloudy}|\text{Rainy}) = 0.2 \end{array} \right\} 1$$

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