Markov Models

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CS 188

Method

Research Design

Objective: Understand Markov Models

Results

Terminology

Markov Models (also called Markov chain/process)

- State: The value of X at a given time

- Transition model: how the state evolves over time given by $P(W_{i+1}|W_{i})$

- Stationarity assumption: transition probabilities are the same at all times

- Markov assumption (Markov property): future is independent of the past given the present (memoryless property)

- Initial distribution: the probability table given by $P(W_0)$

Therefore, we can represent a Markov model with only two tables: $P(W_0)$ and $P(W_{i+1}|W_{i})$

- Markov model application: n-gram models (text classification, spam detection, author identification, language classification, speech recognition), web browsing (google page rank), weather (weather prediction)

Mini-Forward Algorithm

- We have properties of marginalization: $P(W_{i+1}) = \sum P(w_i, W_{i+1})$

- By the chain rule we can re-express this as: $P(W_{i+1}) = \sum P(W_{i+1}|w_i)P(w_i)$

- We use recursive update for this algorithm

Stationary Distribution

- Does the probability of being in a state at a given timestep ever converge? To solve that, we must compute the stationary distribution.

- This is the one that remains the same after the passage of time, i.e. P(Wt+1) = P(Wt)