Gevorderde AI Technieken

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Compilers

Richting	Informatica
Jaar	MINF

Bespreking

Komt nog.

Puntenverdeling

Komt nog.

Examenvragen

Academiejaar 2009 - 2010 - 2de zittijd

1. Statistical Inference
   1. Explain No Free Lunch
   2. Define MAP and ML parameter estimates. When they are equivalent?
   3. Assume that you have a biased coin that produces heads with probability q and tails with probability $1-q$. You throw the coin K times and get L heads. The throws are represented by D.
      - Write the formula for the likelihood $p(D|q)$.
      - Calculate the ML estimate for q and prove that your estimate is correct (Hint: use log-likehood)

      Assume that the prior for q is now $p(q)=Z(A,B)q^A(1-q)^B$, where $Z(A,B)$ is a normalization constant (doesn't depend on q), so that p integrates to 1.

      - Calculate the MAP estimate for q and prove that your estimate is correct.
      - Which values of A and B produce equal MAP and ML estimates.

2. Bayesian Network
    1. Explain in your own words what are Graphical networks, how they are defined, and why they are needed.
    2. Explain what junction trees are used for.
    3. Figure 1 contains a graph describing a network for 8 variables.
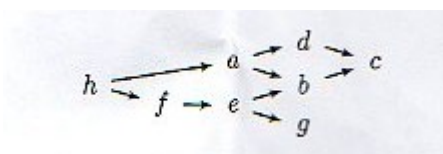
    - Describe what kind of distributions this model represents.
    - Moralize the graph.
    - Triangulate the graph (note that triangulation is not unique, pick a reasonable one)
    - What factorization of a distribution does the junction tree represent.
3. Sampling
    1. Explain what is sampling and when it is useful.
    2. Explain each of the following sampling technique. Name one good and one bad property.
        - Inverse CDF
        - Rejection Sampling
        - MCMC Sampling
4. Mixture Models
    1. Define in your own words what is a mixture model.
    2. Assume that you have KK binary variables coming from a mixture model of MM different classes. The full data consists of NN samples. Assume that according to the model, the variables inside a single class are independent $p(X1,...,Xk|C=c)=p(X1|C=c)...p(Xk|C=c)p(X1,...,Xk|C=c)=p(X1|C=c)...p(Xk|C=c)$.
        - What are the parameters for this model? How many parameters do we have?
        - What are the hidden parameters in this model? How many hidden parameters we have?
        - Describe how these parameters can be estimated using the EM algorithm.
            - Explain how these actual parameters can be estimated from the hidden parameters.
            - Explain how the hidden parameters can be estimated from the actual parameters.