Homework 2: Winter 2012. Stat 238. Due Wednesday. 21 March 2012.

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Abstract

The homework assigning is to read the course notes for lectures 8-14, to put comments on the pdf files (sticky notes) and email to yuille@stat.ucla.edu

The comments can address clarity, errors (e.g., typos), request more examples, more motivation, more figures, more references to background material. The questions below are intended to motivate you to read the notes. These questions should have short answers. A few sentences and not long mathematical derivations.

1. Questions

1. Briefly describe the EM algorithm. What types of problems can it be applied to? What computations does it involve?

2. Briefly describe dynamic programming. When can dynamic programming be used to perform the computations requires by the EM algorithm?

3. What three tasks does a Hidden Markov Model perform? What are the elements of a Hidden Markov Model? What is the forward variable? the backward variables? the Viterbu algorithm? and the Baum-Welch algorithm?

4. What is the Lambertian lighting model? Can it model shadows? What theoretical arguments suggest that inages of an object lie in a three-dimensional space? What is the empirical justification?

5. How can Singular Value Decomposition be used to estimate the surface shape and albedo from several images of the same object taken under different lighting conditions? What is the ambiguity in estimating the shape and albedo?

6. what is perspective projection? What is orthographic projection? When is orthographic a good approximation to perspective?

7. How can the shape of an object be estimated from multiple views with known correspondence? What ambiguity exists in the estimate of the shape?

8. What is binocular stereo? What is the correspondence problem?What is the epipolar line constraint? How can the epipolar line constraint be used to simply the correspondence problem. How can stereo be formulated as a probabilistic model? What algorithm can be used to perform inference on this model if the epipolar line constraint is used? What algorithm if the epipolar line constraint is relaxed?

9. What is the belief propagation algorithm? What is the Bethe free energy and how does it relate to belief propagation? When is belief propagation guaranteed to converge to the correct solution? How can the messages in belief propagation be justified?

10. What is the basic assumption of pattern theory? How does the region competition formulation differ from the weak smoothness model? Briefly describe the region competition algorithm.

11. Briefly describe image parsing and data driven markov chain monte carlo. How can proposals be used to make the markov chain converge quickly? (Optional question).

12. How does AdaBoost relate to regression? How does AdaBoost combine cues? What types of objects can be detected using AdaBoost? What types of cues are used?