ELL788: Minor Test II

October 8, 2015

Maximum Marks: 20

1. (a) Suppose that you wish to assume a $Beta(\alpha, \beta)$ prior on a parameter θ, which represents the probability of a coin coming up heads. Suggest reasonable values of α and β for each of the following cases:

   (i) You think the coin is quite likely to be a normal, fair coin.

   (ii) You think the coin is from a magic trick factory which produces coins with the same image on both sides.

   (iii) You don't want to make any assumptions, or even use your knowledge of what the word 'coin' means. **[1.5]**

   (b) Now suppose you want to simultaneously allow for all of the above options, because you have a whole batch of coins of a particular type, and you would like to use them to infer what that type might be. Describe a model which will allow you to do this. **[2.5]**

2. The representations or features constructed by deep neural networks are particularly of interest to cognitive scientists because it is thought that they might mirror the way our own brains represent certain kinds of information. However, to actually test this hypothesis is not easy, and has only become feasible very recently. Describe any one specific technique employed by Cadieu *et al.* to attempt such a comparison. **[3]**

3. We have discussed that it is often desirable to crop an image for presentation. For example, it may be desirable to present the right-hand image below instead of one on the left.


   Justify such cropping with cognitive principles that are at play when images are seen and remembered. **[2]**

4. Distinguish between structural and semantic descriptions of a scene. Explain how semantic description emerges out of structural description. **[4]**

5. The features used in visual and audio attention models are computed by a set of center-surround operations. Explain the center-surround operation and justify its use in context of attention model. **[4]**

6. (a) Consider the following two sentences:

   (i) *Time flies like an arrow.*

   (ii) *Fruit flies like a banana.*

When these are read in conjunction, a garden-pathing effect is usually felt in the second sentence. Draw simple phrase structure trees for both sentences and use these to explain why the garden-pathing happens. **[1.5]**

(b) Describe an experiment that can distinguish between the garden-path and constraint-based models of sentence processing, explaining why it would do so. **[1.5]**