Homework 1

CS 274B: Spring & 2016

Due: April 15, 2016

Problem 3:

Part A

We need to solve the following

$$p(0,0;\theta) + p(0,1;\theta) + p(1,0;\theta) + p(1,1;\theta) = 1$$

This ends up being the following:

$$exp(-A(\theta)) + exp(-A(\theta)) + exp(\theta_x - A(\theta)) + exp(\theta_x + \theta_{xy} - A(\theta)) = 1$$

After doing some factoring

$$\frac{exp(\theta_x) + exp(\theta_{xy} + \theta_x) + 2}{exp(A(\theta))} = 1$$

After cross multiplying and solving for $A(\theta)$

$$A(\theta) = log(exp(\theta_x) + exp(\theta_{xy} + \theta_x) + 2)$$

Part B

After letting $\theta_{xy} = 1$ we have the following

$$A(\theta) = log(exp(\theta_x) + exp(1 + \theta_x) + 2)$$

After some factoring

$$A(\theta) = log(exp(\theta_x)(1 + exp(1)) + 2)$$

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Part C

This is the partial with respect to θ_x

$$\frac{\partial A}{\partial \theta_x} = \frac{exp(\theta_x) + exp(\theta_x + \theta_{xy})}{exp(\theta_x) + exp(\theta_x + \theta_{xy}) + 2}$$

This is the partial with respect to θ_{xy}

$$\frac{\partial A}{\partial \theta_{xy}} = \frac{exp(\theta_x + \theta_{xy})}{exp(\theta_x) + exp(\theta_x + \theta_{xy}) + 2}$$

Thus we have

$$\bigtriangledown A(\theta) = [\frac{exp(1) + exp(3)}{exp(1) + exp(3) + 2}, \frac{exp(3)}{exp(1) + exp(3) + 2}]$$

Approximately

$$\bigtriangledown A(\theta) = [0.91937, 0.80978]$$