

Math for Deep Learning - Homework 03.1

Name: _____

1. MLE Maximum Likelihood estimator question
2. Bayesian estimation question

$$p(H|D) = \frac{p(H)P(D|H)}{p(D)}$$

- H is Hypothesis and D is the Data
- $p(H)$ Prior
- $p(H|D)$ Posterior
- $p(D|H)$ Likelihood
- $p(D)$ Normalizing Constant

The idea is we update the probability of H after we receive some data. This is how our brain is supposed to work. We think something is true, $P(H)$, we get evidence, D , and then we update what we thought was true to fit the new information, $p(H|D)$.

Problem

The distribution of the colors in m & m's changed between 1994 and 1996 (see table below).

	Blue	Brown	Yellow	Red	Green	Orange	Tan
1994	0%	30%	20%	20%	10%	10%	10%
1996	24%	13%	14%	13%	20%	16%	0%

Assume we draw exactly one candy from one bag of each year. Assuming we drew one yellow and one green. Let's say Bag 1 is the bag the yellow m & m was in.

H_1 : Bag 1 is from 1994 and bag 2 is from 1996.

H_2 : Bag 2 is from 1994 and bag 1 is from 1996.

	Prior $P(H)$	Likelihood $P(D H)$	$P(H)P(D H)$	Posterior $P(H D)$
H_1	1/2	(0.20)(0.20)	0.02	0.02/0.027 = 20/27
H_2	1/2	(0.10)(0.14)	0.007	0.007/.027 = 7/27
			0.027	

3. What is the probability in the Monty Hall Problem using this same analysis?