HW3

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Problem 1:

Show that satisfied when ,

subject to the constraint: .

Proof: (Using Lagrange multiplier)

The equality constraint function can be expressed as:

Let us define a new function

We will find the partial derivative of L.

To show that is given by Equation 1, all the params are irrelevant.

For any :

And,

Now we will solve the equality system:

As requested.

Problem 2:

Solution:

1. To make a uniform distribution over the space of all K-dimensional categorical distributions, we will need that where is a constant.

Hence, for we will obtain that: .

1. A uniform has the same value for each of its entries, .

A sampled from a uniform distribution is not necessarily distributed uniformly itself, it means the probability of obtaining any from the distribution is the same.

1. A prior usage might result in a noise reduction of the data from a prior knowledge information we already have on the problem. When choosing the parameters, in a sense, we are defining how we expect the samples to be sampled.

**Computer Problem 1:**

We will experiment on :

For

Chart, bar chart

Description automatically generatedChart

Description automatically generated

Figure

Chart, bar chart

Description automatically generatedChart

Description automatically generated

Figure

Chart, histogram

Description automatically generatedChart

Description automatically generated

Figure

Chart, bar chart

Description automatically generatedA picture containing chart

Description automatically generated

Figure

For

Chart, histogram

Description automatically generatedTimeline

Description automatically generated

Figure

Chart, histogram

Description automatically generated A picture containing chart

Description automatically generated

Figure

Chart, bar chart

Description automatically generated A picture containing chart

Description automatically generated

Figure

Chart, bar chart, histogram

Description automatically generatedChart, waterfall chart

Description automatically generated

Figure

For

Chart, histogram

Description automatically generatedChart

Description automatically generated with medium confidence

Figure

Chart, histogram

Description automatically generatedChart

Description automatically generated

Figure

Chart, histogram

Description automatically generated A picture containing chart

Description automatically generated

Figure

Chart, histogram

Description automatically generated Chart

Description automatically generated

Figure

Speculations:

* For , we have seen that large entries will cause losing range of colors, as just one gaussian will be dominant that will be picked most of the time.

(Can be seen in figures 8 and 12)

* For , we know that the covariance matrix equals to , therefore, for large the covariance will be very small and thus, the image will be noisier as the pixels of the image are not ‘effects’ each other. (Can be seen in figures 7 and 11 where the means picture gets very grey)
* For , (as the prior variable) we have seen that unbalancing it will cause a tendency towards one of the gaussians over the other. (Can be seen in figure 4 where the bright grass merged with the skies and only the dark green in the image clustered together)