Exercises for Bayesian Decision Theory
for special course in 2012

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# 1   A classification under 1-D Gaussian distribution

Exercise 1 *Assuming two classes ω_1 and ω_2 each follows 1-D Gaussian $N(\mu = 3, \sigma = 1)$ and $N(\mu = 7, \sigma = 2)$, respectively. (i) Create 20 sample points from each classes at random and plot them in x-axis. (ii) Then classify the data point, say, $x = 5$. Does this point belong to ω_1 or ω_2? How about the other point, say, (iii) $x = 4.5$ or (iv) $x = 5.5$?*

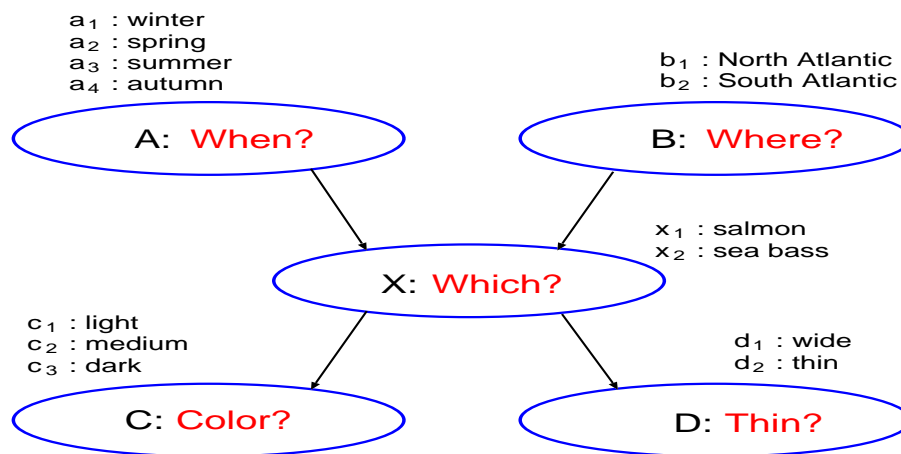First, you must recall 1-dimensional Gaussian p.d.f. See as follows.

$$p(x|\omega) = \frac{1}{\sqrt{2\pi}\sigma} \exp\{-\frac{1}{2}\frac{(x-\mu)^2}{\sigma^2}\}$$

where μ is mean value and σ is standard deviation of the distribution.

An example of 100 points following a p.d.f. is like bellow.
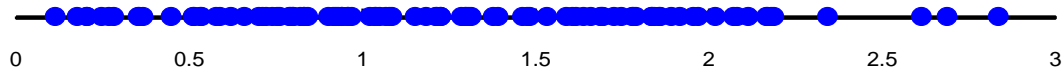
2 Inference

Assume all the parameter as follows:

	p(when)				p(where)	
	Winter	Spring	Summer	Autumn	North	South
	0.30	0.25	0.20	0.25	0.60	0.40

p(which | when)

	Salmon	Seabass
Winter	0.90	0.10
Spring	0.30	0.70
Summer	0.40	0.60
Autumn	0.80	0.20

p(which | where)

	Salmon	Seabass
North	0.65	0.35
South	0.25	0.75

p(color | which)

	Light	Medium	Dark
Salmon	0.33	0.33	0.34
Seabass	0.80	0.10	0.10

p(thickness | when)

	Salmon	Seabass
Salmon	0.40	0.60
Seabass	0.95	0.05

Figure 1: Given primer and conditional probabilities of Salmon and Sea-bass.

Exercise 2 *Create a program that asks a user (i) which valuable is the hyposethes and (ii) which valuables are evidences, from one valuable to the next.*

- *Is <a: winter> in <A: When>*

  - *your hypotheses? [yes][no]*
  - *your evidence? [yes][no]*

After the user specify his/her hypotheses, then stop asking this hereafter, only keep asking evidence from one item to the next.