# Re: How to solve the probability density of z=ax+w?

***Source:*** http://sci.tech−archive.net/Archive/sci.math/2007−03/msg01937.html


- *From*: hhwolf76 <james.zhou76@xxxxxxxxx>


- *Date*: Fri, 09 Mar 2007 15:03:49 EST


On Mar 8, 6:34 pm, matt271829−n...@xxxxxxxxxxx wrote:

> On Mar 8, 5:41 pm, hhwolf76
>
> <james.zho...@xxxxxxxxx> wrote:
>
> > This is a problem
> > If p(a=0)=1/2,p(a=1)=1/2
> > a,x,w are mutually independent. x,w are all
>
> normal distribution and their 1st and 2nd moment have
> been known. E(w)=0
>
> > Can I get the probability density of z=ax+w?
>
> If a = 0 then the pdf of z is the same as the pdf
>
> of w, call it
>
> P_0(z). If a = 1 then z = x + w, so z has a normal
>
> distribution whose
>
> mean is the sum of the means of x and w, and whose
>
> variance is the sum
>
> of the variances of x and w. Call this pdf P_1(z).
>
> Then, unless I'm overlooking something, the overall
>
> pdf of z should be

1/2*(P_0(z) + P_1(z)) (which is, of course, *not* a

normal

distribution).

and can I get E(x|z)?

As far as E(x|z) is concerned, the pdf of x given z,
should, if you'll
excuse the sloppy notation, be given by

P(x|z) = Pr(x and z)/Pr(z)

where

Pr(x and z) = 1/2*N(mu_x, sigma_x, x)*N(mu_w,
_w, sigma_w, z − x) +
1/2*N(mu_x, sigma_x, x)*N(mu_w, sigma_w, z)

I just don't know how do you get this Pr(x and z) ?

Pr(z) = 1/2*N(mu_xw, sigma_xw, z) + 1/2*N(mu_w,
_w, sigma_w, z)

and

N(m