Re: Principal Components (Hotelling of KL Transform) of 2 Band (Red and Green) Real Color Image

Source: http://sci.tech−archive.net/Archive/sci.image.processing/2009−01/msg00022.html

- *From*: Jonathan Campbell <jg.campbell.ng@xxxxxxxxx>
- *Date*: Wed, 07 Jan 2009 17:04:47 +0000

Jonathan Campbell wrote:

> PeterOut wrote:
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> > On Jan 6, 5:37 am, Jonathan Campbell <jg.campbell...@xxxxxxxxx> wrote:
> >
> > > PeterOut wrote:
> > >
> > > > Say you have a 2 channel image (red and
> > > > green channels for example)
> > > > and you want to get the principal
> > > > components in order to do a
> > > > Hotelling (Karhunen−Loève) transform on
> > > > the image so as to minimize
>
> [...]
>
> > > Thank you very much for your reply. You are right. I checked and it
> > > would appear that it is indeed the covariance matrix that I should
> > > use. However, it would appear that I would have the same problem
> > > since covariance is reflective and, consequently, the covariance
> > > matrix between the two data sets would be
> >
> > > M=1 a
> > > a 1
>
> Not unless the variance of both channels is 1? As I say, I have never applied PCA/K−L to 2−d. data, so I'm a little hesitant.
>
> Variance−covariance matrix = Cov = E{ (x − mu) (x − mu)^T } ? 2 x 2 in your case. mu = mean.

Just looking at equations that I use for determining major and minor axes for 2−d. shapes (Masters, 1994, p. 316); same problem and I know these 'work'.

Cov = [a b; b c]

Let r = sqrt((a−c)^2 + 4 b^2)

Eigenvalues: lmax = (a+c+r)/2, lmin = (a+c−r)/2

Eigenvectors: vmax = (a−c+r, 2b); vmin = (a−c−r, 2b); checks with your eigenvectors I think, but that gets us no further.

Masters warns that if the eigenvalues are nearly equal, then the eigenvectors are ill−defined; doesn't that mean a circularly−symmetrical data cloud?

@Book{masters,
author = "T. Masters",
title = "Signal and Image Processing with Neural Networks: C++
sourcebook",
publisher = "John Wiley \& Sons",
address = "New York",
year = "1994"
}

Best regards,

Jon C.
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