Subject: Re: mnf and masks
Posted by Peter Mason on Fri, 01 Jul 2005 00:25:49 GMT
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msauer@calpoly.edu wrote:
> I've recently applied forward mnf in ENVI to an image in which I've
> employed a mask to knock out the region surrounding the one I'm
> interested in. The MNF output shows that the masked area has values of
> zero while the region I'm interested in has + or - values. Good.
> However, when I apply the inversion using the stats from this
> transform, the image that results shows that the previously masked
> areas have values, the same throughout, and z-profiles that appear to
> approximate the mean spectra of the whole region I'm interested in.
> Thought that these previously masked areas should still be 0 with a
> flat line for a spectrum, indicating no data. I've done a map
> difference image thru band math which seems to indicate a difference
> of ~0.002 (rounding error?). Why does area in the inversion
> corresponding to the mask employed in the mnf have a spectrum and
> data values?

The inverse MNF transform is done with a calculation like this (shown here for one spectrum):
    inv_mnf_spec = (mnf_spec ## inv_mnf_trans_matrix) + scene_mean_spec
"Scene_mean_spec" is the mean spectrum, calculated over the masked-on pixels in the (earlier) forward MNF stats step.
MNF is driven by differences from a mean spectrum, so this mean is subtracted from all the spectra when going into MNF space and added back when going out. It's stored in the MNF stats file.

The mask option in ENVI's forward-MNF module is a bit confusing, as this module's work is done in four stages: estimation of noise stats, calculation of signal stats, calculation of transformation matrices from the signal & noise stats, actually transforming the image. It might look like the mask is just for tidying up the result in the last stage but it is also used to focus the signal stats in the second stage. (IMHO this is its *main* use and it should get a mention in the docs.) I don't think that the noise stats are done through the mask (they never used to be in the past) - they (now) have a separate spatial subsetting option of their own.

ENVI's inverse-MNF module has no knowlege of whether or not a mask was used in the forward transform. (It isn't safe to assume that an all-zero MNF spectrum means "this one was masked off so the inverse-MNF spectrum should be all-zero as well".)
The lack of a mask option in this module is probably an oversight. It's much more straightforward than the forward module and has no "higher reason" for a mask option. I imagine that no-one has asked RSI to put one in yet.

HTH

Cheers
Peter Mason

Subject: Re: mnf and masks
Posted by msauer on Fri, 01 Jul 2005 16:51:04 GMT
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Thanks Peter,

It seems that ENVI did do the MNF reduction on the image scene only and that the masked area that surrounded this image scene all had values of 0 as seen in the forward MNF individual band gray scale results. I'm hypothesizing that the masked section in the forward MNF did not have the mean spectra subtracted from its constant 0 value across all bands since the very definition of the mask basically says dont use this part in any calculations, but upon its reintroduction in the inversion, the mean spectra is applied to zero where the mask is no longer valid and is applied directly(unfortunately). Where then is the data for these masked values after the MNF inversion coming from especially since it seems that the low data values (0.002) could be attributable to rounding errors induced when a spectra is subtracted and then added back to produce a slight diversion from zero for these masked image data values. I guess my interpretation of this would be that the mean spectra has data values of 0 and different pixel spectra deviations from this gives particular data values which is seemingly based on the definition of how MNF theoretically works as described below. For masked pixels it would, the spectra would be the result of the mean spectra + 0 for masked pixels that do not have an inv transform matrix applied to it.

It certainly would be nice if the inversion could have some 'higher' calling, that would allow a mask to be supported in the inversion since not having one evidently might have effects on down the line processing of this particular image.

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