NAG Library Function Document

nag_wav_2d_coeff_ext (c09eyc)

1 Purpose

nag_wav_2d_coeff_ext (c09eyc) extracts a selected set of discrete wavelet transform (DWT) coefficients from the full set of coefficients stored in compact form, as computed by nag_mldwt_2d (c09ecc) (two-dimensional DWT).

2 Specification

```
#include <nag.h>
#include <nagc09.h>
void nag_wav_2d_coeff_ext (Integer ilev, Integer cindex, Integer lenc,
     const double c[], double d[], Integer pdd, Integer icomm[],
     NagError *fail)
```

3 Description

nag_wav_2d_coeff_ext (c09eyc) is intended to be used after a call to nag_mldwt_2d (c09ecc) (two-dimensional DWT), which in turn should be preceded by a call to nag_wfilt_2d (c09abc) (two-dimensional wavelet filter initialization). Given an initial two-dimensional data set A, a prior call to nag_mldwt_2d (c09ecc) computes the approximation coefficients (at the highest requested level) and three sets of detail coeficients at all levels and stores these in compact form in a one-dimensional array **c**. nag_wav_2d_coeff_ext (c09eyc) can then extract either the approximation coefficients or one of the sets of detail coefficients at one of the levels into a matrix D. The dimensions of D depend on the level extracted and are available from the arrays **dwtlvm** and **dwtlvn** as returned by nag_mldwt_2d (c09ecc) which contain the first and second dimensions respectively. See Section 2.1 in the c09 Chapter Introduction for a discussion of the two-dimensional DWT.

4 References

None.

5 Arguments

Note: the following notation is used in this section:

n_{cm} is the number of wavelet coefficients in the first dimension, which, at level **ilev**, is equal to **dwtlvm**[**nwl** − **ilev**] as returned by a call to nag_mldwt_2d (c09ecc) transforming **nwl** levels.

n_{cn} is the number of wavelet coefficients in the second dimension, which, at level **ilev**, is equal to **dwtlvn**[**nwl** − **ilev**] as returned by a call to nag_mldwt_2d (c09ecc) transforming **nwl** levels..

1: **ilev** – Integer *Input*

On entry: the level at which coefficients are to be extracted.

Constraints:

$1 \leq$ **ilev** $\leq$ **nwl**, where **nwl** is as used in a preceding call to nag_mldwt_2d (c09ecc);
if **cindex** $= 0$, **ilev** $=$ **nwl**.

2: **cindex** – Integer *Input*

On entry: identifies which coefficients to extract. The coefficients are identified as follows:

cindex $= 0$
The approximation coefficients, produced by application of the low pass filter over columns and rows of the original matrix (LL). The approximation coefficients are available only for **ilev** $=$ **nwl**, where **nwl** is the value used in a preceding call to nag_mldwt_2d (c09ecc).

cindex $= 1$
The vertical detail coefficients produced by applying the low pass filter over columns of the original matrix and the high pass filter over rows (LH).

cindex $= 2$
The horizontal detail coefficients produced by applying the high pass filter over columns of the original matrix and the low pass filter over rows (HL).

cindex $= 3$
The diagonal detail coefficients produced by applying the high pass filter over columns and rows of the original matrix (HH).

Constraint: $0 \leq$ **cindex** ≤ 3 when **ilev** $=$ **nwl** as used in nag_mldwt_2d (c09ecc), otherwise $1 \leq$ **cindex** ≤ 3.

3: **lenc** – Integer *Input*

On entry: the dimension of the array **c**.

Constraint: **lenc** must be unchanged from the value used in the preceding call to nag_mldwt_2d (c09ecc)..

4: **c**[**lenc**] – const double *Input*

On entry: DWT coefficients, as computed by a preceding call to nag_mldwt_2d (c09ecc).

5: **d**[*dim*] – double *Output*

Note: the dimension, *dim*, of the array **d** must be at least **pdd** $\times n_{\mathrm{cn}}$.

On exit: the requested coefficients.

If **ilev** $=$ **nwl** (as used in nag_mldwt_2d (c09ecc)) and **cindex** $= 0$, the n_{cm} by n_{cn} approximation coefficients a_{ij} are stored in **d**$[(j-1) \times$ **pdd** $+ i - 1]$, for $i = 1, 2, \ldots, n_{cm}$ and $j = 1, 2, \ldots, n_{cn}$.

Otherwise the n_{cm} by n_{cn} level **ilev** detail coefficients (of type specified by **cindex**) d_{ij} are stored in **d**$[(j-1) \times$ **pdd** $+ i - 1]$, for $i = 1, 2, \ldots, n_{cm}$ and $j = 1, 2, \ldots, n_{cn}$.

6: **pdd** – Integer *Input*

On entry: the stride separating row elements in the two-dimensional data stored in the array **d**.

Constraint: **pdd** $\geq n_{\mathrm{cm}}$.

7: **icomm**[**180**] – Integer *Communication Array*

On entry: contains details of the discrete wavelet transform and the problem dimension as setup in the call to the initialization function nag_wfilt_2d (c09abc).

8: **fail** – NagError * *Input/Output*

The NAG error argument (see Section 2.7 in How to Use the NAG Library and its Documentation).

6 Error Indicators and Warnings

NE_ALLOC_FAIL

Dynamic memory allocation failed.
See Section 2.3.1.2 in How to Use the NAG Library and its Documentation for further information.

NE_BAD_PARAM

On entry, argument ⟨*value*⟩ had an illegal value.

NE_INITIALIZATION

Either the initialization function has not been called first or **icomm** has been corrupted.

Either the initialization function was called with **wtrans** = Nag_SingleLevel or **icomm** has been corrupted.

NE_INT

On entry, **cindex** = ⟨*value*⟩.
Constraint: **cindex** ≤ 3.

On entry, **cindex** = ⟨*value*⟩.
Constraint: **cindex** ≥ 0.

On entry, **ilev** = ⟨*value*⟩.
Constraint: **ilev** ≥ 1.

NE_INT_2

On entry, **ilev** = ⟨*value*⟩ and **nwl** = ⟨*value*⟩.
Constraint: **ilev** $\leq$ **nwl**, where **nwl** is the number of levels used in the call to nag_mldwt_2d (c09ecc).

On entry, **lenc** = ⟨*value*⟩ and n_{ct} = ⟨*value*⟩.
Constraint: **lenc** $\geq n_{\mathrm{ct}}$, where n_{ct} is the number of DWT coefficients computed in a previous call to nag_mldwt_2d (c09ecc).

On entry, **pdd** = ⟨*value*⟩ and n_{cm} = ⟨*value*⟩.
Constraint: **pdd** $\geq n_{\mathrm{cm}}$, where n_{cm} is the number of DWT coefficients in the first dimension at the selected level **ilev**.

NE_INT_3

On entry, **ilev** = ⟨*value*⟩ and **nwl** = ⟨*value*⟩, but **cindex** = 0.
Constraint: **cindex** > 0 when **ilev** $<$ **nwl** in the preceding call to nag_mldwt_2d (c09ecc).

NE_INTERNAL_ERROR

An internal error has occurred in this function. Check the function call and any array sizes. If the call is correct then please contact NAG for assistance.

An unexpected error has been triggered by this function. Please contact NAG.
See Section 2.7.6 in How to Use the NAG Library and its Documentation for further information.

NE_NO_LICENCE

Your licence key may have expired or may not have been installed correctly.
See Section 2.7.5 in How to Use the NAG Library and its Documentation for further information.

7 Accuracy

Not applicable.

8 Parallelism and Performance

nag_wav_2d_coeff_ext (c09eyc) is not threaded in any implementation.

9 Further Comments

None.

10 Example

See Section 10 in nag_wfilt_2d (c09abc), nag_mldwt_2d (c09ecc) and nag_wav_2d_coeff_ins (c09ezc).