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** $> n_{\mathrm{cm}}$.

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 3.6 in the Essential Introduction).

6 Error Indicators and Warnings

NE_ALLOC_FAIL

Dynamic memory allocation failed.

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.

7 Accuracy

Not applicable.

8 Parallelism and Performance

Not applicable.

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).