Subject: Non-zero diagonals for sparse format
Posted by the_cacc on Thu, 23 Oct 2003 18:12:38 GMT
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Hi,

Suppose you have a matrix with lots of zero elements:

```
IDL> n = 100
IDL> A = randomu(1,n,n) * (randomu(2,n,n) GT 0.95)
IDL> print,total(A EQ 0)
     9449.00
```

Normally you don't have the full matrix A but only co-ordinates for where the non-zeros are:

```
IDL> nz = WHERE(A NE 0)
IDL> sa = A[nz]
IDL> xa = nz MOD n
IDL> ya = nz / n
```

Then you can create a sparse array structure:

```
IDL> B = sprsin(xa,ya,sa,n)
```

Confirm it's identical to A:

```
IDL> print,TOTAL(ABS(fulstr(B) NE A))
    0.000000
```

However, the sparse format in IDL *always* stores the diagonals, regardless of whether they're zero, which results in extra stored zeros:

```
IDL> help,nz
NZ              LONG      = Array[551]
IDL> help,B.sa
<Expression>    FLOAT     = Array[643]
```

In this example, there's about 20% inefficiency. The actual array I'm using is around n = 10^5 and I'm carrying around ~10^5 extra zeros.

Since the array is created only once then used hundreds of times for matrix multiplications it makes sense to spend some time trying to swap the rows so that the diagonals contain non-zeros whenever possible.

So the problem is:

How to swap rows of a matrix to ensure that the diagonals are mostly non-zero?
