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Subject: Re: Fast computation of pairwise array element differences

Posted by [Jeremy Bailin](#) on Sun, 04 Dec 2011 19:13:11 GMT

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On 12/4/11 11:28 AM, erik@bertram-kirn.de wrote:

> Hi folks,  
>  
> I have the following problem that I want to solve with IDL, but do not  
> know how:  
>  
> I have a  $n^2$  array (2D) with some arbitrary numerical data in it and a  
> lengthscale L (let's say a certain number of cells smaller than n).  
> What I want to do now is to compute all possible differences of  
> elements in this 2D array that are L cells far away from each other,  
> but \*without using loops\*!  
>  
> Of course, I could do the following (in pseudo code):  
>  
> -----  
> diff = 0.d  
>  
> FOR x = 0, n do begin  
> FOR y = 0, n do begin  
> - Take array element (x, y)  
> - Look for all cells that are L cells away from cell (x, y)  
> (e.g. in a ring around (x, y) with radius of L cells)  
> - compute all differences from (x, y) to the other cells in a  
> radius of L  
> - Summ differences up in a variable diff  
> - continue with next array element and compute next differences  
> and so on...  
> ENDFOR  
> ENDFOR  
> -----  
>  
> This is an easy mathematical operation. Nevertheless, for an array of  
> 500 x 500 it takes about hours to step through all the looping  
> processes and to calculate the sum of really all possible differences  
> on a lengthscale of L cells...  
>  
> Does someone have another idea how to avoid the loops in this case and  
> to compute all possible differences in such an array very easily?  
>  
> Thank you very much!  
>  
> Kind regards,  
>  
> Erik

It sounds like you're trying to do a convolution with a kernel that looks something like (schematic):

```
0 0 0 1 1 1 0 0 0
0 0 1 0 0 0 1 0 0
0 1 0 0 0 0 0 1 0
0 1 0 0 -16 0 0 1 0
0 1 0 0 0 0 0 1 0
0 0 1 0 0 0 1 0 0
0 0 0 1 1 1 0 0 0
```

(for a particular L of 3, say). If so, try looking at CONVOL, and also convolution via FFT.

-Jeremy.

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