Re: cubic convolution interpolation at boundaries?

Source: http://sci.tech−archive.net/Archive/sci.math.num−analysis/2007−04/msg00213.html

- *From*: Fred Krogh <fkrogh@xxxxxxxxxxxxxxxx>
- *Date*: Thu, 26 Apr 2007 15:35:54 −0700

Markus wrote:

> On Apr 25, 5:00 pm, Fred Krogh <fkr...@xxxxxxxxxxxxxxxx> wrote:
>
>> Markus wrote:
>>
>>> I am using the symmetric cubic convolution kernel
>>> ("Catmull−Rom
>>> splines") to interpolate data over a limited range in a variable
>>> x.
>>> For the interpolation I am using between 8 and 12 nodes
>>> which are
>>> equidistant in x.
>>> Example: The interpolated function between nodes 4 and 5 is
>>> computed
>>> based on the data points at nodes 3,4,5,6
>>> My question is: how should I treat the ranges near the
>>> boundary?
>>> If I am using 10 nodes, how should I interpolate the data
>>> between node
>>> 9 and 10? So far I am using linear interpolation here − but
>>> this is
>>> conceptually ugly (and it's not precise, although the latter is
>>> not my
>>> biggest problem since I want a _nice_ solution).
>>> I am especially worried that in my current approach the
>>> interpolated
>>> function has no continuous 1st derivative at node 9.
>>> Is there a solution, in which I could use e.g. a
>>> non−symmetric
>>> convolution kernel to interpolate between nodes 9 and 10,
>>> based on the
>>> nodes 8,9,10 or maybe 7,8,9,10 − and which results in a
>>> continuous 1st
>>> derivative everywhere?
>>> I have not found any discussion about the
>>> boundary−treatment in the
>>> literature (and neither on the Google−wide web). In image
>>> processing

> sometimes people mirror the image at the boundaries (i.e.
> they would
> introduce a hypothetical 11th node for which the data value
> is set
> equal to the data at the 9th node and interpolate using the
> data
> points at nodes 8,9,10,11) − but this would not work in my
> case.
> Any help is appreciated!
> Markus

The algorithm here,http://mathalacarte.com/cb/mom.fcg/ya58, generates an interpolant with a continuous derivative. For the cubic case the interpolant can be thought of as a linear combination of two quadratics if there are two points on either side of the interpolation point. If there are not two points on either side of the interpolation point, then the quadratic using the nearest three points is used. For more details see the link above.
Fred

This sounds pretty good. I think th