

DEM Interpolation: Why settle for less?

David B. Kidner

*University of Glamorgan
GIS Research Centre, School of Computing
Wales
e-mail: dbkidner@glam.ac.uk*

Abstract. Digital terrain modelling addresses the problem of characterising the Earth's surface by either numerical or mathematical representations of a finite set of terrain measurements. As such, it is necessary to have efficient and precise algorithms for the interpolation of surface elevations between given points. Interpolation is a core function of all digital terrain modelling systems, which we take for granted in our applications – at our peril! At a time when we are now questioning the accuracy of DTM products (e.g. viewsheds, drainage networks, contour maps, etc.), it is essential that we consider the context in which interpolants are used and their relative performance. While some users will demand a real-time solution, others might prefer an accurate solution? This paper argues that we should have a choice, and demonstrates the benefits of better modelling strategies for interpolation within a regular grid digital elevation model (DEM). Higher order interpolation techniques will always outperform the traditional linear or bilinear algorithms favoured by most GIS. A variety of interpolation algorithms are analysed quantitatively (statistically) and qualitatively (visually) via (i) DEMs at a variety of different scales, (ii) benchmark synthetic surfaces which mimic terrain, and (iii) visual comparisons of cartographic output. In all cases, techniques that “model” the local terrain neighbourhood are more consistent and accurate. The increased computational overheads of these alternatives must then be weighed up against accuracy. The majority of these better algorithms are not new – they were developed by the terrain modellers of the 1970s, but often rejected in favour of the quicker linear techniques. Perhaps we should ask whether the developments in computers and CPU performance over the last thirty years warrant these interpolants being given another chance? Why settle for less?