

WATERMARKING CURVES FOR FINGERPRINTING DIGITAL MAPS

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ABSTRACT. *We propose an efficient watermarking technique that may be applied to curves, and is thus suitable for fingerprinting digital maps. We make use of an embedding domain based on the curvature at sampled points, and alter the coordinates of selected sample points to achieve watermark embedding. The watermarked curve is reconstructed using Bezier curve segments. The use of a Bezier model not only ensures a high embedding capacity and a good detection performance but also minimises the distortion of the embedding process.*

Keywords: Bezier curve, Collusion-resistant fingerprinting, Map watermarking, Resilience to printing-and-scanning

1. **Introduction.** Digital multimedia have several advantages over analog media, the most notable being, that is, they can be copied easily and cheaply without any reduction in quality. However, these advantages can present problems in terms of copyright protection, particularly since illegal copying and distribution are also much easier in digital media.

The use of digital watermarking can provide a solution for multimedia copyright protection. It solves this problem by hiding permanent copyright information within the data, because this hidden information may be used as evidence when a copyright dispute occurs. Numerous watermarking schemes have been developed for images [1-5], which alter pixel values slightly and thus embed a watermark.

Digital maps are widely used in government, military and commercial operations. Due to the fact that these data are often presented in the form of digital images, early techniques for digital rights management simply made use of digital image watermarking techniques to enforce copyright protection or to trace traitors [6]. Yet the data structure of maps differs from that of images; hence, these older image watermarking methods cannot be applied to digital maps. However, maps use geometric primitives, such as points, lines, curves, and polygons; hence, watermarks may be applied to maps by modifying these properties.