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| <p>(21) International Application Number: <b>PCT/SG98/00039</b></p> <p>(22) International Filing Date: <b>1 June 1998 (01.06.98)</b></p> <p>(71) Applicant (for all designated States except US): <b>DATAMARK TECHNOLOGIES PTE LTD. [SG/SG]; Innovation Centre, Block 1, Suite 106, 16 Nanyang Drive, Singapore 637722 (SG).</b></p> <p>(72) Inventors; and<br/>(75) Inventors/Applicants (for US only): <b>HO, Anthony, Tung, Shuen [GB/SG]; Nanyang Technological University, School of Electrical &amp; Electronic Engineering, Block S2, Nanyang Avenue, Singapore 639798 (SG). TAM, Siu, Chung [SG/SG]; Nanyang Technological University, School of Electrical &amp; Electronic Engineering, Block S2, Nanyang Avenue, Singapore 639798 (SG).</b></p> <p>(74) Agents: <b>HAQ, Murgiana et al.; Haq &amp; Namazie Partnership, Robinson Road, P.O. Box 765, Singapore 901515 (SG).</b></p> | <p>(81) Designated States: <b>AU, CA, CN, ID, JP, KR, SG, US, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).</b></p> <p><b>Published</b><br/><i>With international search report.</i></p> |                                                                                                                                     |

(54) Title: METHODS FOR EMBEDDING IMAGE, AUDIO AND VIDEO WATERMARKS IN DIGITAL DATA

## (57) Abstract

A method for embedding an entire image, audio or video watermark sequence within another image, audio or video data sequence with minimum loss of data quality is presented. The method exploits the de-correlation property of data coefficients in the orthogonal transform domain, similar to the application in data compression through transform coding. The present invention describes the usage of a Discrete Cosine Transform as the embedding domain. However, other orthogonal transforms such as Fourier, Walsh-Hadamard, Haar, Sine and Wavelet can also be used for this operation. A unique key derived adaptively from spatial locations registering the thresholds of the ac transform energies is used to unlock or de-watermark the embedded image or audio sequence. Moreover, an exponential filter has been developed to compress and expand the watermark coefficients prior to the embedding and retrieval process. The method can be used in resolving multimedia copyright protection issues arising on the Internet and in the music industry, such as the inclusion of a company's logo or an artist's recorded voice. The method can also be incorporated as a built-in feature for digital recording devices, such as still and video cameras, as well as more recent devices such as VCD and DVD players. Moreover, the method can be applied to the commercial and service sectors, where security in transmission and reception of private information in terms of speech or image is of the utmost importance.

