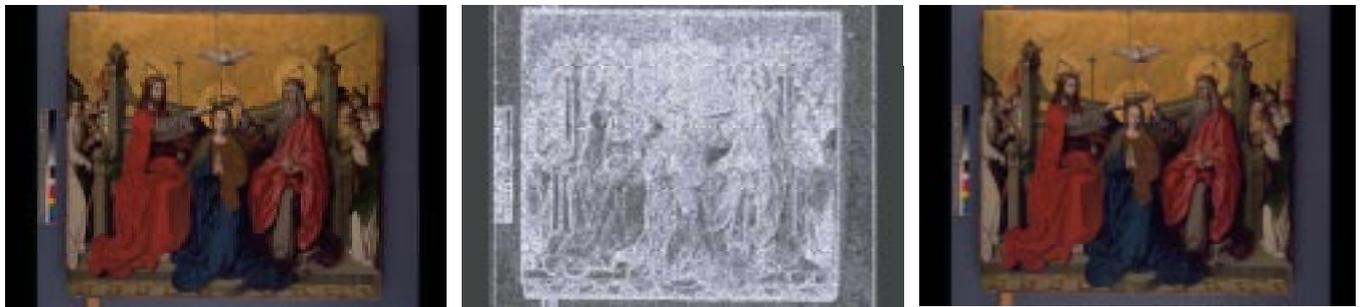


Digital Copyright Protection for Multimedia Documents

Digital watermarking

Copyright infringements of digital audio, images, videos, and 3D models can be detected by means of digital watermarks. Digital watermarks are invisible signatures that are embedded in a document in such a way that they are resistant to unintentional or malicious modifications of the document: only the copyright holder owns the key that permits the decoding and/or removal of the watermark. This watermark, typically a 64 bit information string that is registered at the copyright certificate center, allows to uniquely identify the document and its owner.

The DCT watermarking process relies on the inability of the human visual system to perceive small differences in optical data, especially in edge areas. The watermark bits, first encoded as a pseudo-random sequence, are then hidden in image parts where the color or gray values vary rapidly. The illustrations below show from left to right an original image, the content dependent and pseudo-random sequence based pseudo-random pattern (watermark), and the resulting protected image (original image combined with the pseudo-random pattern); the image quality is fully preserved.



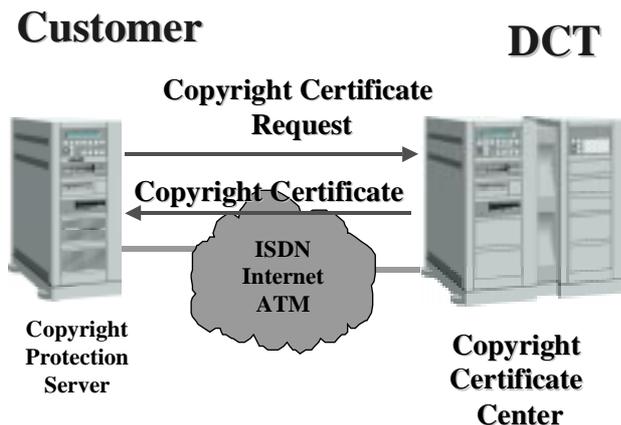
The six key aspects of the DCT watermarking technology

1. Images, videos(raw or compressed), and 3D models can be marked.
2. The original document is not necessary to decode and read the watermark. Only the copyright holder's key and the watermarked document are required.
3. The watermarks are resistant to multiple watermarking, as well as to a variety of image manipulations, such as JPEG and MPEG compression, printing-rescanning, rotation, scaling, cropping, filtering, color changes, etc. . In the case of videos, the watermarks are resistant to format conversion, frame-rate changes, etc. .
4. A time dependent identification is supported.
5. The process is content adaptive to prevent any visible artifacts.
6. The embedding/detection is based on a cryptographic public key scheme. A third party may, therefore, verify in a legal dispute who has embedded the watermark.

The DCT watermark technology has been evaluated by means of a public watermarking benchmark (University of Cambridge, UK) and according to our tests ranks the best. Pilot users have also expressed their satisfaction after an evaluation of the product. The illustration at the end of this brochure shows that many distortions may be applied to an image without destroying the DCT watermark.

Copyright protection

The proof of copyright ownership is strengthened if data derived from the water-



marked document is registered at the copyright certificate center. If several people embed different watermarks into the same image, the digital watermark combined with the digital copyright certificate, generated by the copyright certificate center and send back to the copyright holder, provides an adequate proof of copyright ownership.

As with analog images where a single unique original is always available, a unique digital watermark is provided for every digital image. In contrast to other technologies, the security of the DCT system is based on the secrecy of the cryptographic keys and not on the secrecy of technical procedures. A legal assessment of the DCT technology has shown that the supported features are necessary to provide the adequate amount of evidence required to be successful in a court case.

Products and service

DCT offers two commercial software products and one service. For the PC platform, DCT offers the **Pretty Good Signature (PGS)** product which allows to embed watermarks by file selection. The copyright protection server enables the copyright protection of digital images or videos in batch processing mode, dedicated for the protection of thousands of files for a service provider. The copyright certificate center is a specific service offered in combination with the copyright protection server. It receives secure electronic requests from a copyright protection server and generates the digital copyright certificate. This digital copyright certificate is locally stored at the copyright certificate center and then transmitted to the requesting copyright protection server. Other data such as digital certificates for cryptographic keys applied by the copyright protection server during the copyright protection operations can be provided along with the digital copyright certificates.

The DCT products are based on the DCT multimedia security platform. This platform is partitioned into several software development kits for different types of multimedia data. The platform supports also an enhanced PKCS#11 compliant cryptographic toolkit.

Digital Copyright Technologies Ltd.

Digital Copyright Technologies, Ltd. (DCT), a start-up company based in Zurich Switzerland, is one of the technological leading companies in the copyright protection and secure distribution of digital multimedia data. Our innovative technology (different patents and ongoing patent applications), developed in several advanced European and Swiss research projects such as ESPRIT-OMI (Jedi-Fire), ACTS (Talisman, Octalis, Accopi), SPP (Media), or KTI, addresses the commercial customer needs of multimedia service providers (image or video archives) and small multimedia companies (photographers, graphic designers).

Via the close research cooperation with the Computer Vision Group of the University of Geneva (Prof. T. Pun) and the Signal Processing Laboratory of the EPF-Lausanne (Prof. M. Kunt, Prof. T. Ebrahimi), DCT offers the most advanced technology in the market. In contrast to the competition, DCT participates in the technical selection processes of international conferences and robustness tests. DCT has been selected in 1998 as one of the top 50 European most promising start-up companies (IST'98 Forum in Vienna, December 1998) and received in March 1999 the quality label KTI START-UP! from the Swiss government (BBT/OFFT/UFFT).

Further information

For further information about the DCT technology please contact:

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Many distortions may be applied to an image without destroying the DCT watermark.



Key: 9 Signature: 987654321



Solarize: OK (Key: 9 Signature: 987654321)



Edges: OK (Key: 9 Signature: 987654321)



Wind: OK (Key: 9 Signature: 987654321)



4 objects: OK (K=9 S=987654321, K=1 S=123456789, K=5 S=123123123, K=15 S=321321321)



Blending: OK (K=9 S=987654321, K=1 S=123456789)