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**Watermarking benchmark**

Subject: Analyze, conception and installation of an on line watermark algorithm benchmark.  
The goal is to simplify the test for the scientific community, and the algorithms' choice for the user who wants to secure his numerical creation.



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## ABSTRACT

Actually, we live in the world of information. All data around us can be digitalized. All digitalized data can be infinitively duplicated with no quality lost and can be distributed over the entire world in some seconds.

This fact is not a problem for temperature, weather or time samples in a specific place on the earth. The problem is due to the duplication and the distribution of information created by human. This type of information is frequently under copyright license. Those creations are generally pictures, paintings, videos films, music tracks or more technical information like three dimensional objects models or software.

If all artistic creations could be distributed and duplicated as the same as the original, this would penalized authors. They couldn't get the benefit of their work and would not say that they were the real designer of the creation.

The first solution is in fact to sign data with the author name or with a secret certificate. With this system, he can be identified. He also can receive his benefit and be sure to prove that he was the one and only author of the data.

The second solution is to sign the data with the name or with a secret certificate witch identify the allowed user. This system asks the user to be responsible of the rights' diffusion. If any other user gets the signed creation, the real owner can be accused of illegal transmission.

The merging of these two solutions is the only way for authors to create secured data.

The biggest problem for the information technology is to make the data and certificates not dissociable. That's a big problem when we know that all digitalized data are sums of independents structures samples easily extractable by the littlest computer of the world.

The solution found by the scientific community is to make a mathematical analyze of the data and apply a little distortion of the data depending with certificates. The deformation has to be undetectable by human but readable by a computer who knows the mathematical reading algorithm. This system is called Watermarking, it can store watermark in data to create watermarked data that seem to be identical to the original. The data is the certificate, so they can't be dissociated.

The other common problem is that data can be deteriorated by compression or by filter algorithms. To resist to these attacks, the watermarking algorithms must be robust. The usual attack is, for example, the MP3 compression of an audio CD, a printing or a scanning of a painting, the MPEG compression of a DVD, resizing or cutting pictures...The watermark technology is used in a plenty of media type. For a same media type, different technology can be used.

For helping authors to choose the adapted watermarking algorithm, create a benchmark is necessary. This benchmark could be used for testing watermarking algorithm. It can be very useful for the scientific community.

The project of an on line benchmark was my work in this Catholic University of Louvain (UCL) in Belgium.

The U.C.L. vocation is the experimental research on the hyper frequency tele detection, pictures coding and processing, digital communication systems and secure multimedia networks.

I have joined the telecommunication and teledetection section in the Net-image group directed by Benoît Macq.

The UCL was founded in 1425. It is one of the oldest universities in the world. At the end of the sixties, the university split in two parts. The francophone part of the university moved to Wallonie. The new created town took the name of “Louvain la Noeuvre”.

The UCL is composed by 20 000 students and more than 100 different nationalities and 5 000 searchers.

The telecommunication department is composed by a scientific staff of 33 members, an administrative staff of 8 members and an academic staff of 6 members.

Usually the European projects are an important part of the work in UCL, but there is also some “spin off” which generate a lot of works. Spin off is an internal company created by searchers of the UCL.

For this project, we made a new staff of 3 members. We were directed by Frederic Lefebvre, helped by Audric Thevenet for the WEB part of the Benchmark. The project started from nothing, and had, at last, to be a finalized application.

I had to generate the technical part of the benchmark. The technical part must interpret tests scenario, launch watermark algorithms on a pictures bank and has to store results on a database. Audric Thevenet’s part was to create the WEB user interface to launch tests and read the results.

The first task is to analyze and redraw the advantages of the existing benchmarks witch were not one the WEB.

After that, my work was to cut the benchmark kernel in multiple parts to allow the launching of different types of algorithms written in different languages over diverse platforms. We had to create a client server system to interact with the different architectures usually used by the watermark developer.

To realize the scenario interpreter, we also had to create a library system capable to exchange picture between reading, attacking, watermarking and testing algorithms.

To test the benchmark kernel, we had to write a JPEG, PPM, PGM pictures loader, a steganographic elementary watermarking algorithm, a simple motion blur attack, and the Peak Signal to Noise Ratio quality check system.

The deployment architecture has been realized on the Linux/PC system, NET-BSD/PC system Solaris/Sun system, OSF/Alpha system, Win32/PC system and Matlab/Linux system to drive more algorithms format as possible.

After the release of the benchmark, a technical documentation has been written in French and in English for future users and development contributors. The sources codes are also strictly documented in English for the same goal.

The kernel development was not as a team work. The kernel developer was not directly in contact with the final user. His only interaction is with the developers who use his technologies. These only relationships during the projects development are the comments written in his sources code, for the futures readers.

This distance with the people who work in the UCL, is not a problem to match the project specifications and have a good time with them.

This experience, made me improve my knowledge about system technologies. It helped me to discover and to contribute to the scientific world. It gives me a different approach of the multimedia technology and the possibility to create tools used by a lot of people.