



Telecom Bretagne

LaTIM Inserm UMR1101 / Dpt. ITI

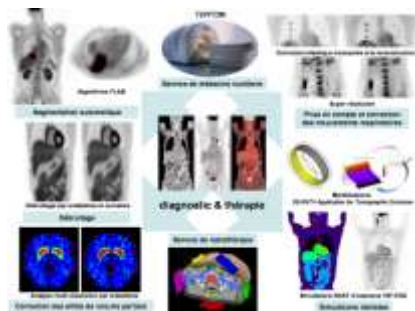
GD2MP / *Traceability & Integrity Research*



Gouenou Coatrieux



LaTIM research axes

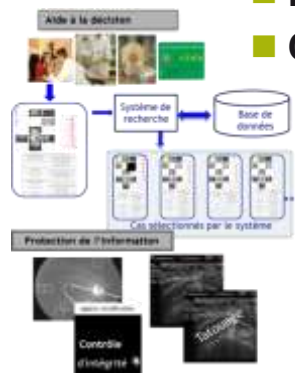


Non-interventional therapies: Quantitative image processing for diagnostic and therapy

- Oncology Domain,
- Quantitative Multimodal Imaging for Diagnosis and Therapy
- Therapeutic response Identification and monitoring
- Radiotherapy planning

Interventional therapies

- Orthopedy and functional rehabilitation
- Surgery and implant optimization
- Determination of accurate biomechanical models
- Consideration of pathophysiological evolution models



Management of shared multimodal medical data for decision support (GD2MP - Transversal axis)

- Multimodal information retrieval (Determination of signatures, indexation, data mining)
- Data security

Emerging axes

- Modelization of bone infection – Neuro imaging in 3D environnement



LaTIM presentation

Clinical and technological platforms

- **PIMATGI: Regional platform for image guided therapy - (low X-ray dose whole body EOS, 3D US, 3T MRI, fMRI, dedicated operating theater ...)**
- **Chorna : Clinical platform for orthopedic surgery**
- **PLACIS: Platform High Computing Performance (HPC) for intensive computation and simulation**

Labex ...

- **CominLabs – COMmunication and Information sciences Laboratories**
- **CAMI – Computer assisted Medical Interventions**
- ...

Human resources:

- **24 Permanent Researchers**
- **6 Post-Docs/Ing.**
- **30 Ph.D. Students**



Security - Global objectives & approaches

- Protection of digital contents by means of ***a priori*** and ***a posteriori*** mechanisms :
 - *Leave access to the information, while maintaining it protected*
 - *Integrity, traceability and confidentiality of digital content*
 - *Continuous protection of data beyond information system frontiers*
- Considered framework: medical data sharing and exchange in open environments, outsourced data (e.g. Cloud, télémedecine)



- Solutions based on watermarking and cryptographic algorithms with protocols in agreement with a security policy

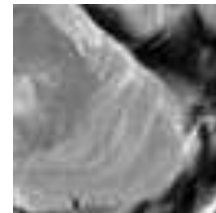


Blind and non-blind digital-forensics

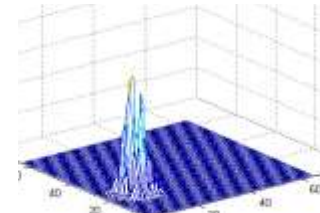
Objectives : detection, localization and identification (at least approximating) of the image tamper

■ Watermarking/signature based digital forensics.

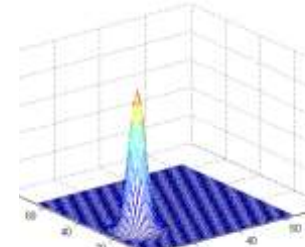
- Combination of cryptographic hash, error detection codes and an image geometric moment signature (less than 2000 bits)
- Identification rates greater than 90%



Tampered 64x64 pixel block

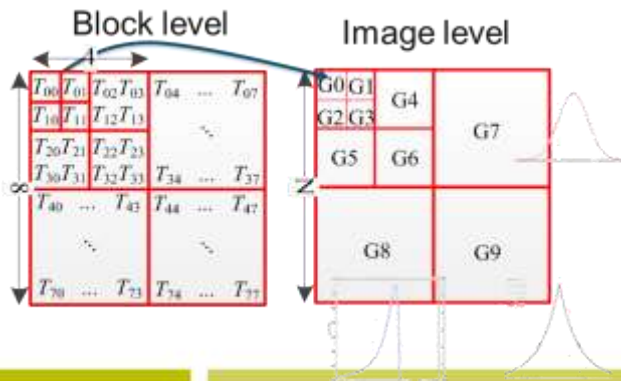


Real tamper



Our approximation of the tamper

■ Blind digital forensics.



- Identification of global image processing by means of classifiers trained with image Tchebychef moments
- Detection/identification rates > 80%



A *posteriori* protection

■ Medical Image watermarking

- Lossless or reversible watermarking
- Region of non Interest watermarking

id_stay	id_patient	age	gender	drg	p_diag
4350986	75484	92,23		0 06M03W	A048
4290235	45587	42,34		0 24M11Z	A050
4372568	43567	25,39		0 24M11Z	A058
4562065	35255	54,02		1 06M03V	A058
4607357	68781	43,65		0 06M03V	A058
4546036	34885	65,87		1 06M03T	A058

Sample view of the original table

One tuple includes the attributes: stay identifier ('id_stay'), patient identifier ('id_patient'), patient age and gender, ICD-10-encoded principal diagnosis ('p_diag')

id_stay	id_patient	age	gender	drg	p_diag
4350986	75484	92,23		0 06M03W	A048
4290235	45587	42,34		0 24M11Z	A050
4372568	43567	25,39		0 24M11Z	A050
4562065	35255	54,02		1 06M03V	A058
4607357	68781	43,65		0 06M03V	A050
4546036	34885	65,87		1 06M03T	A050

Sample view of the watermarked table

At the reading stage 'A58' indicates '0' and 'A050' '1'.

Seen by physicians



Seen by the system

Demonstrator developed in collaboration with Med-E-Com

■ Watermarking of database

- Robust-lossless watermarking
- Fragile lossless watermarking of categorical attributes

Sample view of the watermarked table

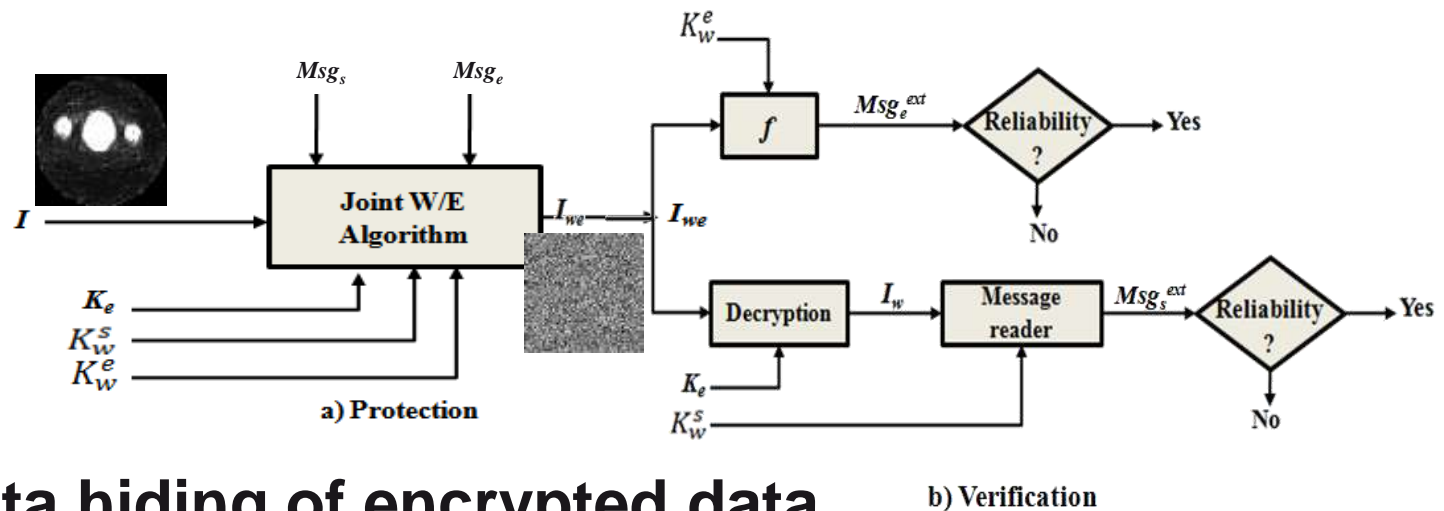
At the reading stage 'A58' indicates '0' and 'A050' '1'.



Joint *a priori* & *a posteriori* protection

■ Joint encryption-watermarking

- Allows verifying the image integrity/authenticity even if it is encrypted
- Works with stream or block-cipher algorithms (e.g. RC4 and AES)
- Interoperable with DICOM standard



■ Data hiding of encrypted data

- Allows watermarking an encrypted image while making the message available in both encrypted and spatial domains
- Can be used for data traceability.



GD2MP / T&I Research Actors



Gouenou
Coatrieux



Christian
Roux



Wei
Pan



Beijing
Chen



Hanieh
Azkia



Dalel
Bouslimi



Yuping
Duan



Javier
Franco-Contreras



Current projects

Labex CominLabs project -
POSEIDON



Object: How to express and deploy integrated security policies for outsourced data
Contribution : Watermarking & security policy interface
Partners: INRIA/CIDRE, IRISA, Lab-STICC

ANR- ARPEGE project
PAIRSE



Object: Confidentiality preservation in P2P environment : an approach based on web services
Contribution: Database watermarking
Partners: LIRIS/SOC, IMT-TSP/SIMBAD, IRIT/PYRAMID, Lab-STICC, SEMSOFT, SWID, MTIC ...

DGA Rapid project-
Frag & Tag



Object: Fragmentation & watermarking
Partners: Lab-STICC, ARISMORE, SWID, CETIMA ...

IRT B-COM project
ISIMED



Object: Distributed medical image info-structure
Contribution: Integrity et traceability of images
Partners: INRIA, Inserm U746 - U936 – 1099, CHRU Rennes, ETIAM, BIOTRIAL, MEDECOM ...

Industrial project -
PROTECIMAGES



Object: Watermarking of medical images
Partners: MEDECOM.

CRITT Santé Bretagne
project- **TOUTATIS**



Object: Watermarking & encryption of medical image data
Partners: MEDECOM.