Interactive Communication InterCom

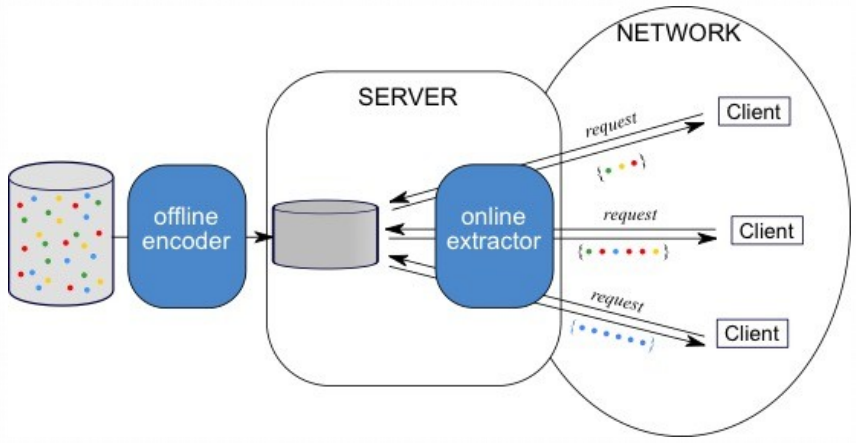
TEAMS
- Inria, Sirocco team
- LabSTICC, Télécom Bretagne
- Inria, i4S team
- External partner: L2S, CentraleSupelec.

Massive Random Access to subsets of compressed correlated data

The **interCom** project aims to develop novel **compression** techniques allowing **massive random access** to **large** databases.

- **large** database: to be stored on a single server, the data have to be ***compressed*** efficiently, i.e. the redundancy/correlation between the data have to be exploited.
- **random access:** The dataset is then stored on a server and made available to users that may want to access only a subset of the data. Such a request for a subset of the data is indeed **random**, since the choice of the subset is user-dependent.
- **massive** requests: upon request, the server can only perform low complexity operations (for instance no decompression/compression).

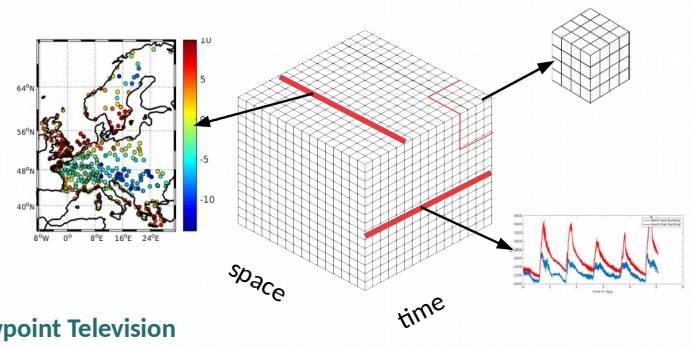
Algorithms for two emerging applications of this problem will be developped:
Free-viewpoint Television (FTV) and massive requests to a database collecting data from a **large-scale sensor network** (such as Smart Cities).



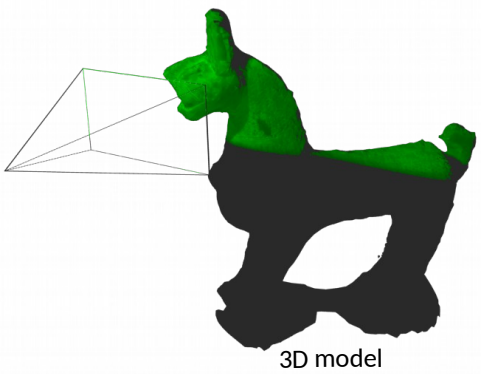
Random access to a database: the user can choose any subset of the compressed correlated data.

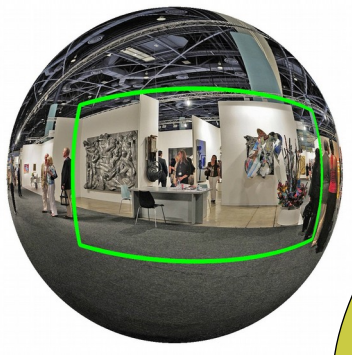
Applications

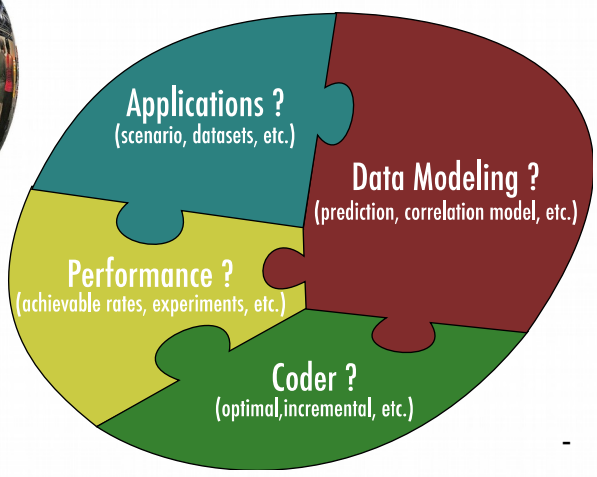
Meteorological spatio-temporal data



Free Viewpoint Television

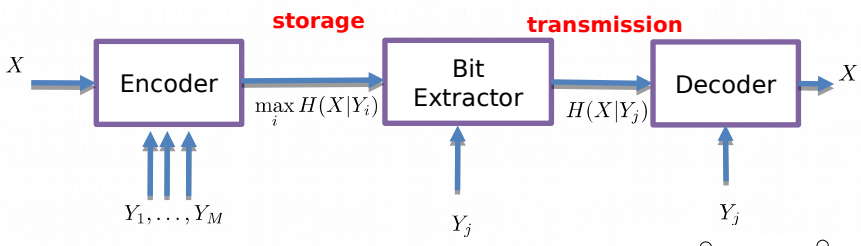

3D model


360° image

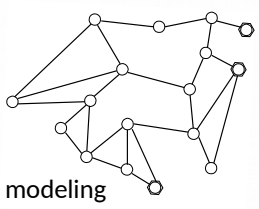


Performance

Derivation of optimal transmission-storage rate performance



Generalization to:
- Lossy coding
- Universal coding (models unknown)
- Not ergodic and not stationary sources

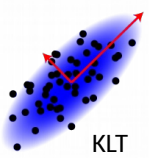


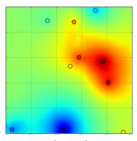
Coding scheme optimization based on user's request modeling

Data Modeling

Meteorological spatio-temporal correlation

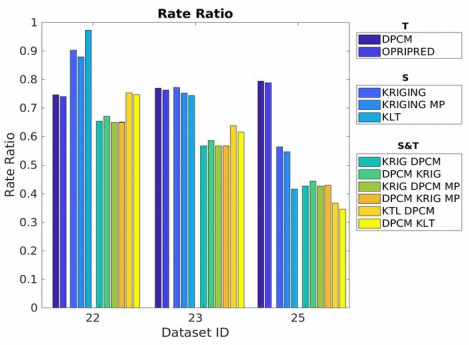
Spatial predictions


KLT


Krigging

Temporal prediction: optimal linear predictor

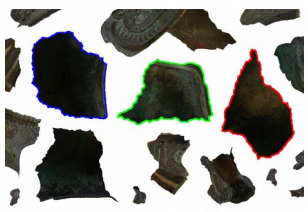
$$Z_n = X_n - aX_{n-1} - bX_{n-2}$$

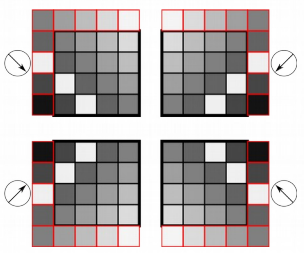


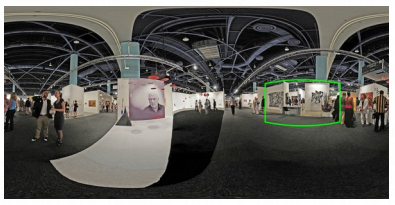
Results

Free Viewpoint Television

- 3D to 2D mapping
- User's request modeling
- Geometry-aware inter-block prediction
- Geometry aware block transform

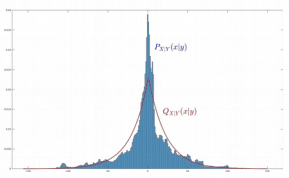




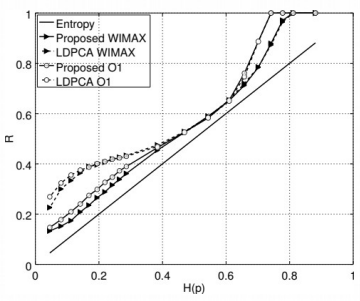


Influence of the correlation model

- Impact of correlation model on the coder performance



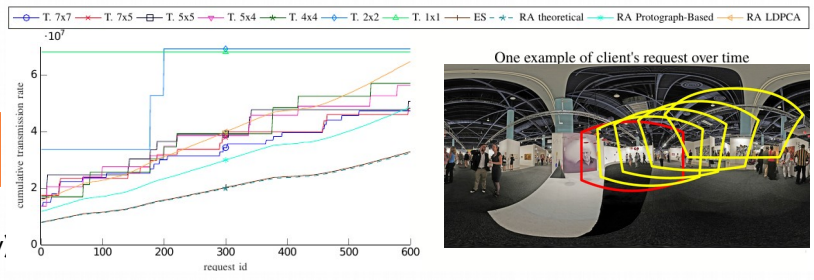
Coder



Implementation of an embedded entropy coder

- Rate-adaptive LDPC codes that adapt to data model
- The proposed code construction greatly reduces the amount of cycles in the parity check matrices of the code
- It shows a clear performance improvement compared to state of the art method called LDPCA

Design and Implementation of a generic interactive coder



Achievements

- 2 journals and 6 journal submitted or in preparation
- 9 conference papers (DCC, ICIP, EGU, GRETSI, WCNC, ICASSP, PCS)
- 1 workshop in Brest (January 2018)
- 9 invited seminar (France, UK, Switzerland, Germany)
- 2 PhD defenses