DE LA RECHERCHE À L'INDUSTRIE

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AI-BASED SMART SYSTEMS FOR CONTAMINATION DETECTION

BIO-SMART KICK-OFF

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List

CALMWATER'S GOALS & PARTNERSHIPS

GOAL 1 : "….adapting existing smart grids technologies to water distribution network management…"

→ **CALMENERGY** techs (founding member of CW)

IT Company developing **Smart Grid services** for EP utilities.

GOAL 2 : "Bringing innovative A.I. (data mining, machine learning) approaches to improve water resources management"

→ **CEA-List** (Joint laboratory with CCW)

•French RTO specialized in Smart Digital Systems

•"From signal processing to decision support"

GOAL 3 **: integration** of adapted/developed smart systems into the targeted platform for **Demo. & simulation**

→ **CALMWATER**

METHODOLOGY - STEP 1

Sensor level (Technology Agent):

- Signal processing of 1D row data (noise, missing data…)
- Technology based Event detection (raise an alarm)

→ Issue of data quantity and quality

→ Issue of sensors specificity/sensitivity

Reducing uncertainty through DATA aggregation

Spot Level (Spot Agent)

- Consider a set of *n* distinct & co-localised sensors
- Gather and process jointly:
  - their n alarms
  - **their n signals (multi-sensor signature, fusion of heterogeneous data)**

→ Improved event detection

CONTRIBUTIONS – STEP 1

Comply with the **state of the art**:

Integrate systems that are readily available for individual & aggregated signals for event detections (SECUREAU, EPA CANARY, etc.)

Going beyond…

P: Proposing a generic approaches for event detection

S: Adapt & integrate **CALMEnergy** technologies:

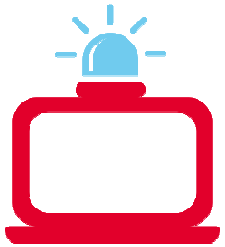
-> Adapted machine learning tools for smart grids.

METHODOLOGY - STEP 2

Exploiting the network topology (wasted information)

(Sub) Network Level :

→ Integrating information from multiple spots according to their connectivity in the distribution network.



Expected functionalities:

-reduce (and estimate) uncertainty

-improve sensitivity and reliability of bio-detection

-situation assessment measures (contamination propagation, initial point of failure …)

-Health impact assessment

→Support decision making for further verification / mitigation

CONTRIBUTIONS – STEP 2

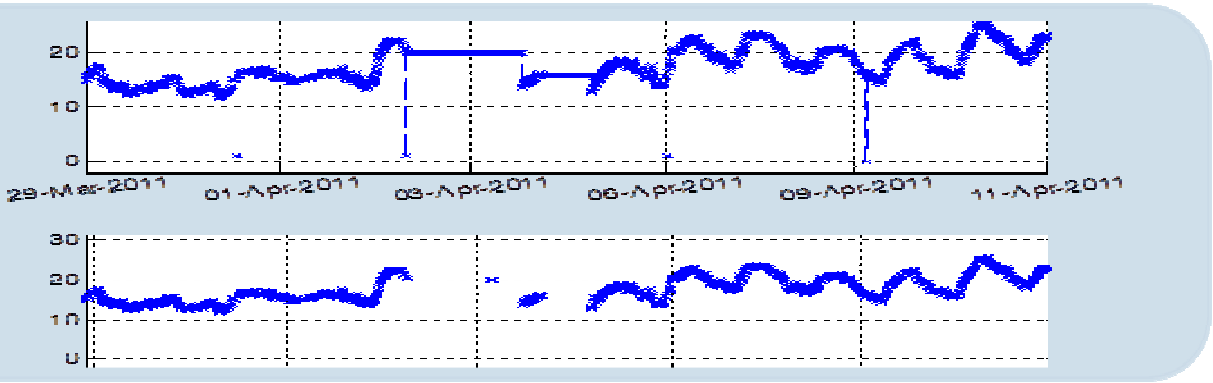
→ CEA will study & exploit recent works in the field of "**sensor networks**".

First hypotheses
-Multi Agent Systems

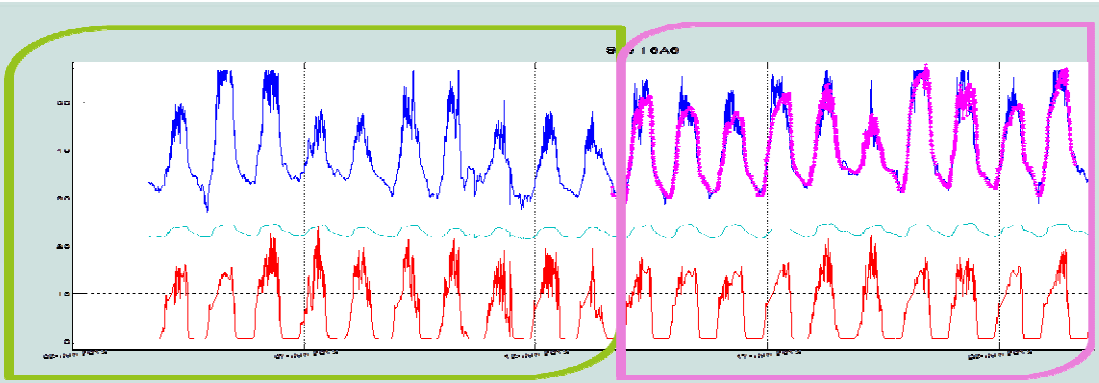
But other building blocks are to be considered:
-Probabilistic graphical models
-Multidimensional data mining
-Distributed machine learning
-…

SIGNAL ANALYSIS FOR BUILDINGS

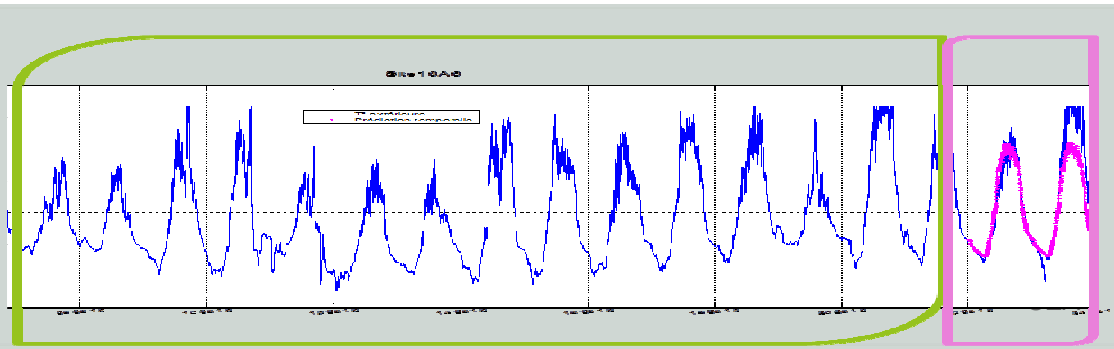
Detection of Irrelevant Data



Spatial Prediction



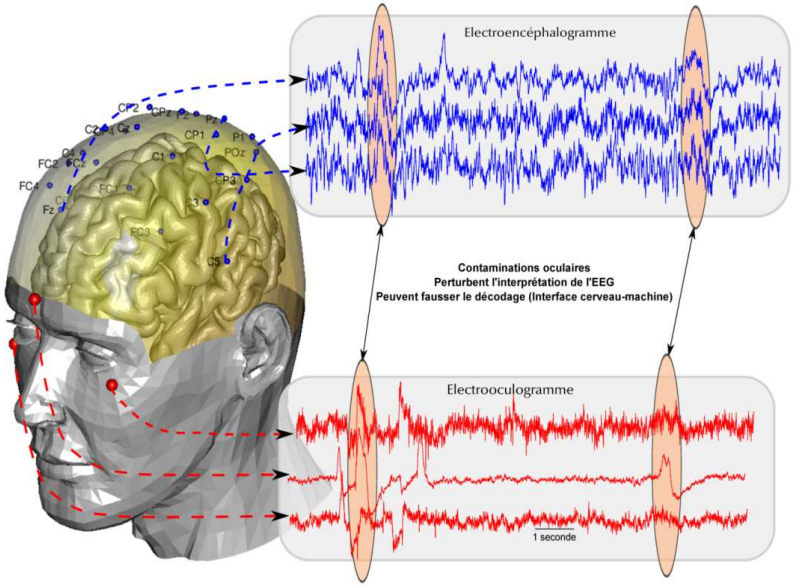
Temporal Prediction

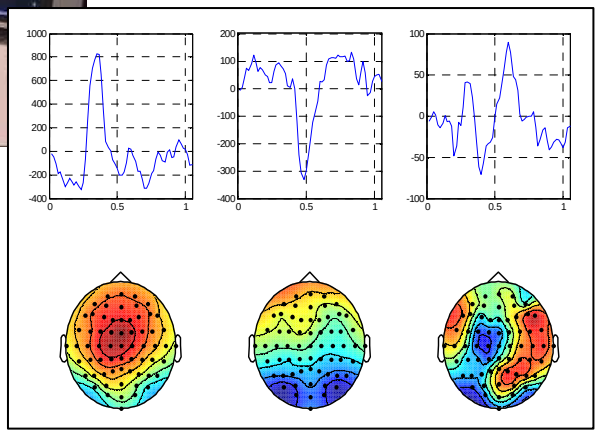


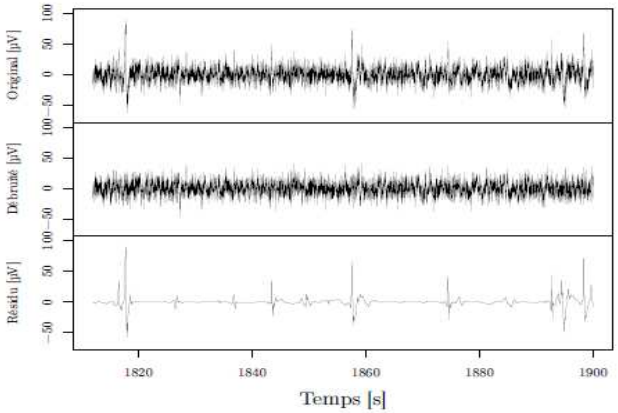
WEAK MULTISENSORS SIGNALS ANALYSIS

Signal analysis « EEG/MEG » :

- Weak signal extraction
- Artefacts suppression
- Discriminant filters learning







R&D PRECONDITIONS

Developing optimized data processing methods requires:

- Water distribution and sensors network specifications

- **Sensors Data handling**

THANK YOU

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