Master 2 Internship Projects in the $\mathcal{LivEMUSIC}$ Project

$\mathcal{L}$iving-$\mathcal{E}$nvironment $\mathcal{M}$onitoring $\mathcal{U}$se $\mathcal{S}$cenario with $\mathcal{I}$ntelligent $\mathcal{C}$ontrol

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October 2014

Context

$\mathcal{LivEMUSIC}$ is a one-year project (January 15, 2015–January 14, 2016) to be led by Prof. Hassan Aït-Kaci, at the LIRIS, at Université Claude Bernard Lyon 1. This project will be part the *"Programme Avenir Lyon Saint-Etienne"* ($\mathcal{PALSE}$).[1] Its objective is to develop a convincing use case in intelligent living-environment monitoring. For this purpose, it will proceed by demonstrating how knowledge-representation and automated-reasoning technology can be put to use for the "smart" monitoring of living environments, focusing on urban and social milieux.

The project will consist in:

1. processing vast amounts of disparate raw data gathered from available sensing and measuring equipment as well as human input records into coherently formatted RDF triple-tores with guaranteed data integrity;

2. analyzing this data formatted as massive RDF stores to extract its implicit knowledge structure as terminological properties using formats such as RDF Schema (RDFS), RDF with attributes (RDFa), and/or the Simple Knowledge Organization System (SKOS);

3. elaborating a realistic use scenario that leverages the extracted knowledge for the intelligent monitoring to applications for which the gathered data is relevant.

To ensure a realistic basis to our approach, we will exploit public data provided by the *Grand Lyon* through its platform SmartData.[2] We can thus have 378 datasets at our disposal. This data, mostly open data, are varied: *e.g.*, the number of kilometers of sidewalks, directory of ponds and wetlands, cycling stations (*vélo'v*),[3] *etc.*., ... Thus, $\mathcal{LivEMUSIC}$ aims to facilitate the development and use of ontological knowledge about the essential nature and properties of such data, which come in massive amounts and disparate formats.

[1] http://imagine.universite-lyon.fr/programme-avenir-lyon-saint-etienne-/
[2] http://smartdata.grandlyon.com/
[3] http://www.velov.grandlyon.com/

Master topics

There are **three** Master 2 topics we are proposing within the $\mathcal{L}iv\mathcal{EMUSIC}$ project. Each is to be addressed during a 6-month internship at the LIRIS to be spent during the year 2015; remuneration is a stipend of 550 €/month.

Each topic is summarily described below.

1. **Generation of RDF triples from raw sensor data**—The objective of this MSc topic is to implement a tool capable of processing massive raw data gathered from primary sources of all kinds, such as sensor devices, surveillance videos, manually entered inputs, *etc.*, cleaning it up into consistently uniform RDF representations. The generated RDF data is to comprise triplestores encompassing data to be analyzed and further processed into intensional knowledge characterizing the sort of specific information this data relies on.

2. **Derivation of ontologies from RDF triplestores**—This MSc topic concerns the analysis of RDF triplestores generated from raw sensor data in order to derive terminological schemas that the generated RDF triples abide by. The objective is to categorize these triplestore data using classes and attributes fitting their structure using Formal Concept Analysis (FCA).[4] The outcome is to constitute a terminological schema for this data that can be used for reasoning about such data.

3. **Use of terminological knowledge for monitoring applications**—This topic's objective is to develop a use case exploiting terminological knowledge over monitoring data with reasoning based on Order-Sorted Feature constraint logic for smart information retrieval, data analytics, and query processing.[5] The object is to demonstrate how to leverage the capabilities brought by knowledge-based processing of monitoring data for intelligent applications with a convincing use case based on actual gathered data.

Keywords: Knowledge Extraction; Data Analytics; Automated Reasoning; Big Data; Environment Monitoring; Smart Cities.

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[4] http://en.wikipedia.org/wiki/Formal_concept_analysis
[5] Using the technology developed as part if the CEDAR project: cedar.liris.cnrs.fr.