ICT PHD

Research project for a PhD curriculum in ICT – Computer Engineering and Science

**Tutor**: Laura Po

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**Proposed Title of the research:**

*Mobility Data Modelling and Mining for Smart Cities*

**Keywords: (5)**

Intelligent Transportation System (ITS)

Sensor Data Management and Outlier Detection

Simulation Model

Big Data Analysis and Integration within Smart Cities

Geographical and Visual Data Exploration

**Research objectives: --(max 10 rows)**

This proposal is focused on the management and analysis of a huge amount of heterogeneous urban data streams focus on mobility-related information. It aims to couple the efforts from several large research areas (modeling, semantics, statistics, and data integration) for developing techniques and tools for creating dynamic urban mobility models based on land use, traffic sensors data, and a socio-economical analysis of the urban area.

The proposal includes the study and the implementation of techniques for

● Data series management: sensors data collection, analysis, and outlier detection

● Data integration: mobility data, geographical data, census data, crowd-sourced data

● Data cleaning: detecting and removing traffic sensors faults

● Urban modeling: development of a multi-modal real-time dynamic traffic model, development of a monitoring system for traffic incidents, computer modeling of alternative land use and transportation situations

● Traffic flow prediction: machine learning methods used on traffic flow time series to predict traffic in the future.

The techniques will be complemented with a visualization engine allowing people to retrieve geographical data of interest from it. Since mobility data have a Spatio-temporal dimension, different techniques to visualize and interpolate this kind of data will be studied.

As a case study, the techniques will be applied in the city of Modena to improve urban mobility control.

**Proposed research activity -- (max 10 rows)**

The main activities will include:

• Survey and Analysis of the different urban models and land-use models

• Urban sensor data analysis, management, and querying

• Outlier detection on Sensor Data Series

• Analysis of the existing best practices, standards, metadata, and services for data mining in a mobility context

• Analysis and use of HPC technologies to store the different sources of data and to elaborate statistics and simulations on scalable datasets. Creation of a data warehouse with OLAP technologies to easily query the two main dimensions of data: time and space.

• Development of an urban mobility model that contains a dynamic traffic flow model and a land-use model

• Development of a tool for the effective display of mobility data

In particular, these activities will be implemented in the urban context of the city of Modena and compared to the other five urban areas analyzed during the TRAFAIR project.

The research activity is carried out within the TRAFAIR project and based on the results outcomes of this project. TRAFAIR is a project funded by the European Commission (CEF TELECOM open data call) that aims at studying the correlation between traffic emission and air pollution dispersion in an urban context.

**Supporting research projects (and Department)**

"TRAFAIR - Understanding Traffic Flows to Improve Air quality" project (2017-EU-IA-0167) funded under the CEF Telecom Call 2017-3 on Public Open Data by the European Commission

**Possible connections with research groups, companies, universities.**

Universidade de Santiago de Compostela (Prof. José Ramón Ríos Viqueira );

Universidad de Zaragoza (Spain – Prof. Raquel Trillo Lado )

Fundación Centro Tecnológico de Supercomputación de Galicia, CESGA (Spain- Dr. Ignacio López Cabido)

LepidaSpA (Regional company)

Comune di Modena

(\*) optional

(\*\*) optional/to be completed on the second year