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Fabio Leuzzi
Stefano Ferilli *Editors*

Traffic Mining Applied to Police Activities

Proceedings of the 1st Italian Conference for the Traffic Police (TRAP-2017)

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Foreword

Applied research. These are perfect keywords to describe our times, efforts, needs, and prospects of human development. For the first time, with TRAP-2017, the Italian Traffic Police—I would say the Italian National Police in general—has organized a scientific conference in which the competences, specialties, and topics of a police force constitute the observation ground of applied research.

Such an initiative might sound unusual for a Public Administration, whereas one might think that the organizers are about a decade late. Whatever the reader thinks about this, the main message we want to convey concerns our new look.

The Italian National Police continuously strives to fully understand the various phenomena, to fight crime and ensure safety and security. Nowadays, however, prevention and repression are not enough to appropriately tackle the new challenges. The great amount of data around us cannot be ignored to successfully and timely meet our objectives. Therefore, our aim is to start a new age in our history, an age centered on technical and sophisticated approaches to extract information from the vast amount of data which otherwise could not be used, an age focusing on the improvement of our abilities to predict significant events. All tasks that can be no longer performed through paper and pencil only.

The safeguard of the freedom of movement, which represents the glorious past and the proud present of the Italian Traffic Police, will still and always be the core of its identity. This identity is essential to be at the forefront in facing the new challenges posed by the so-called smart cities, smart roads, by the circulation of intelligent cars, by Intelligent Transport Systems and other innovations that represent our present and future.

Let us make some brief considerations on the main difference between high school and university. The former aims at providing students with valuable bases upon which specialized studies can be carried out, basing teaching on books containing consolidated notions. University, on the other hand, is the place where the state-of-the-art and latest innovations are developed and, thanks to the research activities of professors and researchers, transferred to students.

The same can be said for the Italian National Police. This volume officially marks the moment in which the Italian Traffic Police improves its approach to knowledge and officially enters the world of research, dealing directly with the relevant academic experts in order to apply state of the art of applied research and perform its institutional activities through up-to-date knowledge, exploiting the most advanced techniques and innovative tools that research in science and engineering can provide.

I am pleased to witness and strongly support these new and strategic directions, and I am sure that these efforts will soon result in tangible outcomes.

October 2017 Franco Gabrielli

Preface

The First Italian Conference on Traffic Mining applied to Police Activities (TRAP-2017) was held in Rome during October 25–26, 2017, in the context of the celebrations for the 70th Anniversary of the Italian Traffic Police (*Polizia Stradale Italiana*). Its aim was to gather data mining researchers, traffic researchers, and decision makers and provide them a common forum for discussing the development and exploitation of automatic traffic analysis systems that can detect, track and, more in general, understand the behavior of road users in order to identify criminal behaviors.

Indeed, with the increasing amount of traffic information collected through automatic number plate reading systems (NPRS), which are widely spread on Italian highways, it is highly desirable for police activities and investigations to be able to extract meaningful traffic patterns from the accumulated massive historical dataset, in order to identify potential criminal behaviors. However, analyzing traffic data for this purpose is challenging due to the huge size of the dataset and the complexity and dynamics of traffic phenomena.

Topics of interest included detection and tracking of road users and vehicles, behavior understanding of road users, automatic understanding of the environment in traffic scenarios, applications related to traffic surveillance, and vehicle accident analysis. Examples of techniques of interest are outliers detection and understanding, clustering and conceptual clustering, process mining, inductive logic programming, deep learning and classification.

To allow interested researchers to work on real-world data that are hardly available to the wide public, the organizers provided a dataset reporting transit data recorded using several gates spread along a limited area of Italy, in which gates are homogeneously distributed. As an option, authors had the possibility to propose contributions specifically focused on this dataset.

With the aim of unifying the way experimental results are evaluated and to push research forward on the development of real working systems supporting police activity, a shared task was proposed, whose main practical goal was to identify itineraries that might indicate a criminal intent. The scientists were free to define the concept of itinerary, formalizing it functionally to their proposed approach. They

were free to integrate open data into the itinerary features or not. Criminal intents could be described, for instance, as follows:

- The sequential visit of service areas facing each other;
- The sequential visit of service areas in the same direction;
- Transits that are inconsistent under the space-time point of view, that might be due to cloned plates;
- Combinations of the previous cases involving several plates and possibly the same criminal organization;

and so on.

Two invited talks and nine original research papers related to the conference main topics, or to other relevant topics of interest to traffic understanding, were presented during the conference, allowing researchers and practitioners to pose problems and propose solutions, to identify common tasks of interest and to plan possible cooperation.

We would like to thank the Italian National Police for its invaluable support to the organization of this conference. Our special thanks go to the Director of the Central Directorate for the Specialties of the Italian National Police, Roberto Sgalla, and to the Director of the Italian Traffic Police, Giuseppe Bisogno. They quickly understood the importance of applied research for police activities and strongly believed that the TRAP-2017 initiative could be appreciated by researchers around the world. Grateful thanks are also due to all the sponsors for making this event possible, and to all the people who contributed to the organization and success of the conference. Let's hope this was just the beginning.

TRAP-2017

Rome, Italy — Fabio Leuzzi
Bari, Italy — Stefano Ferilli
October 2017

Organization

TRAP-2017 is organized by the Italian National Police, Traffic Police Department, Ministry of Interior.

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Contents

Part I
Invited Talks

Data and Analytics Framework. How Public Sector Can Profit from Its Immense Asset, Data

Raffaele Lillo

Abstract Public sector is rich of data, but this alone is not enough to fully exploit insights and information hidden in it. Data needs to be coupled with a team of data scientists and engineers, a big data platform and a legislative framework to make the famous "data driven decision making" actually possible. This is why the Digital Transformation Team introduced the Data and Analytics Framework.

Keywords Public administration · Data and analytics framework · Big data

1 Introduction

"Submersion" is a serious phenomenon that affects the whole of Italy. We are not, in this case, referring to the all-too-common practice of tax evasion. There is another, equally large source of capital to bring to the surface, and its mechanism of "recovery" is technological, organizational and legislative. There is a great resource that is not able to emerge and make itself useful to citizens, businesses and all public administrations because it is fragmented, scattered across different places, imprisoned by rules and practices that impede movement, sharing and optimal use. Public information is the enormous data-set that describes the realities of citizens and businesses — where and how we live, what we do—and, like the first public investments in telecommunication, represents a strategic asset to take advantage of, even with state intervention. It pertains to all of us and is necessary to start up businesses, conduct activities and access public services. It contains data the Public Administration (PA) needs when it offers services to citizens; data that can help the State identify problems more efficiently and develop better solutions; data through which citizens might get to know the actions of the State and assess its results. To tackle this challenge, The Italian Government, via its Digital Transformation Team led by Extraordinary Commissioner Diego Piacentini, is designing and developing the Data and Analytics

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Framework (DAF). The main goal of the DAF is to establish a Chief Data Office of the PA that will set the data strategy for the country and will provide once and for all infrastructure and expertise to all PA. This will translate into: an optimized data exchange between PAs, exiting from the current "siloed" and compartmentalized situation; coherent data strategy across PAs and sectors of society, and adoption of common standards; better interoperability; improved efficiency due to the provisioning of infrastructure and standard functionalities managed in a Platform as a Service fashion, so to free PA's resources to be focused on domain specific and higher value added activities.

2 Big Data Analytics for the Public Administration

Big Data analytics techniques can be used to gather and to use precious information that are usually impracticable (when not impossible) to obtain via traditional methods. The main advantages of this approach are threefold. In the first place, it allows for the usage of multiple and heterogeneous integrated data sources describing a phenomenon (the Variety of the famous Big Data Three Vs), offering multiple angles of analysis. Secondly, it introduces a different approach to traditional economic and statistical analysis, as it allows to ask the data to produce insights, instead of validating hypotheses based on a priori theoretical models. This is particularly useful for complex and interconnected phenomena for which there are "a lot" of data available (more than a human can reasonably handle; here "a lot" refers to both Volume and Variety of the Three Vs). The complexity and availability of huge amount of information is a binomial. That is quite common nowadays thanks to new technologies that allows to collect and manage data cheaply, and it is easily applicable to social activities in general. Finally, technological progress gives the possibility to collect data at a much faster pace and in a timely manner, allowing analysis and responses to be performed right after an event has happened (the Velocity of the three Vs).

A well thought data strategy coupled with established Big Data technologies proved to bring value and provide competitive advantage to corporations. Quoting Kiron, Ferguson and Prentice (2013): *"In the future, analytics will transition from simple information gatherers and maintainers to influential thought-leaders that are integrated parts of teams across organization"*. Furthermore, several studies showed a positive and significant impact on P&L of companies that embraced Big Data activities. In particular, Mckinsey (2011) showed that companies using Big Data techniques have outperformed their respective markets and have created competitive advantage, by comparing both revenues and EBITDA against their peers. Public sector is no different. Resources and capabilities needed to support the decision making processes at all levels are crucial to improve the effectiveness (and efficiency) with which PAs function and serve citizens. Furthermore, the typical scale of a government coupled with the high degree of fragmentation among PA are two aspects

that marry perfectly with the horizontal scaling of Big Data architectures and the institutionalization of a central office that manages the platform and provide a uniform and coherent data strategy for all PAs.

3 Big Data and Public Policy

In analyzing the areas where Big Data analytics techniques may help Government and PAs, it is useful to follow the systematics of administrative functions as defined by Maciejewski (2017):

- **Public regulation**: putting in place policy to shape social behavior and relations by means of permits, prohibitions and orders
- **Public supervision**: monitoring activities, anomalies and irregularities detection, implementing responsive actions
- **Public service delivery**: providing services to citizens and enterprises

Public regulation comprises all the phases of the policy making process, from the identification of the need of a new policy, analysis and impact assessment, policy implementation, fine-tuning. All these phases can highly benefit from big data techniques: continuous and automated mining of "all" available data can help identify otherwise hidden patterns and shape the need for new policies or fine tune existing ones; impact assessment can be expanded to increase the number of connections with aspects of society impacted by the new policy; likewise, the monitoring and fine-tuning phases can benefit from the timeliness and richness of available information.

Public supervision is probably the area where the advantages of Big Data are most evident. In fact, analysis can make use of the widest possible sets of information available to prepare models to recognize irregularities. One of the most direct application of big data to public supervision is fraud detection applied in the fiscal context.

Finally, big data can help improve public services offered to citizens and enterprises in two ways: it supports service design by providing useful information about end-users that are fundamental to better understand needs and usage patterns, and therefore create more effective and customized services; it reuses information already collected by any public administration, minimizing the level of effort required by end-users.

4 Data and Analytics Framework for the Public Administration

The DAF is a component of the 3-year plan for the PA, published in May 2017 and signed by Italian Prime Minister, with the aim of providing the PAs with skills,