

eSecurity and the new horizon of urban security

An information system for police forces
and local administrations

Guidelines

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Andrea Di Nicola
Scientific Coordinator – Università degli Studi di Trento

Serena Bressan
Project Manager – Università degli Studi di Trento

Technical boxes edited by

Giuseppe Espa
“Spatial and Predictive Statistics Team” Coordinator – Università degli Studi di Trento

Cesare Furlanello
“WebGis e ICT Systems Team” Coordinator – Fondazione Bruno Kessler

Ernesto Arbitrio
WebGis e ICT Systems Team – Fondazione Bruno Kessler

Maria Michela Dickson
Spatial and Predictive Statistics Team – Università degli Studi di Trento

Claudia Dolci
WebGis e ICT Systems Team – Fondazione Bruno Kessler

Diego Giuliani
Spatial and Predictive Statistics Team – Università degli Studi di Trento

Translation by Gabriele Baratto, Denise Boriero, Serena Bressan, Maria Michela Dickson
and Fiamma Terenghi

Proofreading by Adrian Belton

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eCrime - ICT, Law & Criminology
Facoltà di Giurisprudenza
Università degli Studi di Trento
Via G. Verdi, 53
38122 – Trento
0461 282336
www.ecrime.unitn.it

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eSecurity: what is it?

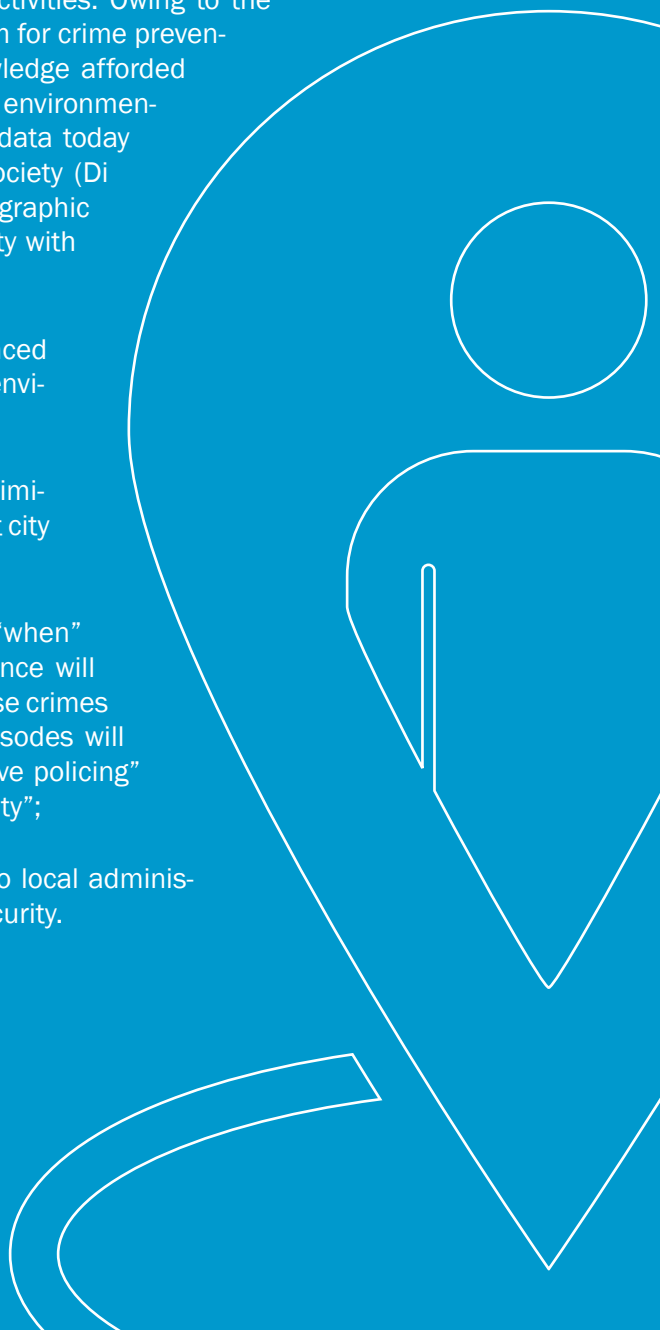
Is it possible, thanks to research and technology, to manage urban security in a more efficient and effective way and also acquire elements useful to predict crimes before they occur? This might seem a fantasy of some futuristic film; nevertheless, it is a possible scenario due to “eSecurity – *ICT for knowledge-based and predictive urban security*” (eSecurity), a European project coordinated by the eCrime research group of the Faculty of Law – University of Trento (Università degli Studi di Trento), in partnership with the ICT Centre of Fondazione Bruno Kessler (FBK), Questura di Trento (i.e. Trento Police Department), and the Municipality of Trento. The project was co-funded by the European Commission under the ISEC program (2011) “Prevention of and Fight against Crime” of the Directorate General for Migration and Home Affairs, and lasted 36 months: from November 2012 to November 2015. eSecurity, piloted in the city of Trento (Italy), is one of the first projects worldwide on predictive policing and the first-ever project on “knowledge-based and predictive urban security”.

Project eSecurity is based on principles pertaining to rational choice theories of crime and environmental criminology. It assumes that, in any urban environment, crime and deviance concentrate in “some areas” (streets, squares, etc.) and that past victimization predicts future victimization. This concentration of crime in time and space results from the concentration of opportunities and causes in time and space that need to be investigated in order to impact on crime within urban territories and to manage urban security issues extensively (Brantingham and Brantingham, 1991). As a consequence, it is knowledge of these “hot spots” and existing criminal opportunities within urban contexts that enables identification of the underlying criminological factors to be considered so that efficient and effective preventive and counter strategies can be deployed (Clarke, 1997; Wartell and Gallagher, 2012).

Accordingly, eSecurity builds on pilot schemes for predictive policing carried out with reference to the United States and United Kingdom: for example, the projects conducted by IBM together with the University and the local police of Memphis (USA); by the University of California of Los Angeles and Irvine with the local police of Los Angeles (USA); by the Jill Dando Institute of Security and Crime Science (University College of London); and by the police of Trafford, Greater Manchester (UK). “Predictive policing refers to any policing strategy or tactic that develops and uses information and advanced analysis to inform forward-thinking crime prevention” (Uchida, 2009). More in detail, predictive policing involves the analysis of police data on past crimes, their spatio-temporal locations (geo-referenced reported offences), and recurrences in the behavioural patterns of offenders. The purpose is to forecast places and areas of future concentration of crime within urban territories, with the ultimate goal of allocating police resources and efforts optimally (RAND, 2013).

Compared with the above-mentioned previous projects, the added value of Project eSecurity stems from its new theoretical model of “predictive urban security” based on geo-referenced data on victimization, urban disorder, and other environmental variables (e.g. street lighting, weather, cars in parking lots) analysed together with police data. The model yields predictive patterns in regard to subjective and objective urban security, thus supporting police forces and policy-makers in their preventive and control activities. Owing to the use of ICT technologies, this new paradigm for crime prevention and control has combined the knowledge afforded by rational choice theories of crime and environmental criminology with the huge amount of data today available within smart cities and the eSociety (Di Nicola et al., 2014a). In particular, the geographic information system developed by eSecurity with its predictive algorithms:

1. uses not only data on past geo-referenced crimes but also other geo-referenced environmental variables (smart city data);
2. considers also the concentration of victimization, insecurity, and urban disorder at city level;
3. tries not only to predict “where” and “when” specific types of criminality and deviance will occur but also to understand “why” these crimes and insecurity and urban disorder episodes will happen. Thus the concept of “predictive policing” will evolve into “predictive urban security”;
4. is useful not only police forces but also local administrators working in the field of urban security.



eSecurity: what does it do?

The aim of Project eSecurity has been to develop an innovative geo-referenced ICT tool (prototype) for data collection in order to enhance crime prevention and security management in an urban area, and with the ultimate goal of assisting police forces and policy-makers. In particular, with reference to the pilot area of the city of Trento (Italy), the following products have been developed:

- a. the eSecDB geo-database (prototype), which stores data on crime events, victimization, security perception and other relevant variables (e.g. socio-demographic variables, information on weather, traffic, public transport);
- b. the eSecGIS geographic information system, which supports multiple input data from eSecDB, with enhanced capabilities for report generation, risk map visualization, and predictive urban security;
- c. the eSecWEB Web portal, which fosters communication and collaboration between citizens and the local administration on deviance, disorder and insecurity, policies and initiatives, as well as providing advice on preventive behaviour.

In order to develop a new urban security management model with which to predict and prevent future concentrations of crime and deviance, the eSecGIS geographic information system, with its related predictive algorithms, has not only analysed the past, geo-referenced and anonymised data on crime events collected in the SDI (“Sistema di Indagine” - Investigation System) database of the Italian Ministry of Interior and stored in eSecDB. It has also integrated other geo-referenced socio-demographic and environmental data from the smart city: for example, neighbourhood street lighting, weather conditions, the distribution of local businesses.

Taking account of these types of data as well is essential for managing urban security at the local level because of the existence in cities of places at risk or acting as crime attractors/generators/enablers, such as bars, stores, shops, factories, parks and parking lots. In these areas, crime, urban disorder and perception of insecurity (as a consequence) are more likely to concentrate. The eSecGIS prototype can support police forces and local administrations in determining the importance of intervening in those areas to prevent crime, while being able to reduce the waste of public funds. It is thus possible to identify ad hoc preventive strategies aimed at urban planning as well as the prevention of crime (Brantingham and Brantingham, 1995; Lab, 2010).

Furthermore, this ICT tool considers the concentration of urban disorder (i.e. physical and social; real and perceived), victimization, and perceived insecurity also as predictors of crime and deviance concentration within urban contexts (Nobili, 2003; Regione Piemonte, 2012). Indeed, the fear of crime seems to increase when the perception

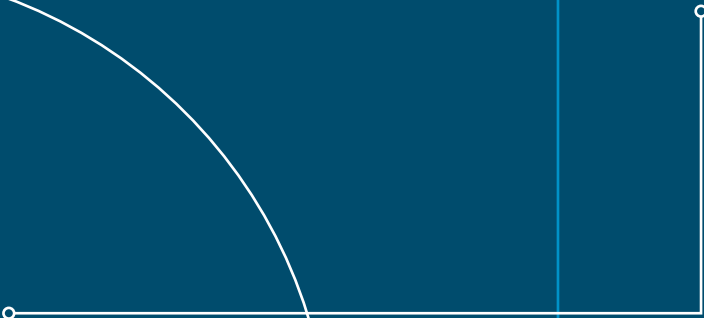
of the risk of being victimized is coupled with urban disorder phenomena. The latter refer respectively to physical signs of disorder (e.g. spray-painted graffiti, broken windows, abandoned cars, garbage in the streets) and social ones (e.g. prostitutes, drug addicts, homeless people). The perception of insecurity among the residents of an urban area is likely to be correlated with the increase in urban disorder phenomena, and especially so if the latter are accompanied by breaches of the rules regulating the use of public spaces. The concepts of urban disorder, victimization, and perception of insecurity are therefore analytical tools also useful for understanding the nature of subjective and objective security in cities (Wilson and Kelling, 1982; Chiesi, 2003).

In order to collect the aforementioned data through Project eSecurity, a victimization survey (4 rounds, 1 every six months) – named “Survey on objective and subjective security in the municipality of Trento” [Indagine sulla sicurezza oggettiva e soggettiva nel comune di Trento] – was conducted (Di Nicola et al., 2014b). The first round was carried out in October 2013 using a dedicated questionnaire which was subsequently administered to citizens residing in the city of Trento in April 2014, October 2014 and April 2015. The aim of the survey was to collect data on crime victimization, the perception of insecurity and urban disorder in the local area during the last 6 months/last year. At the same time, geo-referenced data on urban disorder (physical and social) phenomena present in the districts of the city of Trento were collected every six months (4 rounds in total: October 2013, April 2014, October 2014 and April 2015) by the Questura of Trento with a dedicated device (through an ad hoc developed geo-location application).

Thus, the constant data flow from the eSecDB database and the eSecGIS geographic information system enabled Project eSecurity: 1. to analyse and understand crime, deviance, urban disorder phenomena, and the sense of insecurity among residents, and their causes; 2. to prevent and predict the concentration in space and time of crime and deviance at the urban level with the maximum possible degree of precision, considering the contributions of all the above-mentioned data flows.

eSecurity: what does it do?

A



B

C

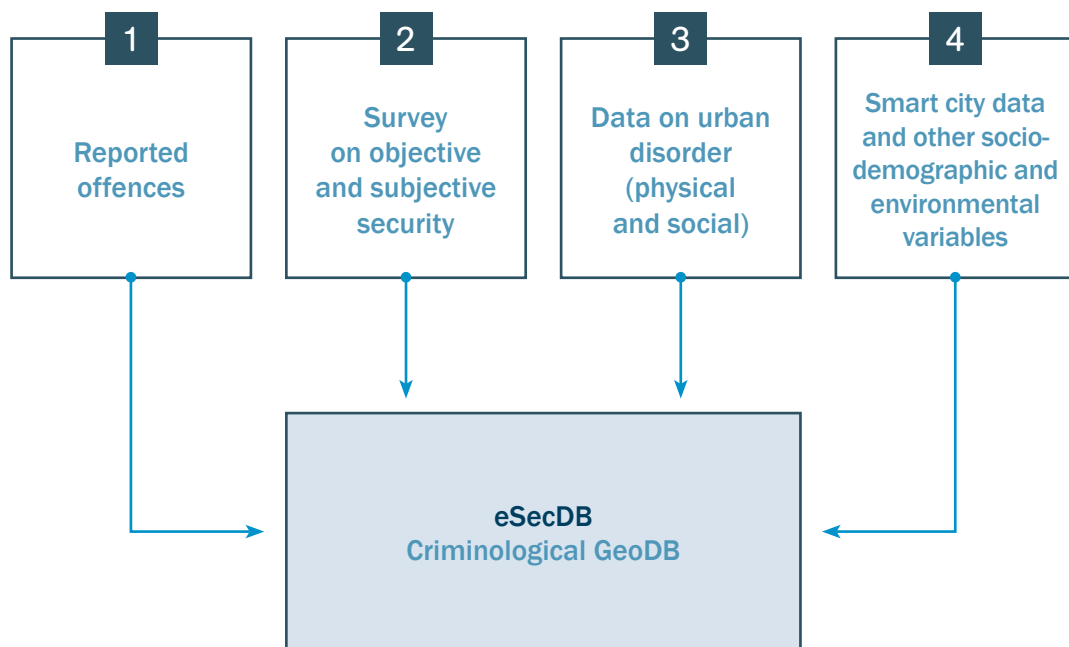


eSecDB

The geodatabase and its data flows

The first phase of Project eSecurity was aimed at implementing an integrated geodatabase (criminological GeoDB) named eSecDB, to store data and information to support police forces and local administrations in enhancing the management of urban security in their local territory (Box 1). In particular, this database gathers four data flows: 1. Reported offences, delivered by Questura di Trento and retrieved from the database SDI (“Sistema di Indagine” - Investigative System) of the Italian Ministry of Interior; 2. Data collected through 4 rounds of the “Survey on objective and subjective security in the municipality of Trento [Indagine sulla sicurezza oggettiva e soggettiva nel comune di Trento] gathering information on crime events, perception of security and urban disorder; 3. Data on urban disorder (physical and social) collected by the Questura di Trento through a dedicated application; 4. Smart city data and other socio-demographic and environmental information relevant to the project’s aims (Fig. 1). All the collected data were processed in compliance with the Italian Data Protection Act (D.lgs. 196/2003), and aggregated for statistical purposes with guaranteed anonymity.

Figure 1 – eSecDB. Data flows



Source: eCrime elaboration on Project eSecurity data

1° data flow. Geo-referenced reported offences

The first data flow that merges into the eSecDB geo-database of Project eSecurity consists of geo-referenced and anonymised police data from the SDI database of the Italian Ministry of Interior relative to reported offences in the municipality of Trento since 2010. The reported offences taken into account are the following: domestic burglaries, car thefts, thefts of items from cars, drug dealing, and assaults. These type of crimes have been selected because they generate high levels of social alarm in the reference local community and depend closely on environmental stimuli. At the same time, they enable police forces and policy-makers to intervene on criminal opportunities, thus acting promptly and efficiently to reduce them. Analysing opportunities makes it possible to plan preventive strategies in the short, medium and long term through actions focused on the specific areas in which crimes occur (Clarke, 1997; Di Nicola et al., 2014a).

2° data flow. Data collected through the victimization surveys

The second data flow of the eSecDB geo-database of Project eSecurity consists of data collected by the “Survey on objective and subjective security in the municipality of Trento” [Indagine sulla sicurezza oggettiva e soggettiva nel comune di Trento] carried out in 4 rounds every six months from October 2013 onwards. In particular, a dedicated questionnaire was delivered online (i.e. the CAWI method) to a sample of around 4,000 local residents and accessed via a personal password. The sample was stratified by sex, age, and district of residence in the city of Trento and randomly extracted from the civil registry of the Municipality of Trento (Box 2). These data, collected within Project eSecurity by means of a dedicated questionnaire, have made it possible to identify the 'dark number' of local crimes (i.e. crimes not reported to police forces) and to understand the perception of urban disorder and the sense of insecurity among local residents. If compared with police data, this information may show possible discrepancies between the objective security of the city of Trento (i.e. the level of crime) and the subjective security perception of residents (Barbagli, 2002; Vettori, 2010; Di Nicola et al., 2014a; 2014b).

3° data flow. Data collected on urban disorder (physical and social)

The third data flow that merges into the eSecDB geo-database of Project eSecurity consists of data collected through systematic social observation of urban disorder (physical and social) phenomena within the local territory of the city of Trento. This observation was carried out four times every six months starting from October 2013. More in particular, the method to measure urban disorder consisted in the collection of geo-referenced data by means of a dedicated device based on an specific app allowing intuitive, accurate and rapid data gathering. This software, applied by the Questura of Trento, maps the 12 districts of the city of Trento, reporting episodes of incivility and negligence. Since urban disorder is a predictor of future concentrations of crime, these data make it possible to interpret and understand crime distribution and the sense of insecurity within the local community (Nobili, 2003; Di Nicola et al., 2014a).

4° data flow. Data from the “Smart City” and other relevant variables

Anonymised data of another type merge into the eSecDB geo-database of Project eSecurity. They come from the information assets of the Municipality and Autonomous Province of Trento. These data, gathered for purposes other than crime prevention, are important for developing the eSecGIS prototype, as well as visualization of risk and “predictive urban security” maps. More in detail, they concern: 1. Socio-demographic variables (e.g. resident population, age, sex, nationality and income); 2. Environmental and urban variables (e.g. number of districts, neighbourhoods, streets, distribution of street lighting, number and types of buildings); 3. Specific territorial variables (e.g. road network, location of railway stations/bus stations, supermarkets, shops, banks and ATMs). If all these geo-referenced variables are compared with the other data flows, they allow the identification of “hot spots” in the city of Trento and the automated analysis of crime and deviance using eSecGIS. Police forces and policy-makers are thus supported in planning interventions and allocating local resources efficiently (Brantingham and Brantingham, 1995; Lab, 2010; Di Nicola et al., 2014a).

Box 1. The eSecDB Integrated geo-database: technical characteristics

by Cesare Furlanello, Claudia Dolci and Ernesto Arbitrio

The integrated geo-database (eSecDB) is designed to store data on crime events and urban disorder, victimization, perception of security and other relevant data (e.g. socio-demographic and environmental variables, information on weather conditions, and street lighting).

The database is built using PostgreSQL technology, which is one of the most suitable open source solutions for relational databases. PostgreSQL allows the management of spatial data with its PostGIS extension. The data stored in eSecDB can be searched, extracted and aggregated through the ad hoc developed WebGis (eSecGIS interface).

As regards analysis of the data contained in this database, the “R” software has been integrated with the PRL module of PostgreSQL, allowing the use of “R” functionalities directly from the database to calculate aggregated tables and maps. This calculation system is a significant result of Project eSecurity at both the technical and operational levels: it is thus possible to produce figures and maps in a few steps, as well to export data for report generation and automated representations.

Box 2. The eSecDB integrated geo-database. Victimization and insecurity: sampling plan

by Giuseppe Espa and Maria Michela Dickson

The “Survey on objective and subjective security in the municipality of Trento” [Indagine sulla sicurezza oggettiva e soggettiva nel comune di Trento] within Project eSecurity was carried out during the period between October 2013 and April 2015. It was conducted every six months for a total of 4 rounds, respectively October 2013, April 2014, October 2014 and April 2015. The civil registry of the Municipality of Trento managed by the Service for Economic Development, Studies and Statistics was the database from which the sample of residents for each survey round was extracted.

The sampling plan applied consisted in a stratified procedure in which the resident population of the city of Trento with age ≥ 18 was divided into “strata”, that is, homogeneous groups based on a priori known characteristics. The civil registry of the Municipality of Trento contains information on sex, age, and district of residence, which were the variables used for sampling stratification. “Sex” was used as a dichotomous variable: label 1 for female residents and label 2 for male residents; while the stratifying criterion “district of residence” (i.e. 12 districts in total within the city of Trento) assumed the following labels: 1. Gardolo; 2. Meano; 3. Bondone; 4. Sardagna; 5. Ravina-Romagnano; 6. Argentario; 7. Povo; 8. Mattarello; 9. Villazzano; 10. Oltrefersina; 11. San Giuseppe-Santa Chiara; 12. Centro Storico – Piedicastello. No preliminary elaboration was needed for both variables because they are disconnected qualitative variables that can be used directly for stratification purposes. In regard to “age”, since this is a continuous variable, a re-classification into classes was needed with reference to individual date of birth, resulting in: class 18-36 - [18-36); class from 36 to 55 - (36-55]; class ≥ 56 .

At each round of the survey, structured into a panel model, it was necessary to update the data on the population contained in the civil registry, and consistently with the extracted sample. This update was made necessary by natural changes occurring within local residents (and subsequently in the sample): for example, deaths, transfers to other municipalities/countries or nursing homes, register cancellations, requests not to participate in the survey. Furthermore, modifications in the resident population required changes to the structure and size of the sample so as to have valid and significant estimates. As a result, the panel was fixed in each round of the survey except for a rotation in regard to: i) natural dynamics in the records of the sample (involuntary cancellations) and ii) refusals to collaborate with the survey (voluntary cancellations). The cancelled sample units were substituted by selecting other units from dynamic populations.

In each round, the population (≥ 18 years old) of the city of Trento amounted to 96,718 residents (1° round); 96,718 residents (2° round), 97,028 residents (3° round) and 93,329 residents (4° round).

The population taken into account for each round of the survey as well as the criteria for sampling stratification were identified and processed? by means of a multivariate stratification based on 3 criteria with respectively 2, 3, 12 codes of stratification for a total of 76 strata. A sampling frame of this kind requires definition of the sample size for each wave of the survey. In our case, non-statistical evaluations guided the selection of the sample because it was not possible to define an optimal size owing to the impossibility of fixing a sampling error; impossibility due to the lack of an historical archive of records with reference to the topic of the survey (i.e. objective and subjective security in the city of Trento). For these reasons, the sample size was fixed at 4,040 residents (1° round); 4,038 (2° round), 4,054 (3° round) and 4,058 (4° round).

The opensource “R” software was employed to extract the stratified sample. More specifically, we used the ‘sampling’ package (Tillé and Matei, 2009) dedicated to sampling techniques and the strata function available in the package. To implement this function, it is necessary to specify the selection criteria to adopt for the units in each stratum and the vector of inclusion probabilities for all units in the reference archive. First, choice is made of a simple random sampling in which all units are selected entirely at random. Second, the inclusion probabilities are assigned to each unit according to the sampling design used. In our case, the design chosen is a stratified sample with proportional allocation of units. This means that in each stratum the number of units drawn is proportional to the stratum size. The minimum number of units per stratum is $n_h = 5$. The maximum number of units per stratum is $n_h = N_h$. When $n_h < 5$, the allocation is forced to be $n_h = 5$, unless $N_h = 5$. If this situation occurs, the stratum is completely enumerated, i.e. all units present are selected in the sample. Hence the inclusion probability per stratum is $h - mo$, and therefore $\pi_h = \frac{n_h}{N_h}$.

eSecurity: what does it do?

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eSecGIS

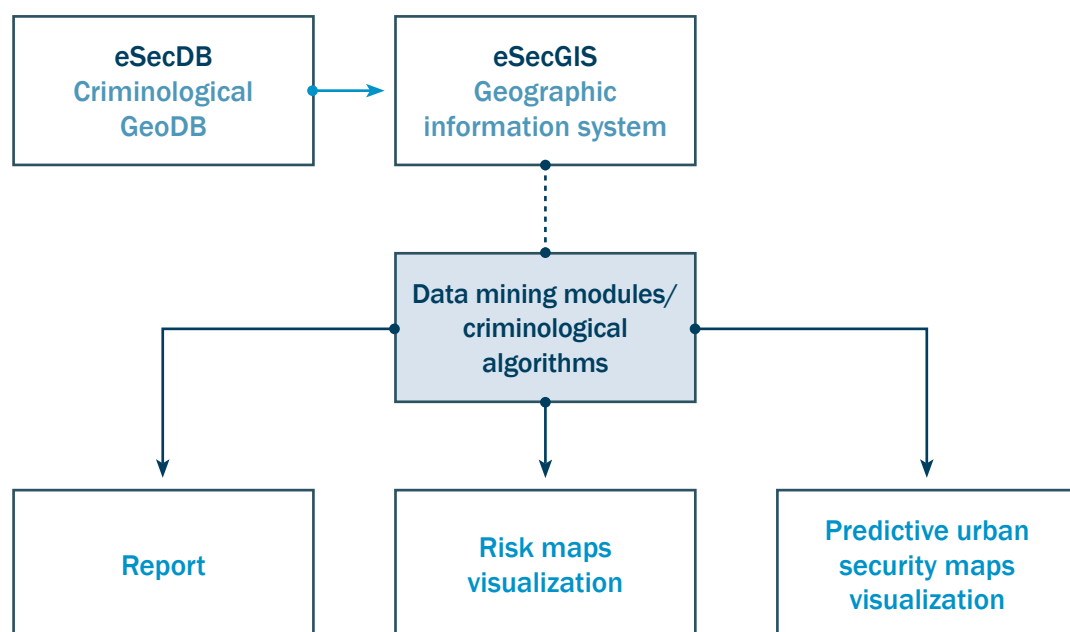
The geographic information system for predictive urban security

The core of Project eSecurity is the eSecGIS geographic information system, an ICT prototype whose main function is to analyse and process the data extracted from eSecDB, and to automatically generate reports and maps of both risk and predictive urban security by applying specific algorithms. The information system is user-friendly and, within the local area, supports police forces and local policy-makers in the following actions:

1. identification, visualization and comparison of crime, insecurity and urban disorder problems;
2. interpretation of the causes of crime/disorder/insecurity in the urban area;
3. forecasts of concentrations of different forms of crime/disorder/insecurity in the urban area.

Furthermore, it allows real time graphic representations of trends in crime and perceptions of insecurity and urban disorder while predicting future concentrations. It is thus an efficient tool with which to manage urban security (Fig. 2).

Figure 2. eSecGIS. How it works



Source: eCrime elaboration on Project eSecurity data

Box 3. The eSecGIS geographic information system. Technical characteristics

by Cesare Furlanello, Claudia Dolci and Ernesto Arbitrio

The geographic information system (eSecGIS) uses data from the eSecDB database. It has advanced capabilities for automatic report generation, and the visualization of risk and “predictive urban security” maps. The eSecGIS operating system (<https://esecwebgis.fbk.eu/>) can be synthesized as a web-based dashboard developed exclusively with open source technologies. It is characterised by a high level of interoperability thanks to adoption of the OGC (Open Geospatial Consortium) international standards. The analysis component of eSecGIS allows direct access to software “R” functions via the web. Within the eSecDB database it acts as a sort of “statistical engine” accessed via the web for data mining modules, algorithms for the calculation of crime indicators, and dynamic functions for map elaboration. More in detail, the database, which is of relational type, is fuelled by 4 heterogeneous data flows and normalized on the basis of spatial and/or logical algorithms starting from the needs of users and the analysis requested. The main software components are presented in Figure 3.

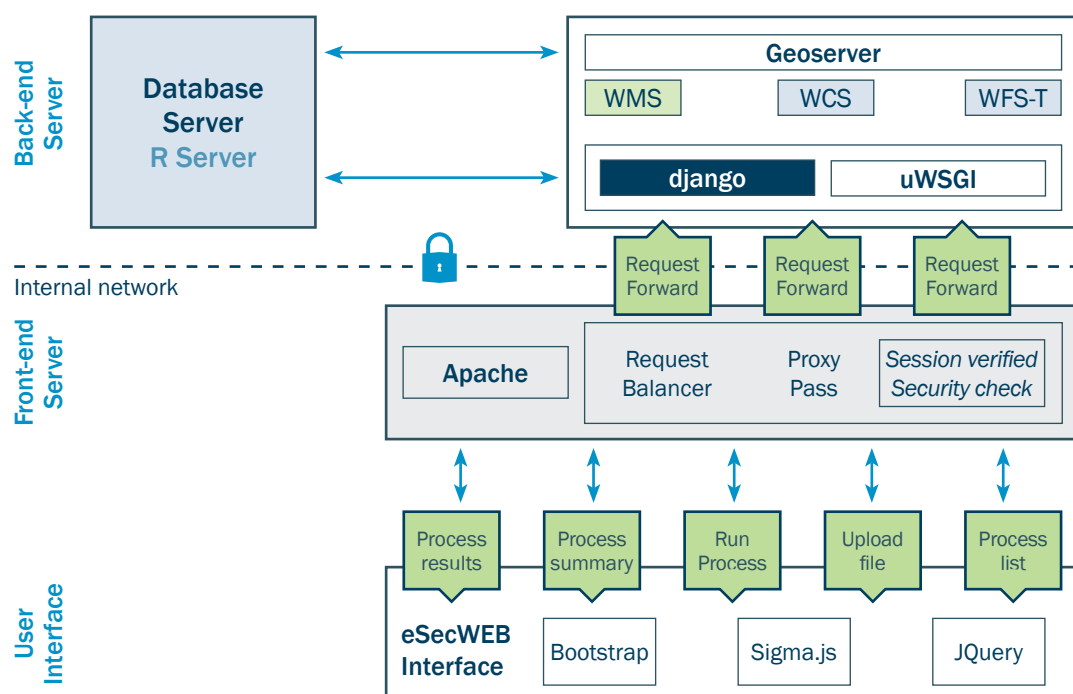
The main elements of the back-end of the infrastructure are a database server and a geo-server. These are essential for data processing and storage. In particular, the data are processed and summarized by a web application written in Python language

But how does the software work? The eSecGIS prototype has been conceived as a user-friendly and intuitive tool (Box 3). After accessing the dedicated website, the user (e.g. mayor, chief of police, law enforcement agent, municipal worker) needs personal credentials to enter the reserved area (username and password). After log-in, associated with each user is a level of access which identifies and enables specific actions. The interface allows easy browsing within the system. More specifically, the area is structured into five sections:

1. **Information flows.** This is the area containing the catalogues of eSecDB data divided into 4 data flows: reported offences, victimization, perception of insecurity, urban disorder (physical and social), smart city data, and other variables;
2. **Maps.** This is the area concerning the production of risk maps (with relative searching and browsing tools);
3. **Data analysis.** This is the area containing the analysis functions that can be applied to the data within the database;
4. **Data comparison.** This is the area in which is it possible to compare the 4 data flows (see point 1) through the automatic production of figures and risk maps;
5. **Estimated probability of burglaries.** This is the area dedicated to the prediction of future criminal offences within the local area. The algorithm has been tested with reference to domestic burglaries committed and reported within the city of Trento in 2014.

(with Django Framework). While the user-friendly and responsive interfaces of the front-end part provide users with an intuitive and easy-to-use application that can be exploited on different devices, the eSecGIS platform has been developed on the basis of the international standards for the processing and transmission of geographic data fixed by the Open Geospatial Consortium (OGC) and allowing the applicative connection with standard systems, and as for Project eSecurity, with the solutions adopted by the Municipality of Trento. Its deployment has been developed by the data centre of the Fondazione Bruno Kessler on the basis of a high performance Unix Like server. A modular architecture has been promoted together with the application of recognised international standards for data transmission, the availability of advanced tools for the analysis and presentation of the information gathered. The platform can be accessed via any standard browser (e.g. Google Chrome, Firefox, Internet Explorer, and Safari). System functions may be also available on mobile devices, for both data insertion and reserved access to information. For example, modules that could be developed in regard to Project eSecurity are tools for monitoring critical areas and places at risk of urban disorder within the city of Trento.

Figure 3. eSecGIS. System components, back-end, front-end and middleware



Source: FBK elaboration on Project eSecurity data

eSecGIS. The data flows

This section of the eSecGIS geographic information system reports in table form the data in regard to:

1. Reported offences

These data refer to crimes reported to law enforcement in the city of Trento since 2010. This information is divided into: a. point data; b. data per census section; c. data per district. Data were extracted anonymously from the SDI database (“Sistema di Indagine” - Investigation System) of the Italian Ministry of Interior by the Questura of Trento to be further transferred into the system. Tables are automatically produced with respect to the selection of users from the “Filter Menu”, and they can be exported into Excel, Cvs and Pdf formats.

The types of offences that can be selected are: assaults, drug offences, domestic burglaries, car thefts, and thefts of items from cars. These crimes have been selected because they are particularly significant in terms of numbers and social and political alarm/attention, and because they are heavily influenced by the urban context in which they occur. The specific information available on each crime is the following: day and time of the offence, the specific moment of the day/time of occurrence, the target of the offence (e.g. citizen, goods/money, etc.), the place of occurrence, and the crime rate (Example 1 – Box 4).

Example 1. eSecGIS. Data flows: reported offences

Reported burglaries in the city of Trento per district. Absolute number and crime rate. Year 2012

Furti in abitazione Furti di auto Furti su auto Lesioni Stupefacenti

Visualizza 25 elementi

Cerca:

Circoscrizione	Nr. di reati	Area [km2]	Nr. di famiglie per circ.	Nr. abitanti per circ.	Densità di popolazione	Tasso di delittuosità
ARGENTARIO	20	13,09	5268	12462	952,2	1,60
BONDONE	4	36,77	2249	5241	142,5	0,76
CENTRO STORICO PIEDICASTELLO	49	8,74	10260	20646	2362,6	2,37
GARDIOLLO	20	9,11	6094	14531	1594,7	1,38
MATTARELLO	14	16,29	2594	6083	373,5	2,30
MEANO	8	15,81	2006	5055	319,8	1,58
OLTREFERSINA	47	6,93	8574	18806	2712,6	2,50
POVO	8	15,49	2284	5667	365,8	1,41
RAVINA-ROMAGNANO	6	16,60	2143	5066	305,1	1,18
S.GIUSEPPE-S. CHIARA	50	3,08	8618	17295	5616,6	2,89
SARDAGNA	1	8,73	469	1100	126,0	0,91
VILLAZZANO	12	7,40	2085	5020	678,6	2,39

Filtra

Seleziona anno
2012

Seleziona mese
Gennaio
Febbraio
Marzo
Aprile
Maggio

Seleziona giorno
Lunedì
Martedì
Mercoledì
Giovedì
Venerdì

Seleziona fase del giorno
NOTTE
POMERIGGIO
MATTINA
SERA

Applica Reset

Source: eCrime elaboration on Project eSecurity data

Box 4. The eSecGIS geographic information system. Data flows: reported offences - technical characteristics

by Cesare Furlanello, Claudia Dolci e Ernesto Arbitrio

The geo-location of the offences reported in the municipality of Trento from 2010 onwards and stored in the eSecDB database (PostgreSQL/PostGIS) was accomplished by applying three different procedures. The processing of the data flow from the SDI (“Sistema di Indagine” - Investigative System) database of the Italian Ministry of the Interior was first managed manually after it had been anonymised by the Questura of Trento. The field related to the address was normalized with specific functions implemented by the database: for example, equivalence of word by word and proximity based on similarity (Q-GRAMS) to the street guide provided by the WFS services of the Municipality of Trento. Once the address had been normalized, it was converted into point data if the building number was present in the reported anonymised offence. By contrast, if the building number was not present or did not correspond to any number of the street guide, it was distributed throughout the building numbers of the street concerned. Geo-locator is the module developed for the geo-location of data from the SDI database.

2. Victimization and insecurity

First, the data refer to information on victimization with reference to property and violent crimes suffered by residents of the city of Trento from October 2012 to March 2015 (absolute value estimated on the total of the population). The data relate to the “Survey on objective and subjective security in the municipality of Trento” [Indagine sulla sicurezza oggettiva e soggettiva nel comune di Trento], carried out in 4 rounds (October 2013, April 2014, October 2014, April 2015) on a sample of around 4,000 residents with age ≥ 18 residing in the city of Trento. Crimes contained in this section are the following: thefts of personal belongings, vehicle thefts, thefts of items from vehicles, robbery, verbal and physical assault, verbal and physical sexual harassment. These types of crimes have been selected because they are particularly significant in their impact on citizens in terms of numbers and social and political alarm/attention, and because they are heavily influenced by the urban context in which they occur (Example 2 – Box 5).

Second, the section gathers information on the perceived sense of insecurity among residents in the city of Trento (i.e. fear of crime) with reference to the district of residence, and the perceived risk of being victimized (i.e. concern about crime) in the neighbourhoods of the city of Trento. In regard to the perceived sense of insecurity, the following questions were put to the sample of citizens: 1. To what extent do you feel safe when walking alone in your neighbourhood at night?; 2. To what extent do you feel at risk of being victimized in your neighbourhood? In regard to the perceived risk of being victimized in other areas of the city of Trento, the subjects the sample were asked to state which was, in their opinion, the neighbourhood of the city of Trento in which a person is at most risk or which should be avoided for security reasons.

Third, the tables automatically produced by eSecGIS report data on citizens' perceptions of urban disorder in the city of Trento, identifying physical urban disorder (e.g. spray-paint graffiti, garbage in the streets/abandoned litter, abandoned buildings) and social urban disorder (e.g. prostitutes, drug addicts, homeless people). With reference to the perception of urban disorder, the sample of citizens was asked to state how frequently (very, somewhat, a little, not at all) they had noticed specific urban disorder episodes (physical and social) in their neighbourhood of residence. Tables are automatically produced according to the selection made by users from the "Filter Menu", and they can be exported into Excel, Cvs and Pdf formats.

Example 2. eSecGIS. Data flows: Victimization and insecurity

Individuals aged 18 or over subject to one or more verbal or physical assaults in the city of Trento from April 2014 to March 2015 per district where the crime occurred (per 100 inhabitants of the same district)

AggressioniMolestie FisicheMolestie Verbal

Visualizza 10 elementiCerca

Circoscrizione	Nr. abitanti per circ.	Nr. di vittime stimato
ARGENTARIO	10322	107
BONDONE	4264	226
CENTRO STORICO PIEDICASTELLO	17191	365
GARDOLO	11832	252
MATTARELLO	5013	56
MEANO	4014	88
OLTREFERSINA	15889	239
POVO	4644	356
RAVINA-ROMAGNANO	4100	0
S. GIUSEPPE-S. CHIARA	14815	427

Filtra

Selezione round di indagine
Aprile 2014 - Marzo 2015 (round 4)

Selezione genere
F
M

Selezione classe d'età
≤ 56
(36 - 56)
(18 - 36)

Selezione numero di reati subiti
1

ApplicaReset

Source: eCrime elaboration on Project eSecurity data

**Box 5. The eSecGIS geographic information system.
Data flows: victimization and insecurity - technical characteristics**

by Cesare Furlanello, Claudia Dolci and Ernesto Arbitrio

The 4 rounds of the “Survey on objective and subjective security in the municipality of Trento” [Indagine sulla sicurezza oggettiva e soggettiva nel comune di Trento] were conducted every 6 months (October 2013, April 2014, October 2014, and April 2015) through a Web questionnaire followed by telephone interviews (CAWI/CATI methods). The Web questionnaire was created with the LimeSurvey open source software, already tested in similar surveys. LimeSurvey is one of the software packages most widely used today for the purpose of online questionnaires. Once the Web questionnaire had been published, the eSecGIS operating system collected data in a structured manner for subsequent statistical analysis. This type of data collection allows huge savings in time and resources, since the data gathered with this method are immediately saved in a database without having to be imported manually, as in the case of surveys carried out with paper questionnaires.

3. Objective urban disorder

This section provides information about objective urban disorder in the municipality of Trento, distinguishing between phenomena of physical disorder (e.g. graffiti, abandoned garbage, buildings in bad condition) and social disorder (e.g. presence of drug dealers, prostitutes, beggars). The data derive from the urban disorder monitoring conducted in four rounds (October 2013, April 2014, October 2014, April 2015) by the Questura di Trento. Local policemen used a dedicated application to map the city areas where episodes of urban disorder had occurred. The eSecGIS tables, which users can automatically process, set out the episodes of physical and social urban disorder by category, type, place where the phenomenon was detected, and other information. There are precise and aggregate data by section of census and district of the city in which the event occurred (Example 3 - Box 6). The tables are generated on the basis of the choices made in the “Filter Menu” and can be exported into Excel, CSV and PDF.

Example 3. eSecGIS. Data flows: Objective Urban Disorder

Episodes of physical and social urban disorder detected in the municipality of Trento per district. Absolute number. April 2015

Visualizza 25 elementi

Cerca:

Circoscrizione	Nr. di rilevazioni	Area [km2]	Nr. di famiglie (per circ.)	Nr. abitanti (per circ.git.)	Densità di popolazione
ARGENTARIO	3	13,09	5318	12560	959,7
BONDONE	4	36,77	2276	5265	143,2
CENTRO STORICO PIEDICASTELLO	111	8,74	10224	20510	2347,0
GARDOLO	28	9,11	6224	14714	1614,8
MATTARELLO	1	16,29	2652	6170	378,8
MEANO	28	15,81	2017	5020	317,6
OLTREFERSINA	27	6,93	8601	18790	2710,3
POVO	5	15,49	2332	5765	372,1
S.GIUSEPPE-S.CHIARA	54	3,08	8614	17228	5594,8
VILLAZZANO	5	7,40	2111	5041	681,5

Vista da 1 a 10 di 10 elementi

Precedente 1 Successivo

Filtra

Seleziona categoria

Disordine fisico
Disordine sociale

Seleziona data inizio intervallo

Seleziona data inizio intervallo

Questo campo è obbligatorio.

Seleziona data fine intervallo

Seleziona data fine intervallo

Questo campo è obbligatorio.

Seleziona categoria

Cabine telefoniche
Cassonetti
Edificio
Fermate bus

Applica Reset

Source: eCrime elaboration on Project eSecurity data

Box 6. The eSecGIS geographical information system. Data flows: objective urban disorder - technical characteristics

by Cesare Furlanello, Claudia Dolci and Ernesto Arbitrio

Data on physical and social urban disorder in the municipality of Trento are collected by an ad hoc application with the help of police officers at the Questura of Trento. The software for the collection of data is an application for Android smart phones which can be used to report episodes of urban disorder by means of a mobile device (smartphone or tablet) with Internet access and integrated GPS.

The advisories are therefore geo-referenced and directly saved in the eSecDB database. Photographs, if available, can be attached. The physical and social urban disorder data were classified in the above-mentioned application as follows:

Physical urban disorder

- Damaged telephone booths
- Damaged dustbins
- Abandoned buildings
- Damaged bus stops
- Insufficient street lighting
- Damaged walls
- Illegal parking
- Abandoned parks/gardens
- Presence of waste
- Damaged traffic signals
- Roads with potholes
- Abandoned vehicles

Social urban disorder

- People involved in prostitution
- Gutter punks
- Homeless people
- Drug dealers
- Drug addicts
- Drunks
- People living in temporary camps
- Illegal traders
- Gamblers
- Jugglers/Street musicians
- Beggars

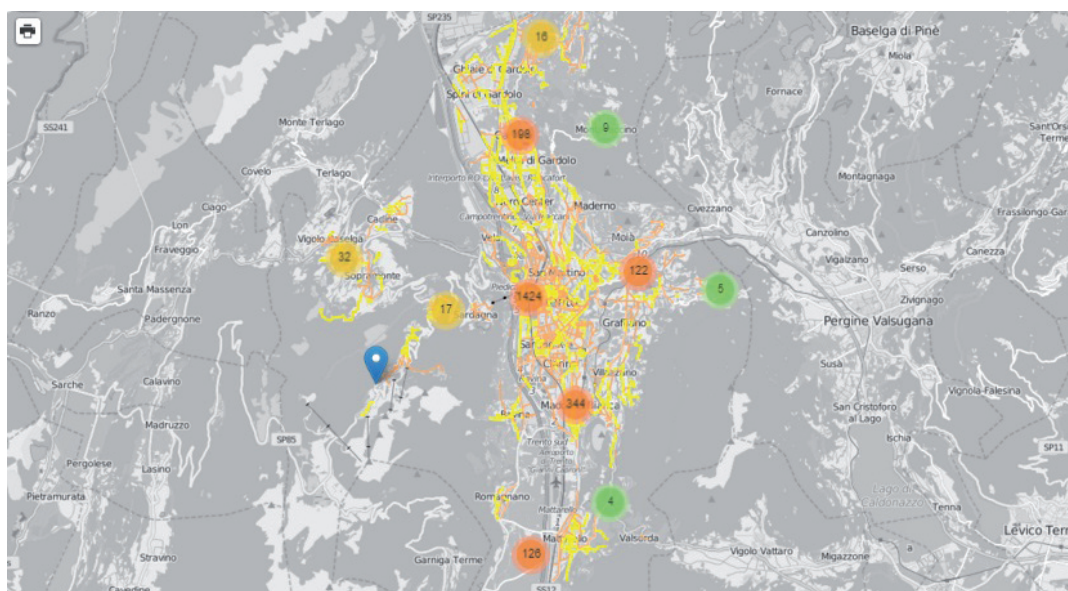
Each user, with personal authentication credentials, can access all the functionalities of the software for the data collection. The interface of the eSecGIS geographic information system then makes it possible, through any browser, to create, view or modify data. As an alternative to the mobile device, through this application it is possible to select data by selecting a point on the map, date and time and the detected items.

4. Smart City data and other variables

Smart city data and other socio-demographic/environmental variables relevant to the eSecurity project are available in the “Maps” section described in the next section in the form of graphic layers. The following data are available in this section: information on buildings in the city of Trento; ITEA buildings (public housing); house numbers of shops, public buildings and accommodation facilities; kindergartens, elementary, middle and high schools, universities; street network; street lighting in the city areas; data on weather (Example 4 - Box 7).

Example 4. eSecGIS. Data flows: Smart City data and other variables

Offences reported in the Municipality of Trento and good or poor street lighting. Absolute number. Years 2010-2014



Source: eCrime elaboration on Project eSecurity data

Box 7. The eSecGIS geographic information system.

Data flows: smart city data and other variables - technical characteristics

by Cesare Furlanello, Claudia Dolci and Ernesto Arbitrio

A number of other geo-referenced socio-demographic and environmental variables were included in the eSecGIS. If read together with the police data, this information can provide knowledge useful for the city's smart management and highlight predictive rules on objective and subjective security to support the action of police and local administrators. The GIS variables and the statistics included in the software are divided into the following categories:

Population structure

- Resident population
- Age of residents
- Sex of residents
- Nationality of residents
- Marital status
- Family composition of residents

Structure of the city

- Census sections 2011
- Number and names of districts, neighbourhoods and streets
- Structure of the street network
- Restricted traffic zones
- Parking zones
- Inner city
- IMUP zones (i.e. residential zones)
- Pharmacies
- Street lighting system
- Acoustic class - Zoning
- Number and types of shops
- Number and types of public businesses
- Number and types of buildings
- Number and types of enterprises
- Orthophoto 2011
- Land registry
- Abandoned houses
- Public housing (Itea)
- Sheltered housing
- Rest homes
- Areas under video surveillance

Street network

- Poorly lit roads
- Narrow and/or closed streets
- Roads with a high number of parked vehicles

Economic and occupational aspects

- Education
- Profession
- Employment/Unemployment rates
- Income per capita
- Number of interventions by social services
- Number of access to clinics/SERT (i.e. Italian public body that helps drug addicts)

Network of trade and industry

- Shopping centres
- Supermarkets
- Businesses/Commercial enterprises
- Food/cigarettes vending machines
- Arcades/Betting shops
- Service stations
- Petrol stations

Network of meeting places and public utilities

- Exhibitions
- Markets (e.g. weekly or specialized markets)
- Green areas
- Parking areas
- Nursery schools
- Kindergartens
- Elementary schools
- Middle schools
- High schools
- Universities
- Sports facilities
- Stadiums/Sports halls
- Locations of other musical events/sports/etc.
- Post offices
- Banks/ATMs
- Building permits

The geographical and statistical data merged into the eSecDB/eSecGIS system were provided by various local authorities, including the Municipality of Trento, the Autonomous Province of Trento and other provincial services. The database also contains the ISTAT (Italian Institute of Statistics) data on the census conducted nationwide in the years 2001 and 2011.

eSecGIS. Maps

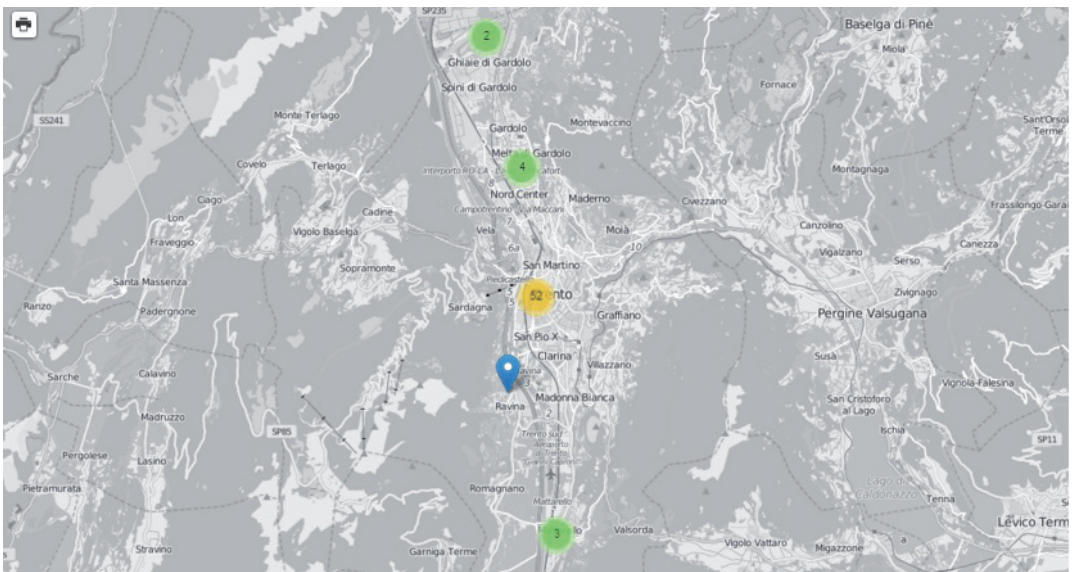
This section of the geographic information system allows the map visualization of data on:

1. Reported offences

In this subsection, it is possible to map reported offences (by census tract) occurring in the Municipality of Trento since 2010. Data have been anonymously retrieved from the SDI database of the Italian Ministry of Interior by the Questura di Trento, and then transferred to the eSecGIS system. The types of offences selected are: personal injuries, drug-related crimes, domestic burglaries, car thefts, and thefts of items from cars (Example 5).

Example 5. eSecGIS. Maps: Reported offences

Drugs-related offences reported in the Municipality of Trento by district. Absolute number. Year 2012



Source: eCrime elaboration on Project eSecurity data

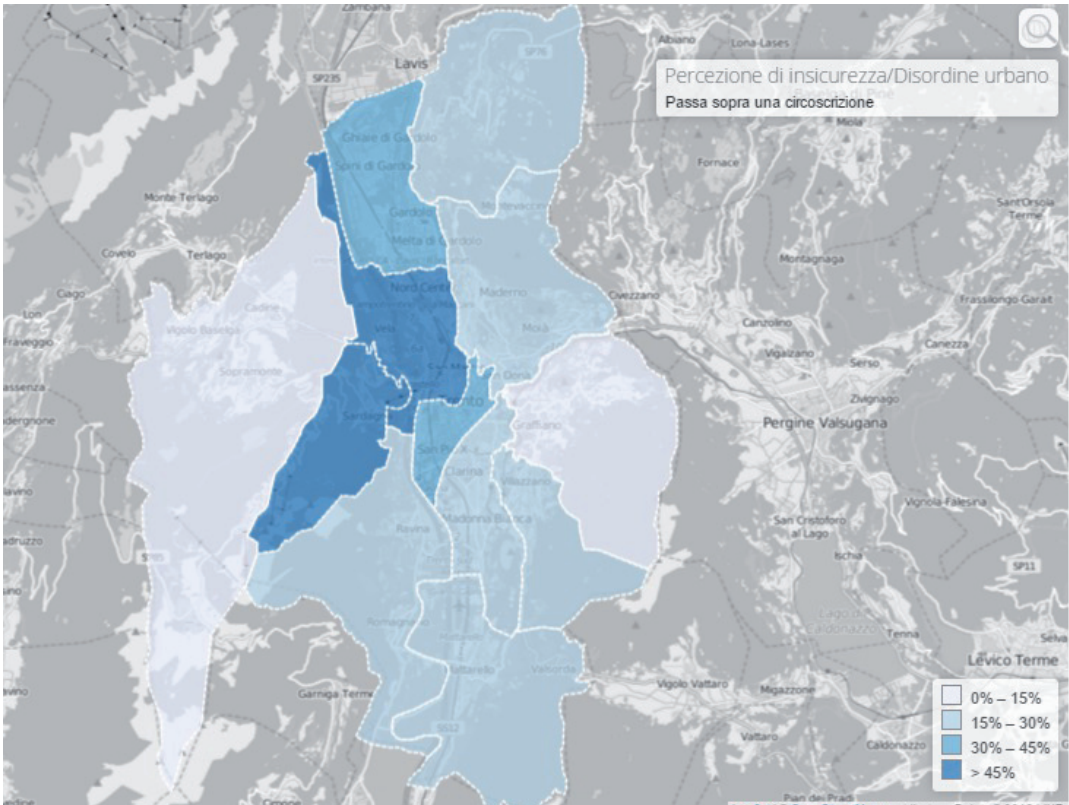
2. Victimization and insecurity

First, this subsection makes it possible to map information concerning victimization rates related to property and violent crimes in the municipality of Trento from October 2012 to March 2015. The victimization rate is the number of individuals aged 18 or over who have suffered one or more crimes in the municipality of Trento by district where the crime took place, per 100 inhabitants of the same district. This section covers the following offences: theft of personal property, domestic burglaries, vehicle thefts, thefts of items from vehicles, robbery, verbal and physical aggressions, verbal and physical sexual harassments.

Second, it is possible to map data on the perception of insecurity and of physical and social urban disorder in the municipality of Trento, from October 2012 to March 2015. Data are expressed in the number of individuals living in a given district who feel/perceive a given problem in a given way per 100 inhabitants of the same district. The only exception is the perception of the level of danger in the city, which is expressed as a percentage of individuals who consider a given urban district to have high crime risks out of the total of those who believe that areas with high levels of danger exist in Trento (Example 6). Data have been retrieved from the above-mentioned “Survey on objective and subjective security in the municipality of Trento” [Indagine sulla sicurezza oggettiva e soggettiva nel comune di Trento].

Example 6. eSecGIS. Maps: Victimization and insecurity

Individuals aged 18 or over who have “very” or “fairly” often thought about the possibility of being a victim of crime in their neighbourhood of the municipality of Trento from October 2013 to September 2014 (per 100 inhabitants of the same district)



Source: eCrime elaboration on Project eSecurity data

eSecGIS. Data analysis

This section of the eSecGIS geographic information system allows the automatic production of descriptive analyses of data contained in the eSecDB database. More in detail, it is structured into two subsections:

1. Reported offences

This subsection is dedicated to the automatic generation of charts on reported offences in the municipality of Trento since 2010 onwards (Example 8).

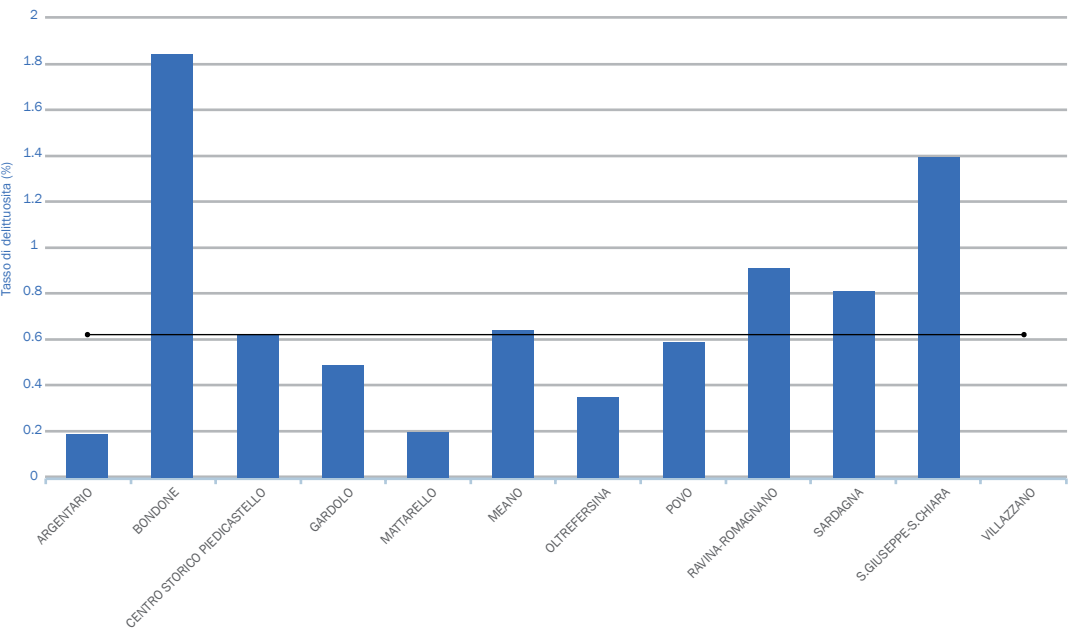
2. Victimization and insecurity

This subsection is dedicated to the automatic generation of charts on victimization (appropriative and violent offences), and on perception of insecurity and urban disorder in the districts of the municipality of Trento from October 2012 to March 2015 (Example 9).

Users can explore data by using the menu items in the column on the right. All the items in the menu are selected by clicking the “Check” button. In order to select multiple entries in a sub-menu, it is necessary to press and hold the “Ctrl” key while clicking on the desired items: once the selection has been made, the user must press the “Apply” button. To download the chart, the “Chart context menu” button must be clicked.

Example 8. eSecGIS. Maps. Data analysis: Reported offences

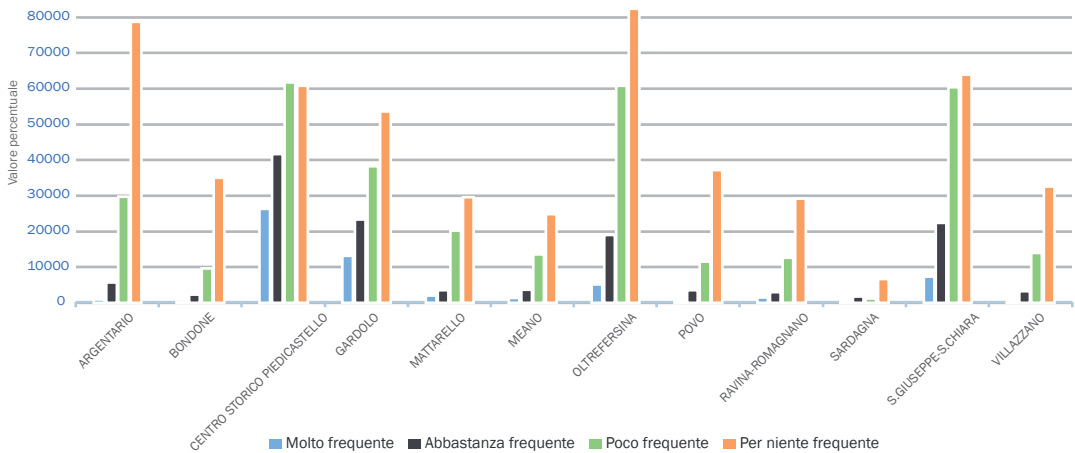
Thefts of items from cars reported in the municipality of Trento by district. Crime rates. Year 2012



Source: eCrime elaboration on Project eSecurity data

Example 9. eSecGIS. Maps. Victimization and insecurity

Individuals aged 18 or over who perceive as “Very”, “Somewhat”, “A little” or “Not at all” frequent the presence of social urban disorder in their neighbourhood in the municipality of Trento from October 2012 to September 2013 (per 100 inhabitants of the same district)



Source: eCrime elaboration on Project eSecurity data

eSecGIS. Data comparison

In this section of the eSecGIS geographic information system, it is possible to compare by means of maps and charts the different information flows contained in the platform, i.e. data on: 1. reported crimes in the municipality of Trento; 2. victimization, perception of insecurity, and urban disorder perceived by citizens in the municipality of Trento; 3. objective urban disorder detected in the municipality of Trento. This interactive comparison allows very simple verification of the presence of discrepancies between the real security situation and the perceived security in the municipal area (Example 10). Users can choose whether to compare the information flows using maps or charts.

Example 10. eSecGIS. Data comparison: Navigation screen

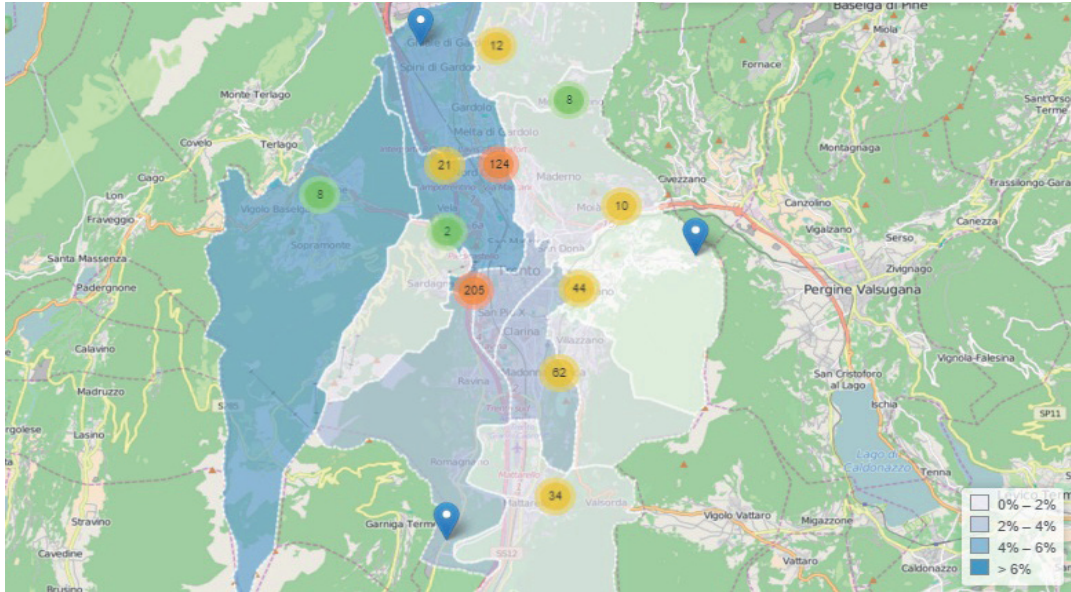
Domestic burglaries reported in the municipality of Trento by district (absolute number) in 2014, and individuals aged 18 or over whose families were victims of one or more domestic burglaries in the municipality of Trento from April 2014 to March 2015 by the district where the crime took place (per 100 inhabitants of the same district). Navigation screen

The screenshot shows the 'Flusso Informativo 1' and 'Flusso Informativo 2' sections. 'Flusso Informativo 1' has dropdowns for 'Reati denunciati', 'Tipologia' (Furti in abitazione), and 'Anno/Periodo' (2014). 'Flusso Informativo 2' has dropdowns for 'Vittimizzazione (reati appropriativi)', 'Tipologia' (Furti in abitazione), and 'Anno/Periodo' (Aprile 2014 - Marzo 2015 (Round 4)). At the bottom are buttons for 'Crea Grafico' and 'Crea Mappa'.

Source: eCrime elaboration on Project eSecurity data

Example 11. eSecGIS. Data comparison: Map of comparison

Domestic burglaries reported in the municipality of Trento by district (absolute number) in 2014, and individuals aged 18 or over whose families were victims of one or more domestic burglaries in the municipality of Trento from April 2014 to March 2015 by the district where the crime took place (per 100 inhabitants of the same district). Map



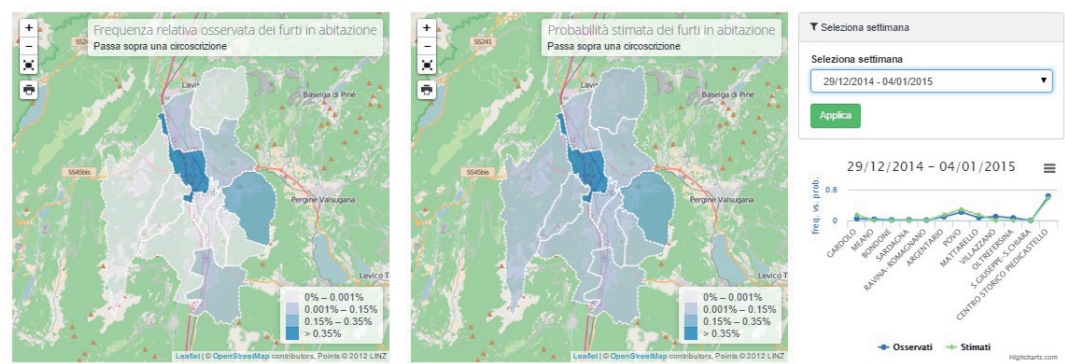
Source: eCrime elaboration on Project eSecurity data

eSecGIS. Estimated probability of domestic burglaries

This is the predictive section of the eSecGIS geographic information system: it is dedicated to the prediction of domestic burglaries (estimated probability) in the municipality of Trento in 2014 by district. The forecasting spatio-temporal model has been tested at district level on 52 weeks of the year 2014, which the user can browse through the items in the dropdown on the right. Once the selection of the week of interest has been made, the user must press the “Apply” button. The automatically-generated map on the right shows the “Observed relative frequency of domestic burglaries”, while the one on the left shows the “Estimated probability of domestic burglaries”. The line chart located below the pull-down menu compares the observed relative frequency of domestic burglaries with the estimated probability by district, in relation to the week selected (Examples 12 and 13 – Boxes 8 and 9).

Example 12. eSecGIS. Estimated probability of domestic burglaries: Navigation screen

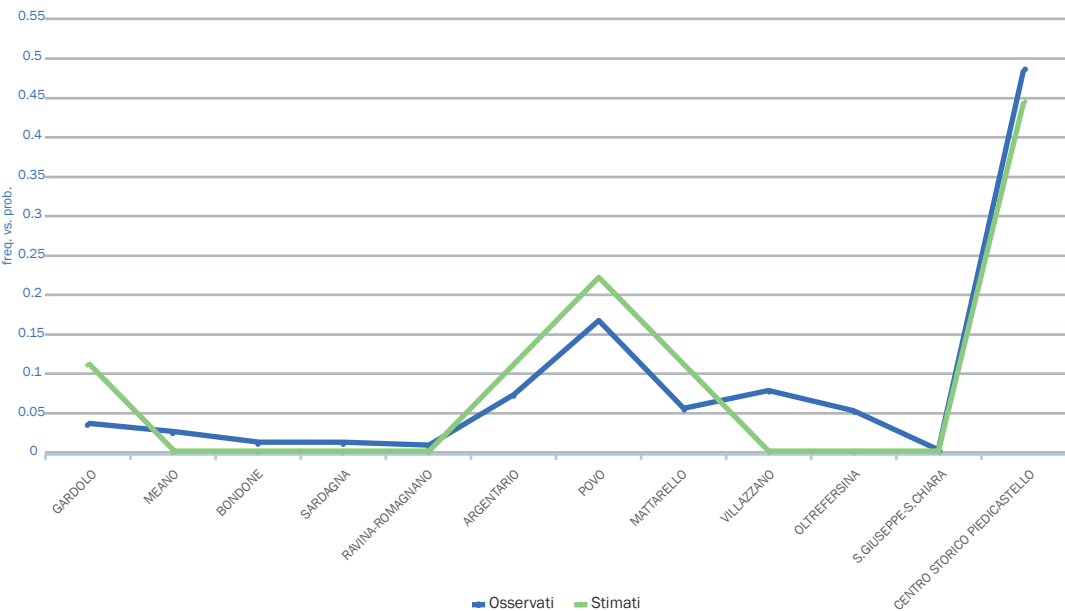
Observed relative frequency and estimated probability of domestic burglaries from 29 December 2014 to 4 January 2015 in the municipality of Trento by district. Navigation screen (Comparison maps and line chart)



Source: eCrime elaboration on Project eSecurity data

Example 13. eSecGIS. Estimated probability of domestic burglaries: Line chart

Observed relative frequency and estimated probability of domestic burglaries from 29 December 2014 to 4 January 2015 in the municipality of Trento by district. Line chart



Source: eCrime elaboration on Project eSecurity data

Box 8. The eSecGIS geographic information system. Estimated probability of domestic burglaries

by Giuseppe Espa, Diego Giuliani and Maria Michela Dickson

Examples 12 and 13 illustrate the estimation of the probability of suffering a domestic burglary in Trento per week at district level. It is a predictive exercise built to show the potential applications of the models that we have developed. On the one hand, due to computational problems we aggregate micro-data relating to domestic burglaries (see Box 9) per week at district level, even if information is available at the most disaggregated spatial and temporal level: hours/minutes, and precise spatial coordinates. On the other hand, we do not at present have covariates with the same spatio-temporal details. Hence the model used in the above-mentioned Examples is substantially the following auto-model:

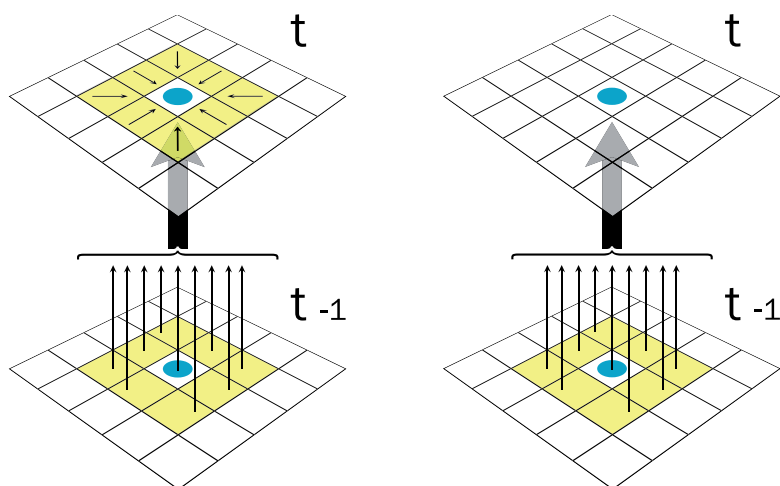
$$Y_{i,t} = \beta_0 + \beta_1 Y_{i,t-1} + \beta_2 \sum_{j \in C\{i\}} Y_{j,t} + \beta_3 \sum_{j \in C\{i\}} Y_{j,t-1}$$

which has been estimated per week at district level, in the form below:

$$Y_{i,t} = \beta_0 + \beta_1 Y_{i,t-1} + \beta_3 \sum_{j \in C\{i\}} Y_{j,t-1}.$$

The predictive model can therefore work without the necessary presence of covariates spatially delayed but temporally concurrent with the data being estimated. Figure 4 below clarifies what has been said. To estimate the probability of suffering a domestic burglary in the district i at time t , data relating to the districts contiguous to the i -th and reported at time t cannot be considered known.

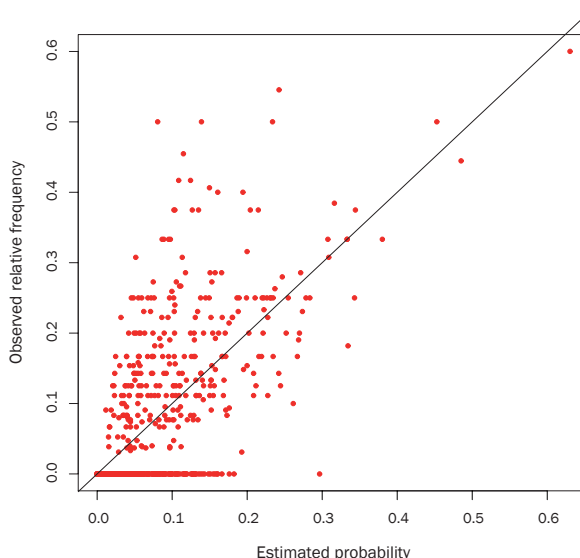
Figure 4 - Structure of the space-time dependence in the estimated model and in the predictive equation



Source: eCrime elaboration on Project eSecurity data

As a demonstration, we report some simple numerical and graphical measures with which to assess the predictive power of our model. The overall linear correlation coefficient between the probabilities estimated by the model and the corresponding observed relative frequencies is $r_{\hat{p},f} = 0.641$. This is an acceptable high value that evidences the good performance of the model that we have built. This impression is confirmed by the scatter plot reproduced below (Fig. 5), which shows a good concentration around the line (i.e. the position of the points where the relative frequencies observed are equal to the estimated probability), especially if one notes that the range on the two axes is not extended to the theoretical upper limit of 1.

Figure 5 - Observed relative frequency and estimated probability of domestic burglaries in the municipality of Trento (2014): Scatter plot



Source: eCrime elaboration on Project eSecurity data

For reasons of space, we do not publish analogous performance indicators per week and district, nor any estimate of the parameters of our model. We merely point out that the good performance of our predictive model can only be further improved by the use of explanatory variables with more precise spatial and temporal details. The eSecurity information system is modular and has already been fitted to accommodate, in this and other environmental contexts, a) other explanatory variables at the most disaggregated spatial and temporal level (e.g. collection of real-time point data); b) predictive models calculated on these variables, which will be estimated from time to time.

Box 9. The eSecGIS geographic information system. A risk model for specific types of crime

by Giuseppe Espa, Diego Giuliani and Maria Michela Dickson

A statistical model is a useful tool with which to identify and simulate events related to crime, and other complex events related to associative phenomena, in space and time. The objective of such analysis is twofold and may consist of: i) the formulation of forecast scenarios; and ii) the estimation of the damage that a criminal event (domestic burglary, theft of items from cars, etc.) may cause. The basic elements of the predictive model that we have designed are the following:

1. an archive of the events occurring over time in areal units (i.e. also very disaggregated from the spatial point of view) as the census sections; practically, this is a binary matrix **X** (presence or absence of a crime). This archive can also be at micro level (point data);
2. a **C** contiguity matrix of the areas referred to at point i) which defines the associative structure of the sites. If data are identified as points, **C** becomes the **D** distance matrix;
3. a cross-sectional set, or simply a sectional set, of suitable explanatory variables **Y**, related or otherwise to the territory, selectable from eSecDB.

Information concerning points 1 and 3 is collected in the eSecDB database, while the associative structures that link this information in space (see point 2) are handled in the eSecGIS. To integrate the three elements referred to at points 1-3, in order to predict specific types of crime on the territory and to derive some “basic” risk measures, it is a priority to specify an appropriate model for the description of the subject matter of the research. The specialized literature offers three solutions in this regard. A model traditionally used for these purposes is a classic model analysing binary variables that has received much attention in several disciplines since the seminal paper by Cox (1970). In formal terms:

$$E(X_i) = \theta_i = \frac{e^{y_i' \beta}}{1 + e^{y_i' \beta}}, i = 1, 2, \dots, n$$

where $\theta_i = P(X_i = 1)$, i.e. the probability that the criminal event occurs in the *i*-th area, y_i is the row vector of independent variables observed in the same area, and β is a column vector of unknown parameters (for more details see Cox and Snell, 1989).

Although interesting from a logical and formal point of view, a very significant practical problem affects the use of logistic regression on geo-referenced data such as those on criminal events stored in the eSecDB and managed by eSecGIS. It is the hypothesis of independence of the variables X_i treated without taking their spatial nature into account. Indeed, a characteristic common to all geographical studies is the mutual dependence among observations: “*everything is related to everything else, but near things are more related than distant things*” (Tobler, 1970). This empirical law may be reproduced in formal terms to predict the probability associated with an area, consider-

ing the spatial dependence between the same areas. A family of models suited to representing the above-mentioned situation are the so-called auto-models and, in particular, the auto-logistic model (or better, a variant known as LAM, as we will see later). Without going into methodological details but only to provide some insights, the auto-logistic model assumes the following functional form (Besag, 1972):

$$P(X_i = x_i | X_j = x_j, j \neq i, j \in C\{i\}) = \frac{\exp\left\{x_i \left(\alpha_i + \sum_{j=1}^n \beta_{ij} x_j\right)\right\}}{1 + \exp\left\{\alpha_i + \sum_{j=1}^n \beta_{ij} x_j\right\}}.$$

The parameters β_j are measures of the interactions between pairs of areas; the terms α_i are, instead, local quantities useful to take account of the presence of possible spatial trends within the model. The main difference with logistic regression is not logical but inferential. Traditional estimation methods cannot be applied to an auto-logistic model to estimate the parameters of the vectors, since these methodologies are inconsistent. In this case, it is necessary to use, among others, algorithms known as maximum pseudo-likelihood algorithms (Besag, 1975). The auto-logistic model, while defining a structure of spatial dependence through the X_i , does not include the explanatory variables Y_i . Conversely, the traditional logistic approach is explained only in relation to the covariates, but ignores the effects of spatial dependence in the construction of models.

As noted by Arbia and Espa (1996), both models (the logistic and auto-logistic ones) may be incomplete and inappropriate to fit criminological data with a territorial connotation. Consequently, we consider as appropriate the use within the eSecurity project of a combined model that mixes the advantages of the logistic and auto-logistic approaches. The scheme used is the following:

$$P(X_i = 1 | X_j = x_j, j \neq i, j \in C\{i\}) = \frac{\exp\left\{\alpha + \gamma' y_i + \sum_{j=1}^n \beta_{ij} x_j\right\}}{1 + \exp\left\{\alpha + \gamma' y_i + \sum_{j=1}^n \beta_{ij} x_j\right\}}$$

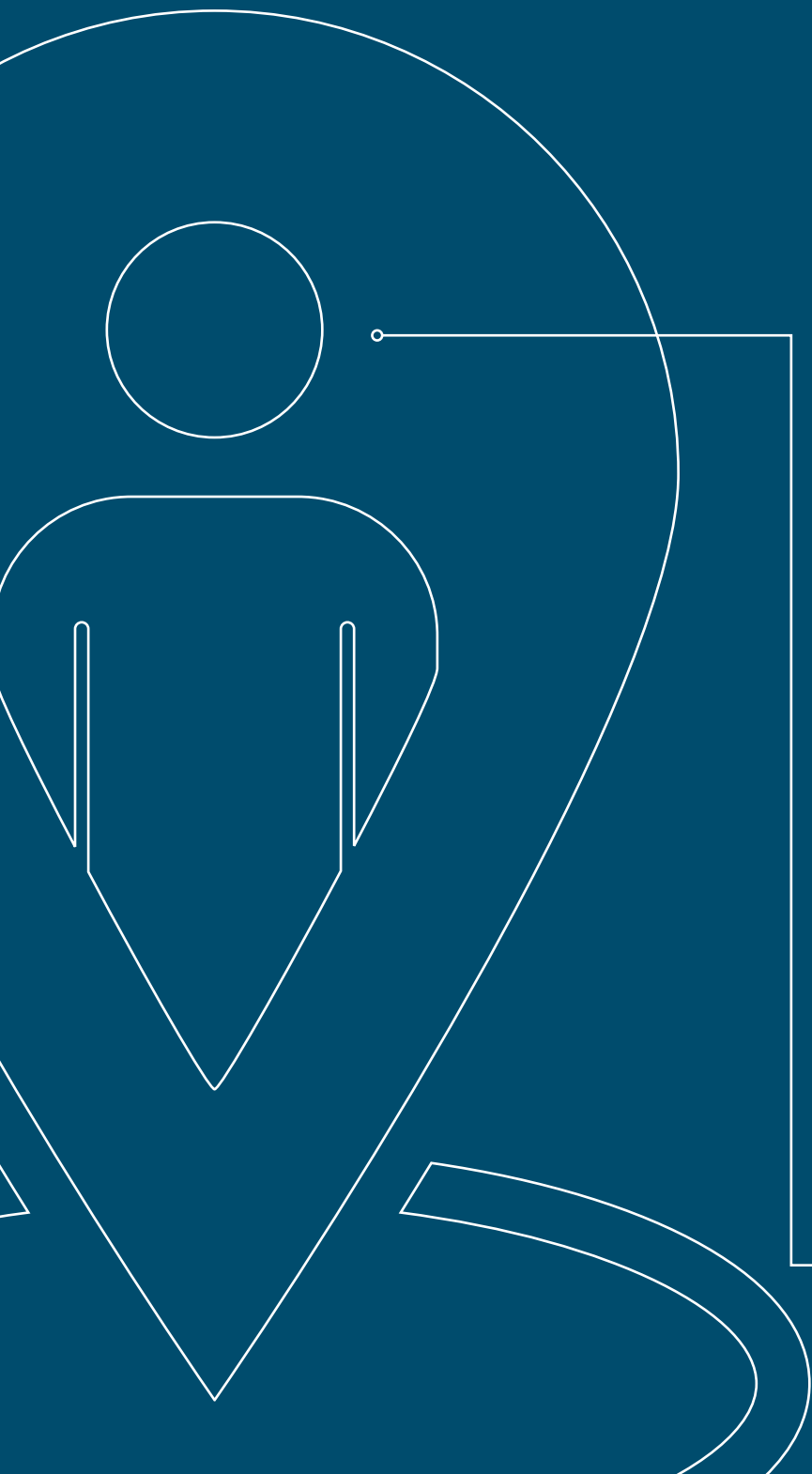
known in the scientific literature as LAM (Logistic Auto-logistic Model; Arbia and Espa, 1996; Arbia, 2006). The parameters α , $\gamma' = (\gamma_1, \gamma_2, \dots, \gamma_p)$ e β_j take on the usual meanings. We used a LAM spatio-temporal model (at district level and per week) to estimate the probability of suffering a domestic burglary in the city of Trento in the three-year period covered by the project. Some results of this complicated procedure are set out in the pages preceding this box with reference to the year 2014.

eSecurity: what does it do?

A

B

C



eSecWEB

The crime prevention portal

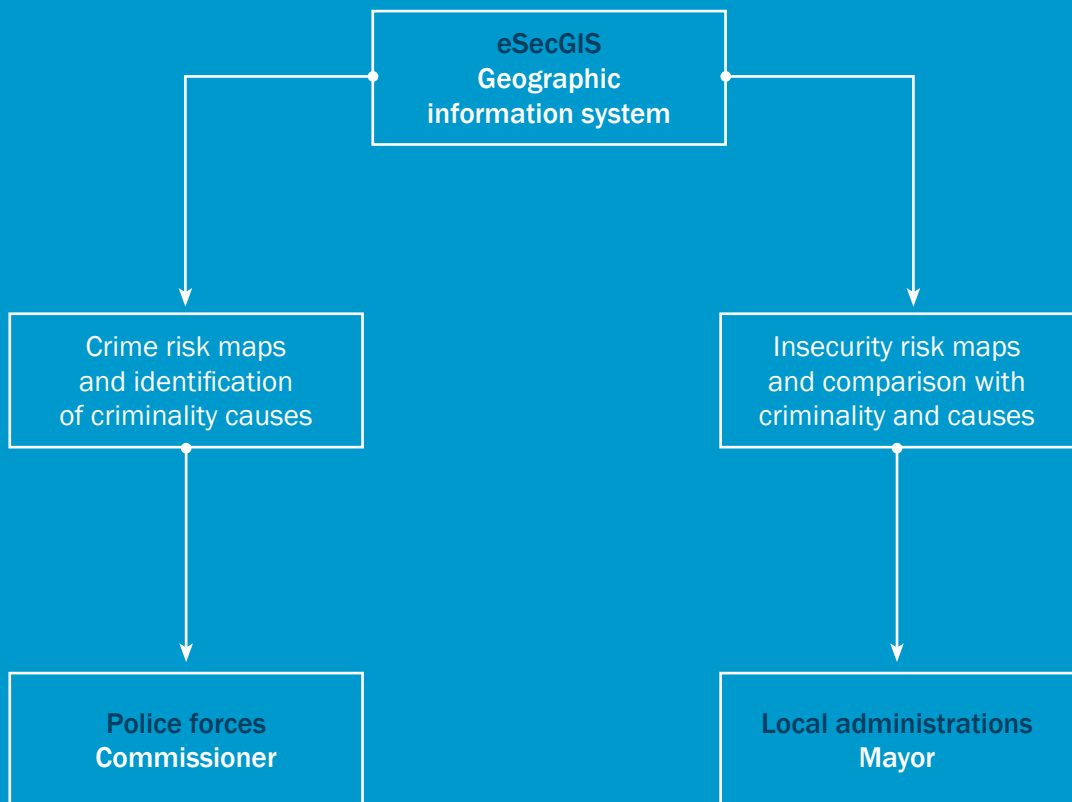
The last product of the eSecurity project is the eSecWEB portal, which is already available in a prototype form at www.esecurity.trento.it (Fig. 6). The purpose of the website is to provide a channel of communication among citizens, local authorities and police forces for dissemination of the research results. eSecWEB enables the public to access some contents of the project. In this way, the eSecurity team can provide citizens with precise and objective information on the state of deviance and crime in the municipality of Trento. Moreover, the Web platform will comprise a section dedicated to the preventive behaviours and best practices that people can adopt to minimize the risk of victimization. Finally, this tool will foster closer collaboration between the public authorities that deal with urban security and the city's residents in relation to possible policies and prevention initiatives to reduce crime and deviance in the city.

Figure 6. eSecWeb



Source: www.esecurity.trento.it

Figure 6. eSecGIS. The overall aim of the project



Source: eCrime elaboration on Project eSecurity data

Conclusions

eSecurity, which is one of the few predictive policing schemes globally, has sought to take two steps forward with respect the above-mentioned projects of Memphis, Los Angeles, London and Greater Manchester in order to implement the new model of “predictive urban security” (RAND, 2013). First, the eSecGIS ICT tool (prototype), which has been developed in Trento, uses not only data on spatial-temporal location of past criminal events but also socio-demographic and environmental variables, as well as other information from the smart city.

The second step forward taken by the Trento project concerns recognition of the need to understand and take account of the concentration of insecurity and physical and social disorder in the city, with the ultimate goal of determining the present and the future of urban security management. Accordingly, the ICT system seeks not only to predict “where” and “when” some forms of crime and deviance will take place in an urban area but also to understand “why” these crimes, episodes of deviance, urban disorder, and (personal and collective) insecurity have occurred. The intention of eSecurity is to furnish advanced knowledge to guarantee a comprehensive prevention strategy which considers the various aspects that compose the concept of urban security, at the service of all the institutional actors that are involved in the urban security management, i.e. both police forces and local administrators (Selmini, 2004; Di Nicola et al., 2014a).

Specifically, the eSecGIS geographic information system enables:

- a. police officers to define local critical areas for the optimal allocation of police resources in relation to criminal/deviant episodes, to intervene through targeted efforts to prevent and eradicate episodes of crime and deviance, and to measure the results achieved;
- b. local administrators to understand the real dimensions of these phenomena and their “why”, to design more effective policies and actions on crime, urban disorder and insecurity, and to monitor the results achieved; in particular, it enables preventive and support action in the case of marginality also in collaboration with non-profit organizations;
- c. citizens to obtain precise and objective information on the state of security in the city and receive advice on recommended preventive behaviour (Fig. 7).

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