SAPIENZA
UNIVERSITÀ DI ROMA

VICrime

Visualization tool for analyzing italian crime

The Team

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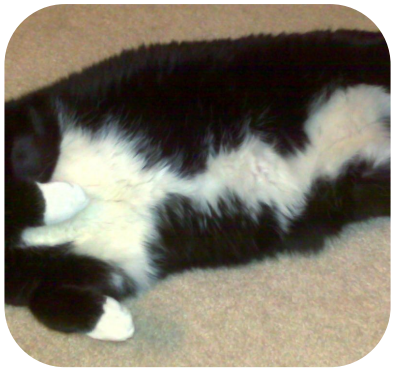

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The Idea behind VICrime

Introduction

Why analyze crime?

Crimes affect the quality of life, economic growth and reputation of a nation.
Furthermore, they impact over important life's decision, like even moving to a new place, avoiding dangerous areas.

Introduction

Our objective

Assist users into studying the **behaviours of crimes** in specific Italian areas, identifying **hotspots**, **crime patterns** and their **evolution** over time.

In order to do that we needed to find a way to represent information such that they could be easily visualized, analyzed and understood, supporting Italian authorities into monitoring the situation and, if necessary, conceiving plans of action

Introduction

The Components of VICrime

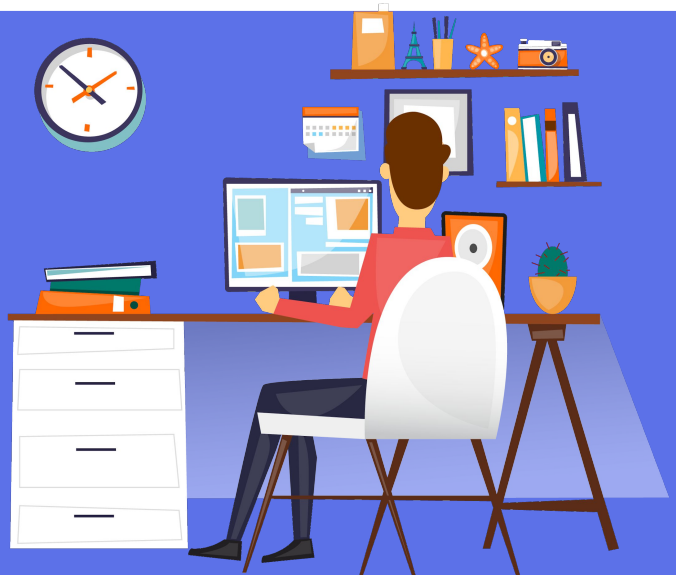
Three different and ***coordinated*** views:

1. **Crime mapping** - to understand the geographic crime distribution, identifying hotspots, and highlight how much the demographic incidence can affect the rate of felonies.

2. **Parallel coordinates** - to find patterns, analyzing every crime composing a territory, also reporting their recurrence rate, and to detect evolution over time.

3. **Multidimensional scaling** - for having a tangible situation of the differences existing between areas without having to compare each location crime by crime.

Related Work



Related Work

Inspirational Works

similar technical solution and **similar objectives:**
CrimeVis: An Interactive Visualization System for Analyzing Crime Data in the State of Rio de Janeiro (2017)

- Map view and parallel coordinates to visualize the crimes of the Police Department that exposed them.
- Various clustering techniques, included MDS.

CrimAnalyzer: Understanding Crime Patterns in Sao Paulo (2015)

- Analysis of crime patterns variations over space and time, focusing on some particular crimes.
- Very good definition of what an hotspot is. With the intuition of weights specific crime with the penalty gave from the Sao Paulo government.

Related Work

Other Works

similar dataset:

Un'analisi sul rapporto tra criminalità e benessere in Italia (2010).

- Find a relationship between crime rates and environmental wellness
- The reasons behind diffusion of crimes are very hard to find because even family fights in childhood, friendship or work dissatisfaction could led a person to commit a crime, and this is why we did not treated this aspect.

similar technical solution:

Multiple Coordinated Views to Analyze Geo-referenced High-dimensional Datasets

- *Encoding of the attractiveness of Swiss cities considering economic, social and environmental fields.*
- *Map view, parallel coordinates and MDS*

Related Work

Other Works

similar objectives:

CrimeVis: Visualizing Vancouver Crime (2017)

- Represent the crime changes over the years and how a crime rates changes in different locations

Online tool with similar purpose:

NYC Crime Map

- Governmental visualization in 3 kind of maps (Precinct/Crime Location/Heat)

CrimeMapping

- TriTech Software System to help US community. Provides the exact address of the crime reported by most of all US Police departments.

Indice della Criminalità

- Elaboration of similar data from “Il sole 24 ore” journal.

Dataset

Istat

Dataset

The Data Sources

- All the views process all the **denounced** crimes reported by the ISTAT in the years 2012 - 2019 jointed to the population of the italian territories (region and provinces)
- A small preprocessing (“subcrimes” and population) has been made in order to create a solid structure
- The output is a csv file containing **1073 rows** (representing all italian regions and provinces in the year interval of 2012-2019) and **35 columns** (representing the crimes, the name of the territory the sum and the *population*), with the total of a **AS index of 37.555.**

Dataset

The Data Sources

- The MDS , in order to retrieve the danger coefficient, exploits the **convicted** criminals data. (still reported by ISTAT) containing for each crime the detention time that Italy's government adopt.

Dataset

The Data Sources

- The Map view use two others ISTAT datasets for **draw** the **Italian maps** divided for regions and for provinces. The downloaded file is a shapefile so for the use, it needs a **pre-processing** for the transformation in a GeoJson file.

Dataset

The Data Sources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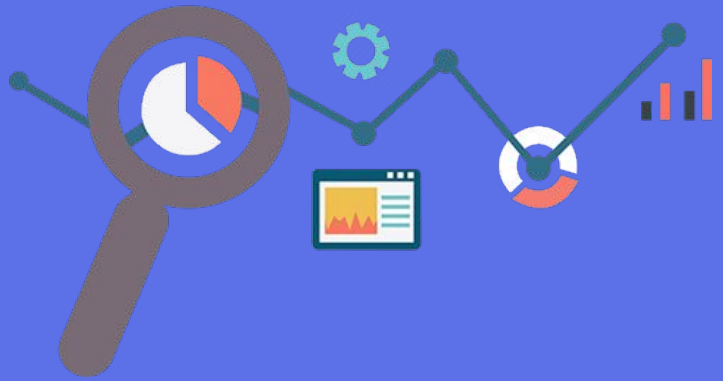
omicidi	0	0	3	11	5	0	3	29	44	95	0,005708	0,64	0,00364	0,364
percosse	4	11	2	1	0	0	0	0	0	18	0,001082	0,01	0,00001	0,001
lesioni dolose	43	253	315	202	65	9	2	1	0	890	0,053476	0,03	0,0016	0,16
sequestri di persona	0	0	0	0	0	0	0	2	0	2	0,00012	0,5	0,00006	0,006
violenze sessuali	0	2	7	19	94	144	49	10	0	325	0,019528	0,18	0,00351	0,351
atti sessuali con minorenne	0	0	1	2	11	13	8	0	0	35	0,002103	0,18	0,00038	0,038
corruzione di minorenne	0	0	0	0	0	0	0	0	0	0	0	0	0	0
sfruttamento e favoreggiamento della prostit	0	0	0	1	1	1	0	0	0	3	0,00018	0,12	0,00002	0,002
pornografia minorile e detenzione di materiali	1	3	0	2	11	13	8	0	0	38	0,002283	0,16	0,00037	0,037
furti	158	1331	3045	2143	394	23	6	3	0	7103	0,426786	0,03	0,0128	1,28
rapine	3	14	84	626	1543	884	242	17	0	3413	0,205071	0,13	0,02666	2,666
estorsioni	0	0	8	62	201	142	34	3	0	450	0,027038	0,14	0,00379	0,379
truffe e frodi informatiche	1	7	11	10	4	0	0	0	0	33	0,001983	0,04	0,00008	0,008
delitti informatici	0	0	0	0	0	0	0	0	0	0	0	0	0	0
contraffazione di marchi e prodotti industriali	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ricettazione	32	199	418	550	402	48	5	0	0	1654	0,099381	0,05	0,00497	0,497
riciclaggio e impiego di denaro, beni o utilità	0	3	16	31	28	6	1	0	0	85	0,005107	0,07	0,00036	0,036
usura	0	0	0	0	4	0	0	0	0	4	0,00024	0,1	0,00002	0,002
incendi	0	0	4	10	14	0	2	0	0	30	0,001803	0,09	0,00016	0,016
normativa sugli stupefacenti	19	50	484	762	614	307	102	26	1	2365	0,142102	0,09	0,01279	1,279
associazione per delinquere	0	0	0	0	1	2	1	1	0	5	0,0003	0,26	0,00008	0,008
associazione di tipo mafioso	0	0	0	3	4	2	2	0	2	13	0,000781	0,27	0,00021	0,021
contrabbando	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Totale condanne per fascia di pena	261	1873	4398	4436	3398	1610	499	117	51	16643	1	4,15	0,07331	7,333

territorio	anno	popolazione	strage	tentati_omicidi	omicidi	[.....]	altri_delitti	totale
Piemonte	2012	4357663	1	84	142	[.....]	31621	243077
Piemonte	2013	4374052	1	69	112	[.....]	34851	248366
Piemonte	2014	4436798	0	75	123	[.....]	32094	240892
Piemonte	2015	4424467	0	66	134	[.....]	30359	227047
Piemonte	2016	4404246	3	57	124	[.....]	29684	207885
Piemonte	2017	4392526	1	73	122	[.....]	30207	193783
Piemonte	2018	4375865	0	67	158	[.....]	29369	184594
Piemonte	2019	4328565	1	73	128	[.....]	30873	180478

Views



Views

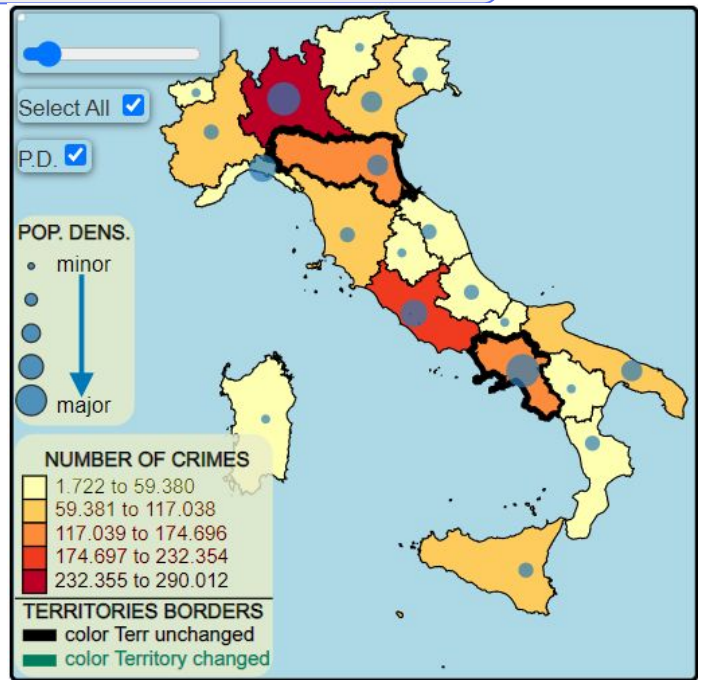
Italian Map

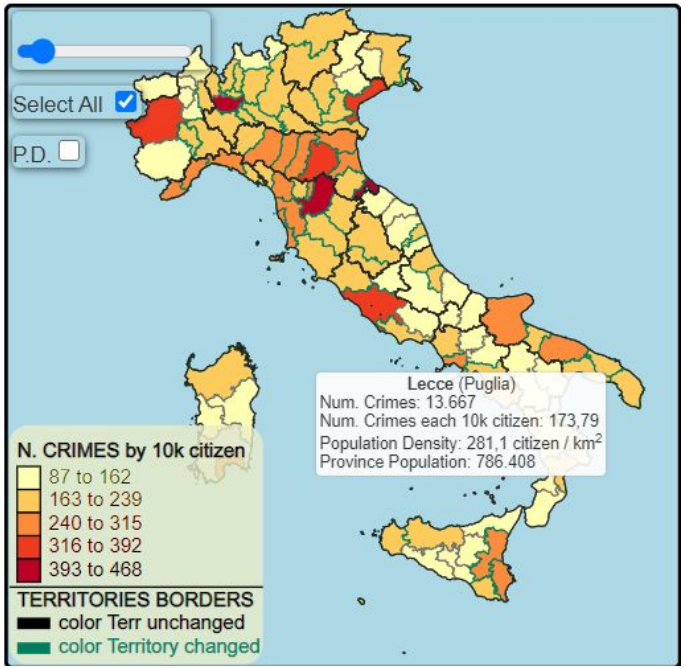
Visualization of data through a color scale.

- Each colour represent the range of number of crimes given the number of infractions on each territory.
- Every selected area has a fill color weighted over the number of crimes in that place.
- The color of the borders of each territory is meaningful
- The legend permits to understand the number of crimes given a color, and relate a color wrt the amount of felony happening.
- The map provides zoom for a better selection and analysis of the small areas.
- It’s offered a tool for visualizing the population density of each location

Views

Italian Map





Views

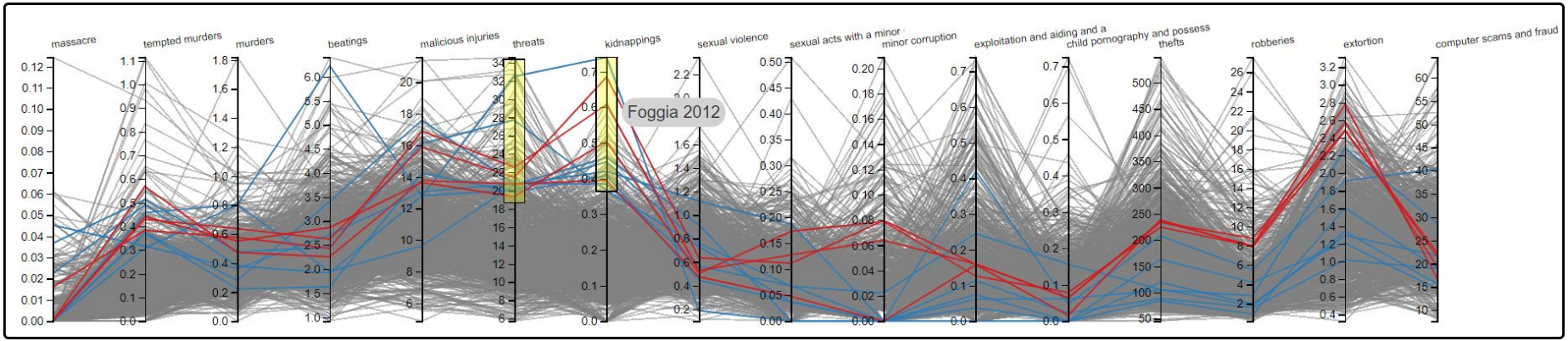
Parallel Coordinates

Visualize multidimensional data through parallel axes in a 2D chart.

- Each axis represents a crime
- Each territory (region or province) is represented by a polyline that intersects each axis at its corresponding crime value.
- Brushing feature can highlight only the territories that for each crime have a certain range
- Highlights of the same territory in different year in order to check the crime trend
- Drag function to order crimes

Views

Parallel Coordinates



Views

Multidimensional Scaling

Input: each territory with 31 variables, representing different crimes.
To understand the relationship among objects we had to generate a **proximity matrix.**

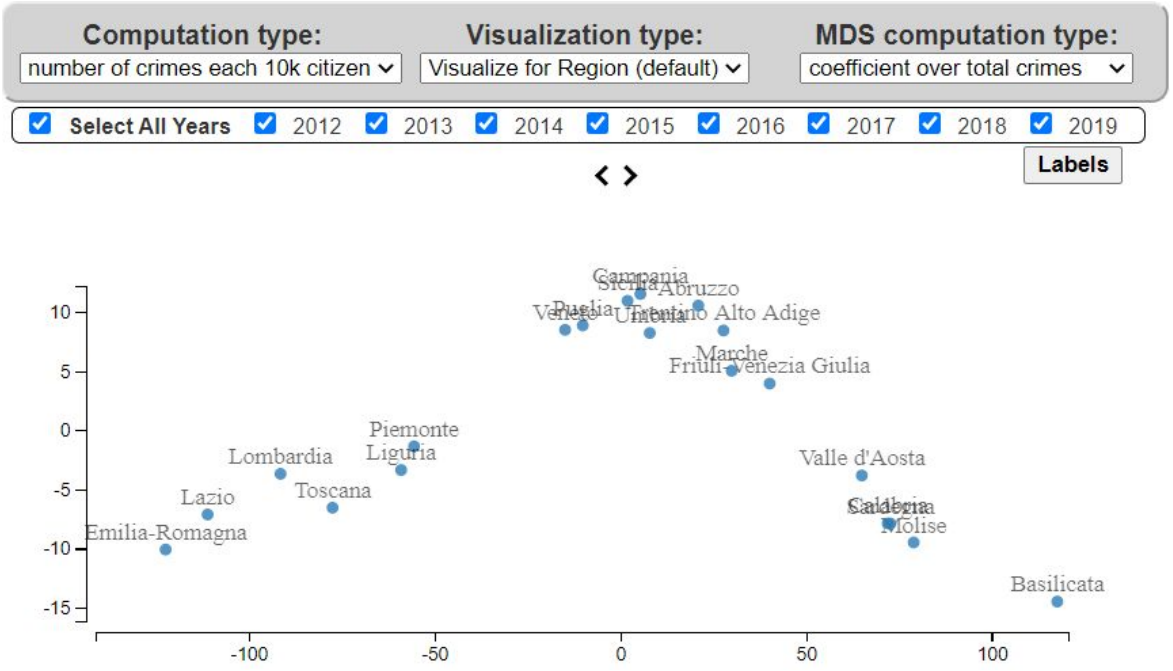
To calculate this proximity values we used the Euclidean distance.
We also decided to calculate some coefficient in order to weight every crimes according to their danger using the convicted criminals dataset

The user has the ability **to choose** the coefficient that he prefers or he can even **compute** a dissimilarity matrix without these additional information.

Output: *scatter plot* with brush function

Views

Multidimensional Scaling



Future Works

Future work

What we will do with VICrime

When the new and updated data will be published by ISTAT, this visualization will easily integrate them giving an **up-to-date vision** of all crimes in Italy.

With similar data, the work could be expanded including more geographical territories (Municipalities, Other nations and so on)

Conclusion

Conclusion

What have we seen

VICrime supports the analysis of crimes in Italian territories. This tool has the dual property to offer to the user both a **general and global view of all crimes** denounced to the authorities, and a **fine grained visualization** that can inform the user about what's happening in a particular place, giving him:

- A geographic **localization**,
- The **dissimilarity** of that place with respect to others and
- The **trend** of that place all over the crimes selected.

All of this conceived in a manageable and fitting-screen environment, that can help users to start solving crime problems.

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THANKS

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https://github.com/FrancescoArtibani97/VA-project