Spatial analysis of police open data as a part of community policing – an example of Pardubice city (Czech Republic)

Conference Paper · November 2015

CITATIONS
0

READS
124

11 authors, including:

Peter Ondrejka
Masaryk University
5 PUBLICATIONS **9** CITATIONS
SEE PROFILE

Lukáš Herman
Masaryk University
38 PUBLICATIONS **109** CITATIONS
SEE PROFILE

Jan Russnak
Masaryk University
13 PUBLICATIONS **18** CITATIONS
SEE PROFILE

Petr Kubicek
Masaryk University
82 PUBLICATIONS **299** CITATIONS
SEE PROFILE

Spatial analysis of police open data as a part of community policing – an example of Pardubice city (Czech Republic)

Peter Ondrejka, Lukáš Herman, Jan Russnák, Petr Kubíček, Robert Cibula, Pavel Grochal, Josef Chrást, Adam Mertel, Daniel Vrbík

Department of Geography, Faculty of Science, Masaryk University Brno, Czech Republic

Extended Abstract

Spatial data collected by the police has considerable potential for spatial analysis. Such analysis can help to improve the performance of the police itself, raise public awareness of local issues, and serve as an input for decision-making processes in other institutions. For these reasons we believe that police data should be, with certain limitations, distributed as open data freely available to everyone to use and republish as they wish, without restrictions from copyright, patents or other mechanisms of control.

In this paper, we demonstrate the possibilities of spatial analysis and cartographic visualisation of crime data. We provide two use cases based on data gathered by the municipality police in Pardubice, the tenth largest city in Czech Republic. Our approach is inspired by risk terrain modelling introduced by Caplan & Kennedy (2011). The input dataset contains a geolocated list of minor criminal offences that occurred in the city in 2014.

Crime incidence statistics were produced by the Municipality police of Pardubice. The dataset contains all reported incidents in the city area in 2014. Because of different terms of references for Municipality police and the Police of the Czech Republic the dataset includes rather minor offences. Each dataset entry is classified by the offence type, and holds information on the date and time, on-the-spot fine fees, as well as notes on actions taken by the police and the resolution of the event. Geolocation is provided by the address and GPS coordinates in WGS84 georeferencing system stated in decimal form. The validity of GPS data was manually confirmed on the subset of data by comparison with stated address.

Use case 1 – gambling sites

The influence of gambling sites on population is a subject of several studies, focusing on social capital (Barmaki 2001; Griswold & Nichols 2006), gambling problems (Fischer 2001), effects of regulation (Hansen & Rossow

ICA European Symposium on CARTOGRAPHY
VIENNA, 10–12 NOVEMBER 2015

Published in "Proceedings of the 1st ICA European Symposium on Cartography", edited by Georg Gartner and Haosheng Huang, EuroCarto 2015, 10-12 November 2015, Vienna, Austria

2010), accessibility (Robitaillle & Herjean 2008) or availability (Jacques, Ladouceur & Ferland 2000) of gambling and video lottery terminals.

There were over 57 000 gambling sites in the Czech Republic at the end of the year 2014 (Ministry of Finance 2014). Permission and licence for casino, gaming machine or roulette is granted by the Ministry of Finance of the Czech Republic. The list with locations of permitted gambling sites is legally open data provided by the Ministry of Finance. Addresses of these places were geocoded in QGIS 2.6. Fig. 1 shows the distribution of gambling sites in the city center of Pardubice.

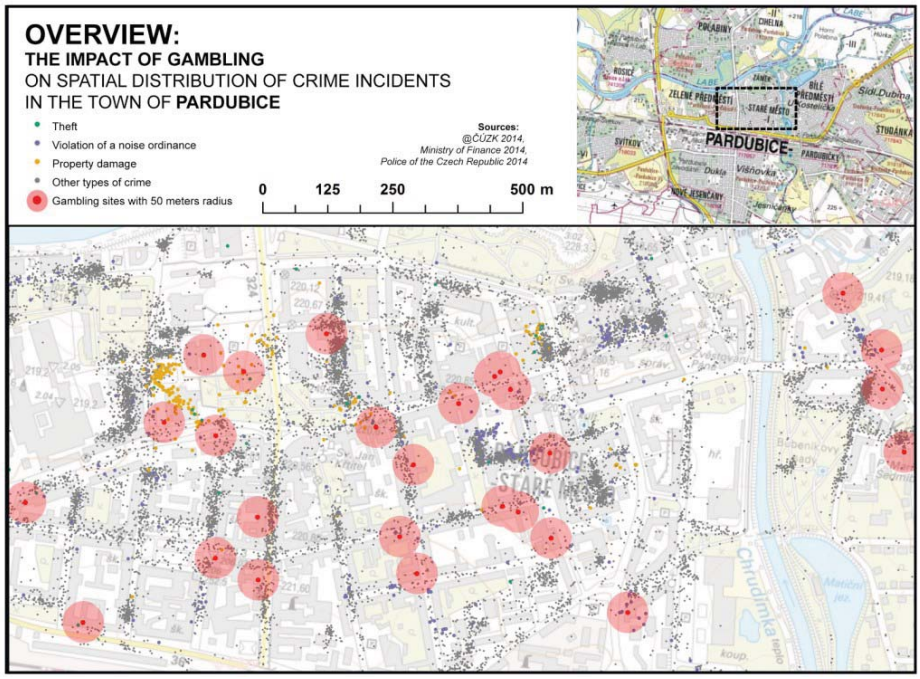

Figure 1. The distribution of gambling sites and crime incidents in the Pardubice city centre.

The first use case analyses how gambling sites influence the number of crime offences in their surroundings. The Czech Republic legislation does not permit the presence of a gambling site in a 100 m distance from specified buildings such as schools, hospitals, or places of worship (Act No 202/1990). Our findings support the validity of the 100 m threshold as it roughly agrees with the 85-120 m influence reach we found in the input dataset. For the purpose of our analysis, we devised a method of concentric

buffer zones to observe if the change in the relative amount of crime incidences of different types depends on the distance from the gambling site. With this method, we identified three crime types that appear to be significantly influenced by the proximity of a gambling site: theft, violation of noise ordinance and property damage. The results suggest that the distance of highest influence is 15 meters, where the amount of crimes culminates (see Fig. 2). The threshold beyond which the gambling site ceases to influence the crime rate falls between 85 and 120 meters.

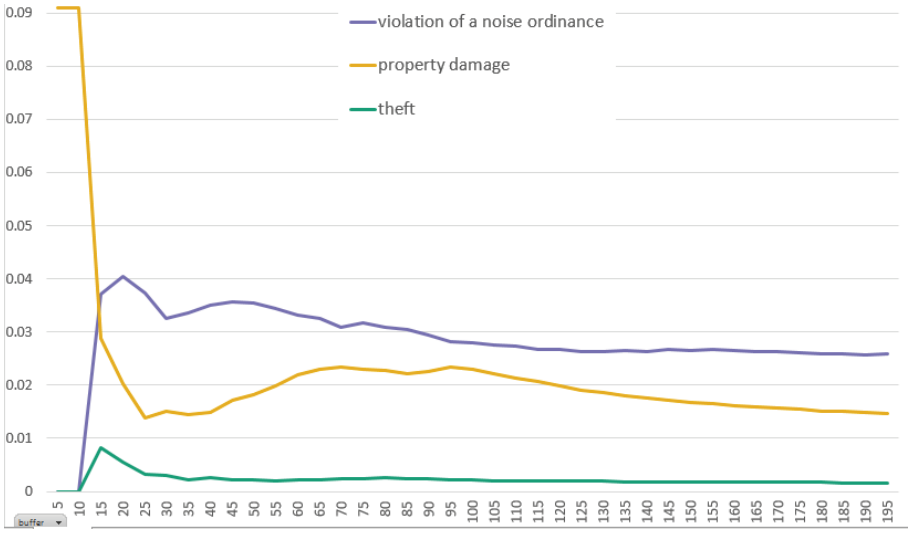

Figure 2. The Impact of the distance from a gambling site on the relative amount of three selected crime.

Use case 2 – traffic offences

The second use case is focused on possible methods for accident prevention and enhancing urban transportation planning by using data of committed offences. This topic is covered, for example, by Levine (2008), Cinnamon et al. (2011) or by Gundogdu (2011). Traffic offences have been extracted from source data and they have been devised in two parts: offences caused by pedestrians and offences caused by cyclists.

For the second use case, the offences dataset has been combined with other open data stored in RUIAN (Registry of Territorial Identification, Addresses and Real Estates) registry, e.g. streets and buildings. Different methods have been used for processing and analysing this data. Temporal analysis groups the offences by date ranges (see Fig. 3). For cyclists, the number of

offences is highly dependent on the weather conditions, peaking during the summer holidays, August and September. This probably reflects the new trend of active holiday spent on bicycles. For the pedestrians, the results are quite reverse as more offences were noticed during the winter months.

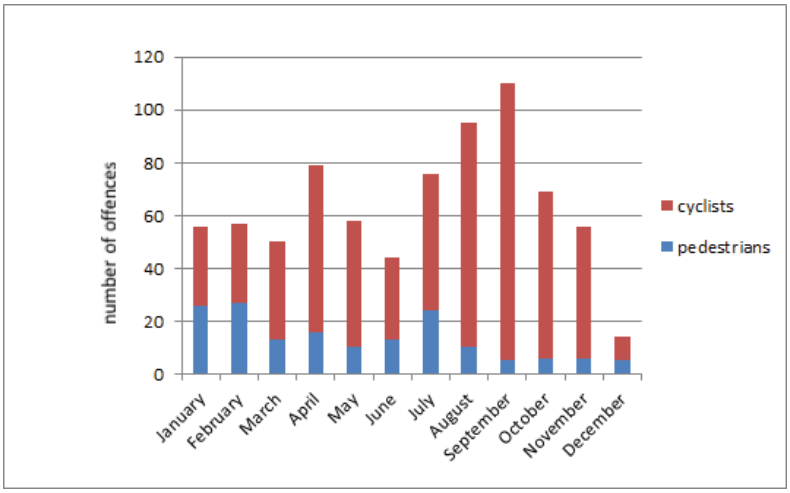

Figure 3. Monthly distribution of offences committed by pedestrians and cyclists.

Along with the temporal analysis, heat maps were also created to localize areas with the highest concentration of offences. Hot-spots of traffic offences have been extracted from the heat map. The data was filtered by pedestrian and cyclist offences into separated layers. Then we assessed these separate layers by using the "*Kernel Density*" analysis. Important clusters have been extracted semi-automatically from these heat maps. ArcGIS 10.3 was used for this step of data processing. Workflow has been developed in Model Builder. Most important parameter of this workflow is threshold that is set for reclassification of raster data. Threshold values are different for offences caused by pedestrians (0.003) and cyclists (0.002). Output of this workflows point layers have been exported to MS Excel and there, the contingency table was created.

Some hot spots from the city center are shown on Fig. 4. For example area C is on frequented road with heavy traffic in rush hours. The traffic lights in this crossroad don't change the interval so some of the pedestrians try to pass the road on the red light. The construction of overpass would solve the problem. Another solution would be in optimization of the traffic light intervals. The J spot is located in the park. There are no bicycle lanes in this

park and there are also only one-way roads around the park that complicates mobility of cyclists and they use the park as a significant shortcut.

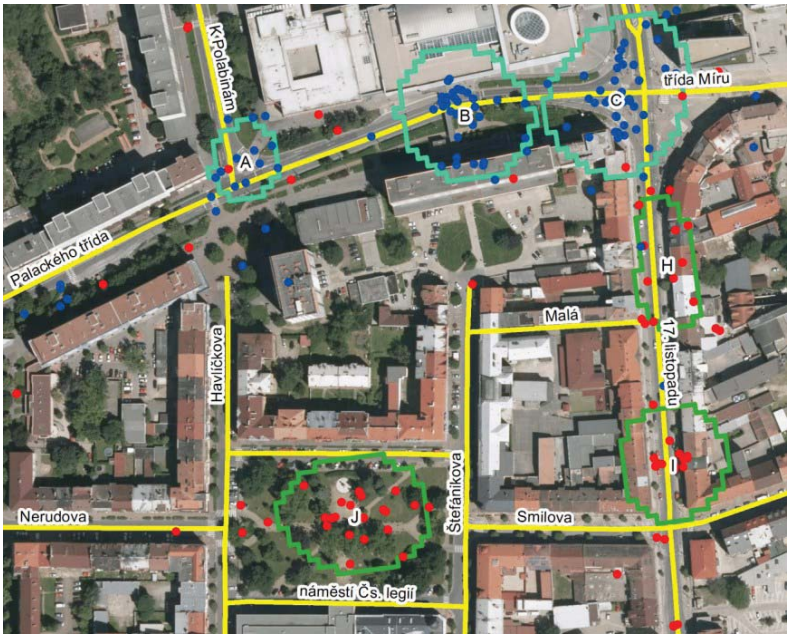

Figure 4. Overview of the offence clusters in the city centre (blue – pedestrians; red - cyclists).

Conclusion

Results of both aforementioned use cases can be used by both police and public administration authorities as a supportive source for community policing. Community policing is a strategy of policing that focuses on police working closely with members of the communities. In this concept, police forces are seen as part of the public and should not be considered only as a tool of repression Office of Community Oriented Policing Services (2014). Analysis of data collected by the police can positively affect not only the safety but generally the quality of life and urban transport.

It should be noted that each type of offenses requires the selection of specific methods of analysis. We started from the general work dealing with crime mapping in GIS (e.g. Caplan & Kennedy, 2011), but it was necessary to concentrate on analytical methods closer related to solved topics, which were impact of gambling sites on amount of offences and distribution of traffic offences caused by cyclists and pedestrians.

References

Act No 202/1990 Coll. on Lotteries and other similar Games

Barmaki R (2010) Gambling as a social problem: on the social conditions of gambling in Canada. Journal of Youth Studies. Vol. 13, No. 1, pp. 47-64

Brnění, o. s. (2012) Ministerstvo financí: potřebujeme studii o dopadech hazardu. [on-line] 3. 9. 2012 [see in 21. 5. 2015] Available from: http://www.osbrneni.cz/ministerstvo-financi-potrebujeme-studii-o-dopadech-hazardu

Caplan JM, Kennedy LW (2011) Risk Terrain Modeling Compendium. CreateSpace Independent Publishing Platform. 162 p.

Cinnamon J, Schuurman N, Hameed SM (2011) Pedestrian Injury and Human Behaviour: Observing Road-Rule Violations at High-Incident Intersections. In: Plos One. 2011. DOI: 10.1371/journal.pone.0021063

Fischer S (2001) A Prevalence Study of Gambling and Problem Gambling in British Adolescents. ADDICTION RESEARCH & THEORY. Vol. 7, No. 6, pp. 509-538

Griswold MT; Nichols MW (2006) Social Capital and Casino Gambling in U.S. Communities, Social Indicators Research, Vol. 77 Issue 3, p369-394

Gundogdu IB (2011) A new approach for GIS-supported mapping of traffic accidents. In: Proceedings of the ICE - Transport. Vol. 164, No. 2, 01.

Hansen M, Rossow I (2010) Limited Cash Flow on Slot Machines : Effects of Prohibition of Note Acceptors on Adolescent Gambling Behaviour., International Journal of Mental Health & Addiction, Vol. 8 No. 1, pp. 70-81.

Jacques C, Ladouceur R, Ferland F (2000) Impact of Availability on Gambling: A Longitudinal Study. Canadian Journal of Psychiatry Vol 45, No. 9.

Levine T (2008) On Traffic Safety and Law Enforcement. In: Geography & Public Safety. Vol. 2, No. 1, pp. 1-2.

Ministry of Finance of the Czech Republic (2014) Informativní přehled povolených zařízení - stav k 31. 12. 2014 [on-line]. 31. 12. 2014 [see in 21. 5. 2015] Available from: http://www.mfcr.cz/cs/soukromy-sektor/regulace/loterie-a-sazkove-hry/prehled-povolenych-zarizeni/2015/informativni-prehled-povolenych-zarizeni-20151

Office of Community Oriented Policing Services (2014). Community Policing Defined. [online] ISBN: 978-1-935676-06-5. [see in 30. 5. 2015] Available from: http://www.cops.usdoj.gov/pdf/vets-to-cops/e030917193-CP-Defined.pdf

Robitaille E, Herjean P (2008) An analysis of the accessibility of video lottery terminals: the case of Montreal. International Journal of Health, Vol. 7, Special section p1-15