Usage of street-level imagery for city-wide graffiti mapping

Eric K. Tokuda, Claudio Silva, Roberto Cesar-Jr

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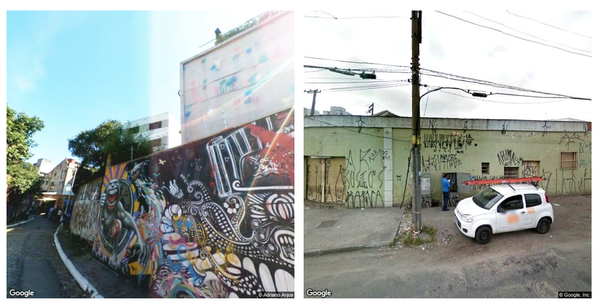
Eric K. Tokuda[1], Claudio T. Silva[2], Roberto M. Cesar-Jr[1]
[1]University of São Paulo
[2]New York University

Problem

- Graffiti commonly found in large urban centers
- It can be categorized into artistic drawings and tagging, as seen in the picture below. We are interested in the latter. Images obtained from [1].



- Such acts are seen as crimes and are combated by public authorities
- In 2017, the city hall of São Paulo, Brazil, enacted a law [2] that establishes high fees and combat to acts of graffiti against public heritage.
- The European Union maintain programs to understand and combat such acts [3].
- Identifying where the concentration of graffiti in the city are would be of great utility because it would allow auditing saturated regions (Broken Windows theory)
- There is currently no automatic way of obtaining a tagging map of the city

Contributions

We propose a method to automatically compute the graffiti map of a city using computer vision over public images. We systematically collect data, train a segmentation algorithm and evaluate using the obtained dataset. We perform a case study in São Paulo, Brazil, and compare to socio-economical indicators.

Acknowledgements

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References

[1] Google, “Google Maps,” https://www.google.com/maps, 2005, [Last accessed April-2018].

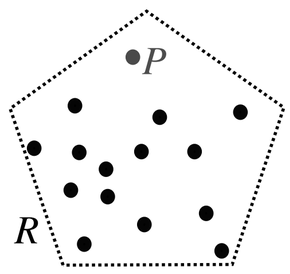
[2] Folha de São Paulo, “Dória sanciona lei anti-pichação e veta até grafite não autorizado,” https://www1.folha.uol.com.br/cotidiano/2017/02/1860352-doria-sanciona-lei-anti-pichacao-e-veta-ate-grafite-nao-autorizado.shtml, 2017, [Last accessed April-2018].

[3] S. Gmbh, “GRAFFOLUTION Awareness and Prevention Solutions against Graffiti Vandalism in Public Areas and Transport - Final report summary,” 2016.

[4] K. He, G. Gkioxari, P. Dollár, and R. Girshick, “Mask r-cnn,” in *Computer Vision (ICCV), 2017 IEEE International Conference on*. IEEE, 2017, pp. 2980–2988.

Method

- Use of street-level imagery
- Sampling the region of interest
- Identification of the region affected by graffiti on each image
- We use an aggregation metric by region

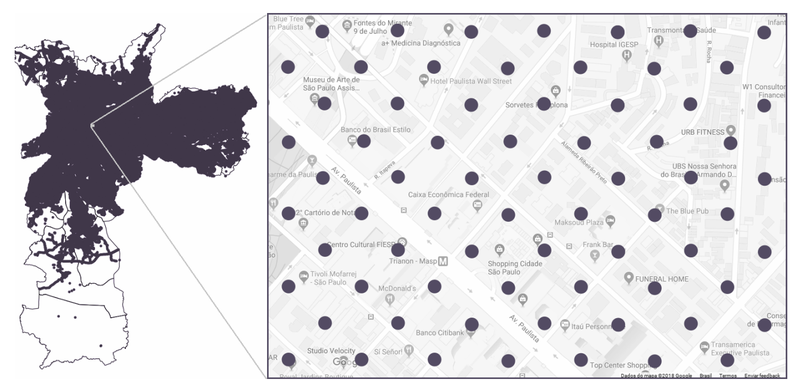


$$g(R) = \frac{\sum_{j=1}^{n} \sum_{i=1}^{k} A_i}{nk}$$

- We define the graffiti level g of a region R as the average of the graffiti levels of each sampled point. The graffiti level of each point is computed as the average affected area in each picture.

Experiments

- Images from [1]
- We manually annotated 632 images and trained a method of segmentation of graffiti [4]
- Regularly-spaced grid over São Paulo



Evaluation of the trained model over a sample. Images from [1].

- We applied the previous equation to compute the graffiti level in each neighbourhood of the city