



Using Google Street View to Estimate Demographics

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Topics to Discuss



1. Intuition: Why does this paper matter? Why is it interesting?
2. Technical perspective: Can we trust the results of the paper? Does it hold what it promises?
3. Moral perspective: Which are the ethical implications resulting from this paper?

Intuition



- 1) When I am looking for an Airbnb, I am looking at....? (Poll)
- 2) Google Street View shows me... (open disc.)
 - a) Their answers are: income, race, political affiliation, education....
Do you agree? (open disc.)
- 3) I have to find an apartment in a city I don't know. I am looking for a neighborhood which offers me...? (Poll)
- 4) In their paper they use cars to estimate demographic variables. Which features visible in google street view would you use? (open disc.)
- 5) Does Google Street View help me to assess my preferences? (open disc.)

Technical Perspective



1) Would you trust the predictions of the car classification network? (Poll)

- a) “Our models accurately identified cars (95%), vans (83%), minivans (91%), SUVs (86%), and pickup trucks (82%)” (Gebru et al., 2017)
- b) “At the most fine-grained level (2, 657 classes), we achieve an accuracy of 33.27%. We classify the car make [e.g.: Toyota] and model [e.g.: Camry] with 66.38% and 51.83%, accuracy respectively. Whether it was manufactured in or outside of the United States can be determined with 87.71% accuracy....” (Gebru et al., 2017)

2) Do you trust the estimation of demographic statistics? (Poll)

- a) Wealth: median household income, $r = 0.82$
- b) Racial composition: % of Asians, $r = 0.87$ / % of Blacks, $r = 0.81$ / % of Whites, $r = 0.77$
- c) Education: % of people w. graduate degree, $r = 0.70$ / % of people w. bachelor’s degree, $r = 0.58$ / % people w. high school degree, $r = 0.65$ / % of people w. less as high school degree, $r = 0.54$

Moral Perspective & Ethical Implications



“Although automated methods could be powerful resources for both researchers and policymakers, their progress will raise important ethical concerns; it is clear that public data should not be used to compromise reasonable privacy expectations of individual citizens, and this will be a central concern moving forward. In the future, such automated methods could lead to estimates that are accurately updated in real time, dramatically improving upon the time resolution of a manual survey.”

(Gebru et al., 2017)

Moral Perspective & Ethical Implications



1. I think techniques of Computer Vision should be used for demographic estimates in conjunction with traditional surveying? (Yes/No)
2. I think CV methods for demographic estimates should be used at ... level? (Poll)
3. Do you think property value should be estimated with CV methods? (Poll)
4. Which other moral implications do you see with CV methods and the estimation of demographic variables (e.g.: race, income, education)? (open disc.)

Moral Perspective & Ethical Implications



4. Which other moral implications do you see with CV methods and the estimation of demographic variables (e.g.: race, income, education)? (open disc.)

Some ideas:

- a) Real time demographic estimates?
- b) Racial makeup of a neighborhood?
- c) Misclassification and possible effects of this misclassification?

Resources



- Gebru, T., Krause, J., Wang, Y., Chen, D., Deng, J., Aiden, E. L., & Fei-Fei, L. (2017). Using deep learning and Google Street View to estimate the demographic makeup of neighborhoods across the United States. *Proceedings of the National Academy of Sciences*, 114(50), 13108-13113.
- Poll: <https://directpoll.com/c?XDVhEtXgHSh81ZgWUZ3cpDYze6ZrTkJ>

Additional Slides



Technical Perspective



On city level:

median household income, $r = 0.82$

percentage of Asians, $r = 0.87$

percentage of Blacks, $r = 0.81$

percentage of Whites, $r = 0.77$

percentage of people with a graduate degree, $r = 0.70$

percentage of people with a bachelor's degree, $r = 0.58$

percentage of people with some college degree, $r = 0.62$

percentage of people with a high school degree, $r = 0.65$

percentage of people with less than a high school degree, $r = 0.54$

On precinct level:

machine estimate vs electoral outcomes at the single-precinct level ($r = 0.57, p < 1e-7$)

Regression features



“In all of our demographic estimations, we use the following set of 88 car-related attributes: the average number of detected cars per image; average car price; miles per gallon (city and highway); per-cent of total cars that are hybrids; percent of total cars that are electric; percent of total cars that are from each of seven countries; percent of total cars that are foreign (not from the USA); percent of total cars from each of 11 body types; percent of total cars whose year (selected as the minimum of possible year values for the car) fall within each of 5 year ranges (1990–1994, 1995–1999, 2000–2004, 2005–2009, and 2010–2014); and percent of total cars whose make is each of 58 makes in our dataset.”

Confusion Matrices

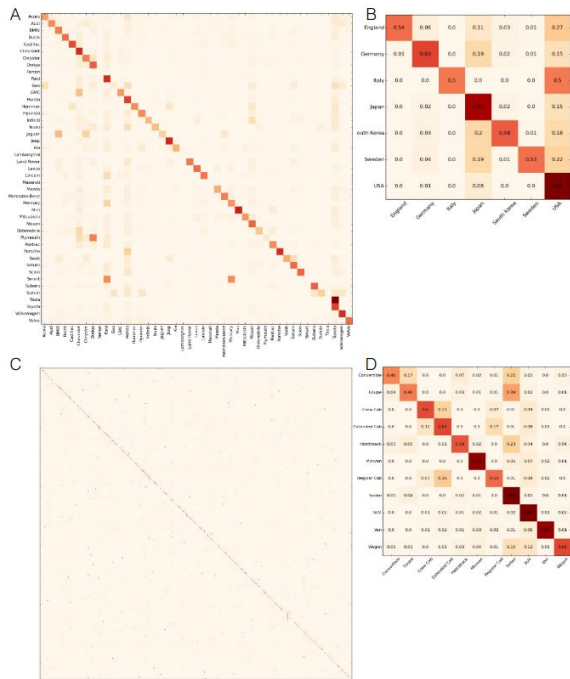


Fig. 59. Confusion matrices of predictions. The entry in row i and column j indicates how many times ground truth attribute i was classified as attribute j . The attributes are A. the make of the car, B. the manufacturing country of the car, C. the model of the car, and D. the body type of the car.