

Combining surveys and big data

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	Sampling	Interviews	Data environment
1st era	Area probability	Face-to-face	Stand-alone
2nd era	Random digital dial probability	Telephone	Stand-alone
3rd era	Non-probability	Computer-administered	Linked

Will big data kill surveys?

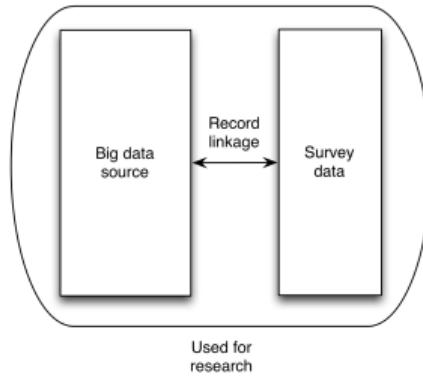


<http://schlitterblog.com/wp-content/uploads/2014/05/peanutbutterlover.jpg>

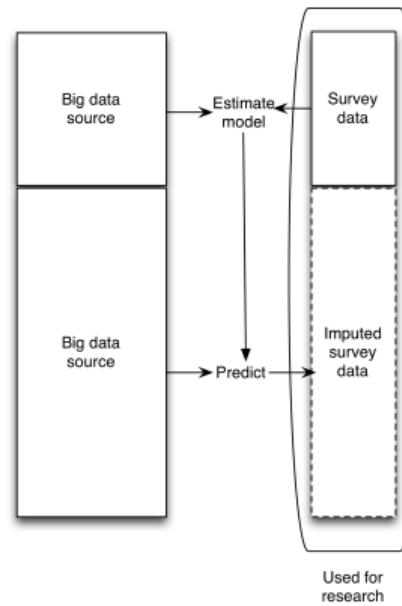


<http://schlitterblog.com/wp-content/uploads/2014/05/peanutbutterlover.jpg>

Enriched asking



Amplified asking



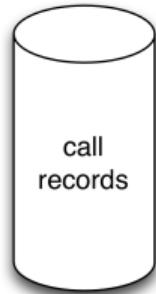
Note the different role of the big data in each case

Predicting poverty and wealth from mobile phone metadata

Joshua Blumenstock,^{1*} Gabriel Cadamuro,² Robert On³

<http://dx.doi.org/10.1126/science.aac4420>

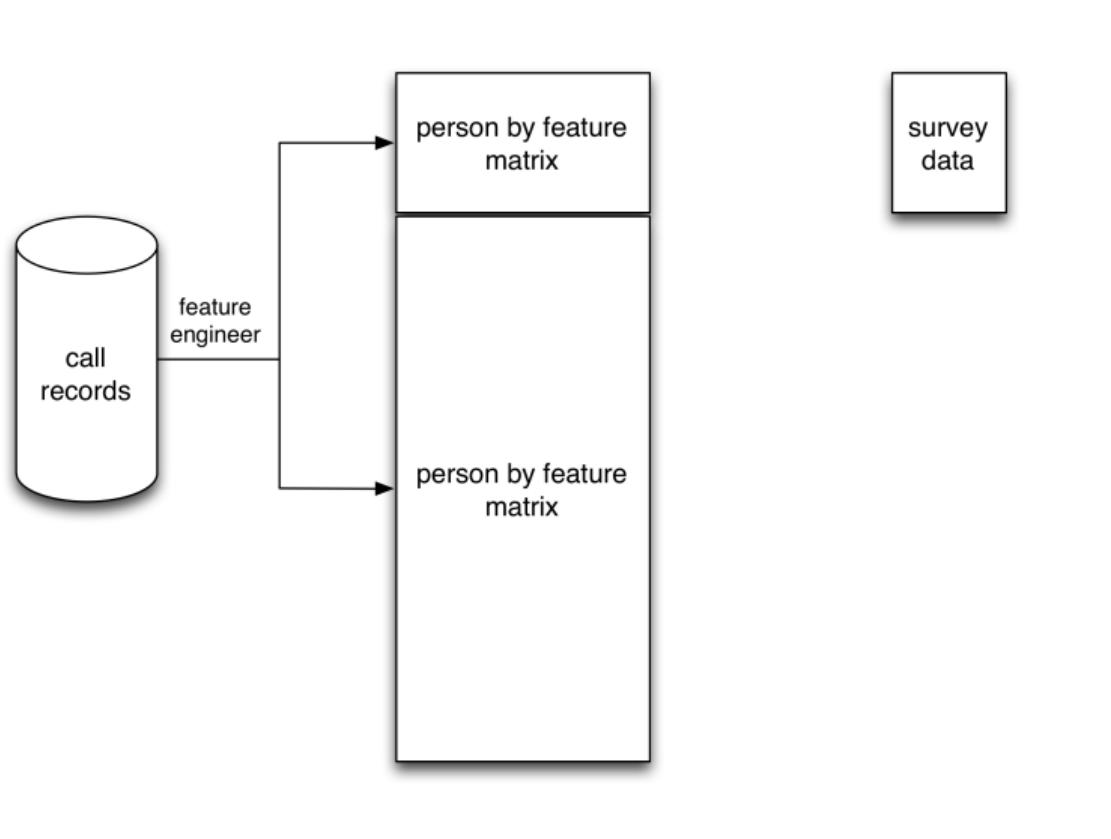


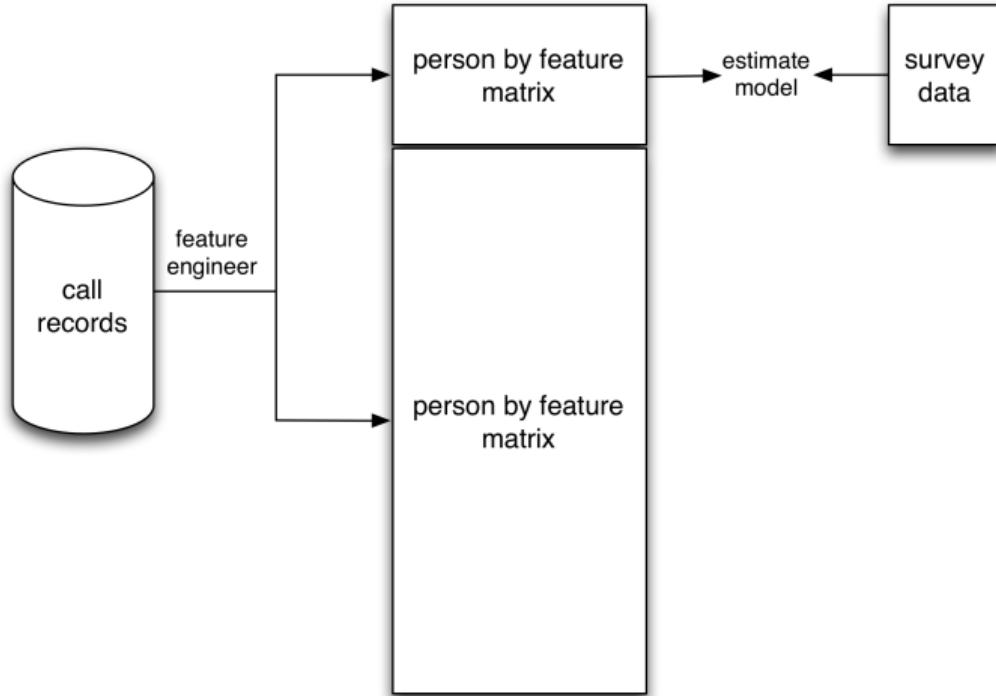


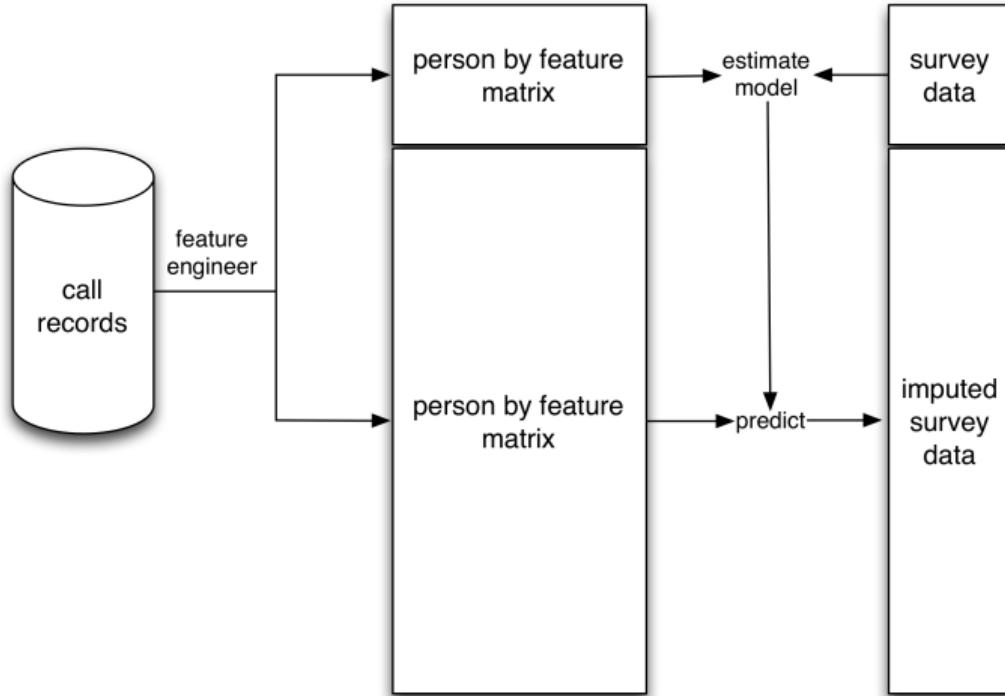
call
records

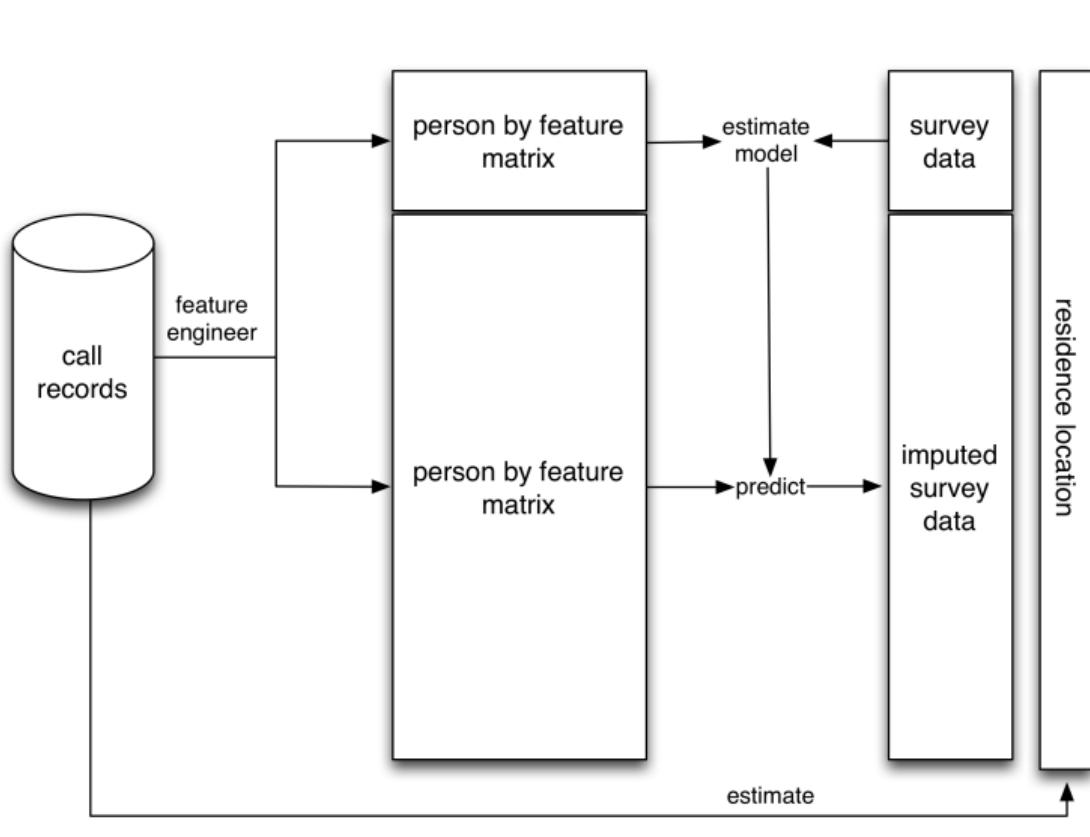


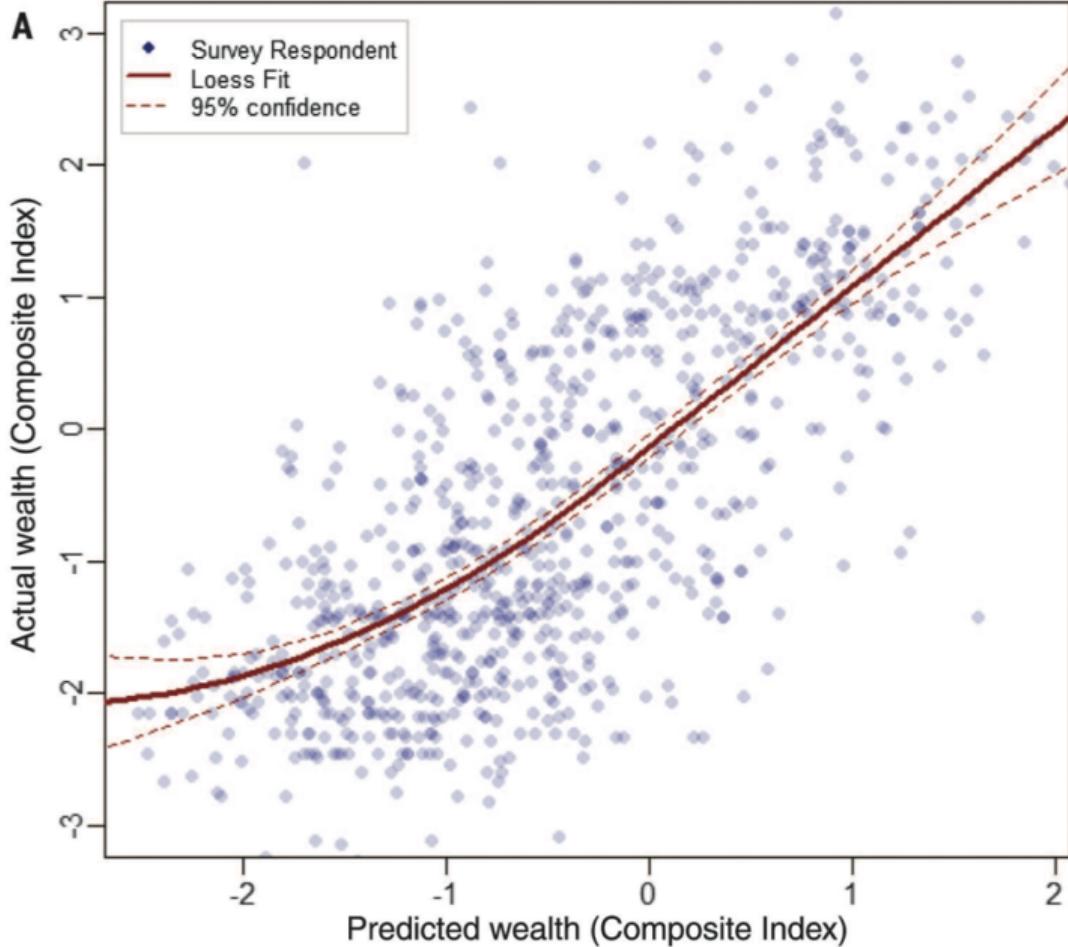
survey
data

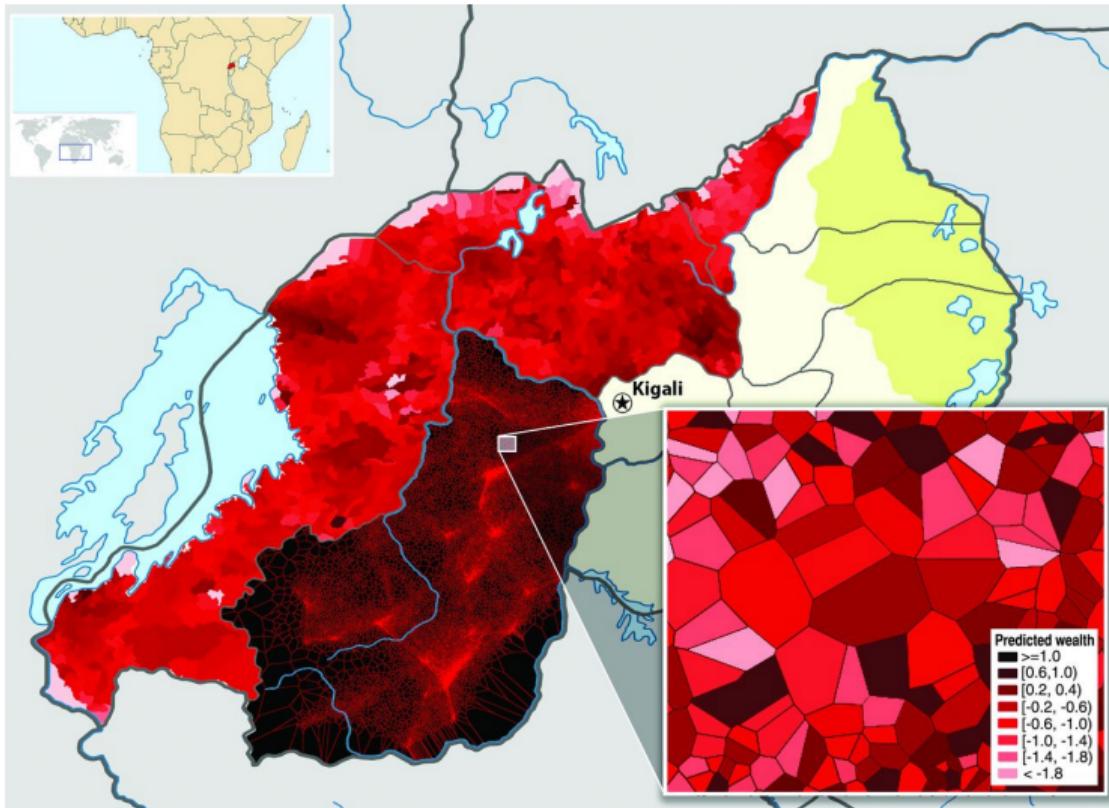


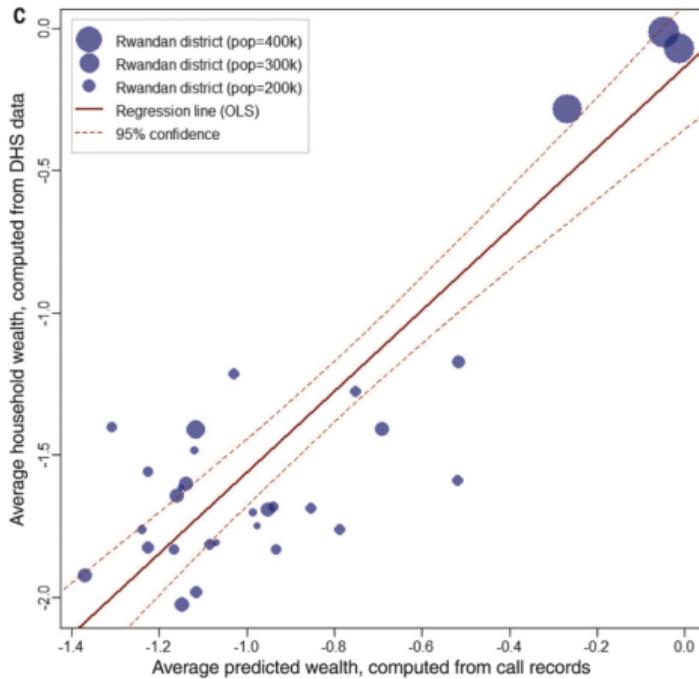


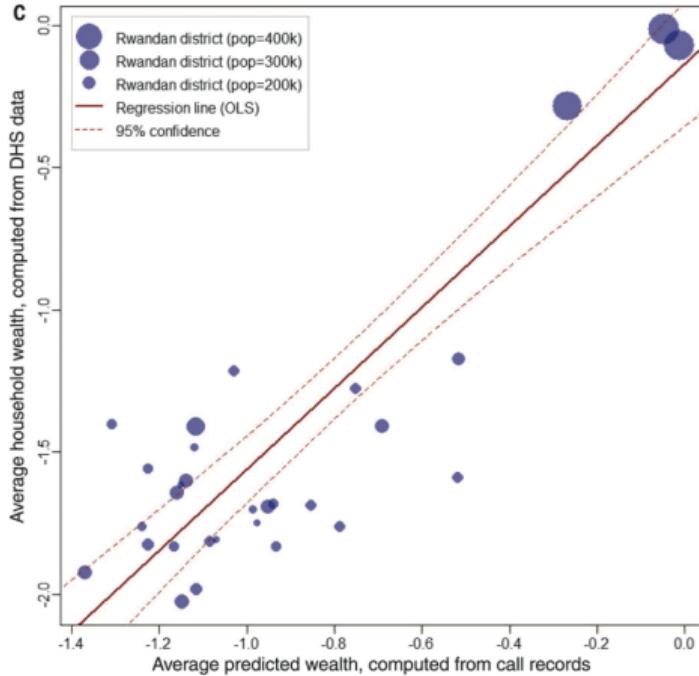












- ▶ 10 times faster
- ▶ 50 times cheaper



Readymades

+



Custommades



Behavioral Modeling for Churn Prediction:

Early Indicators and Accurate Predictors of Customer Defection and Loyalty

Muhammad Raza Khan¹, Joshua Manoff², Anikate Singh³, Joshua Blumentrost⁴

¹Information School, University of Washington, Seattle, WA, USA

Email: mraza@uw.edu, joshua@uw.edu, anikating@uw.edu, joshblum@uw.edu

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Calling for Better Measurement:

Estimating an Individual's Wealth and Well-Being
from Mobile Phone Transaction Records

Joshua E. Blumenstock

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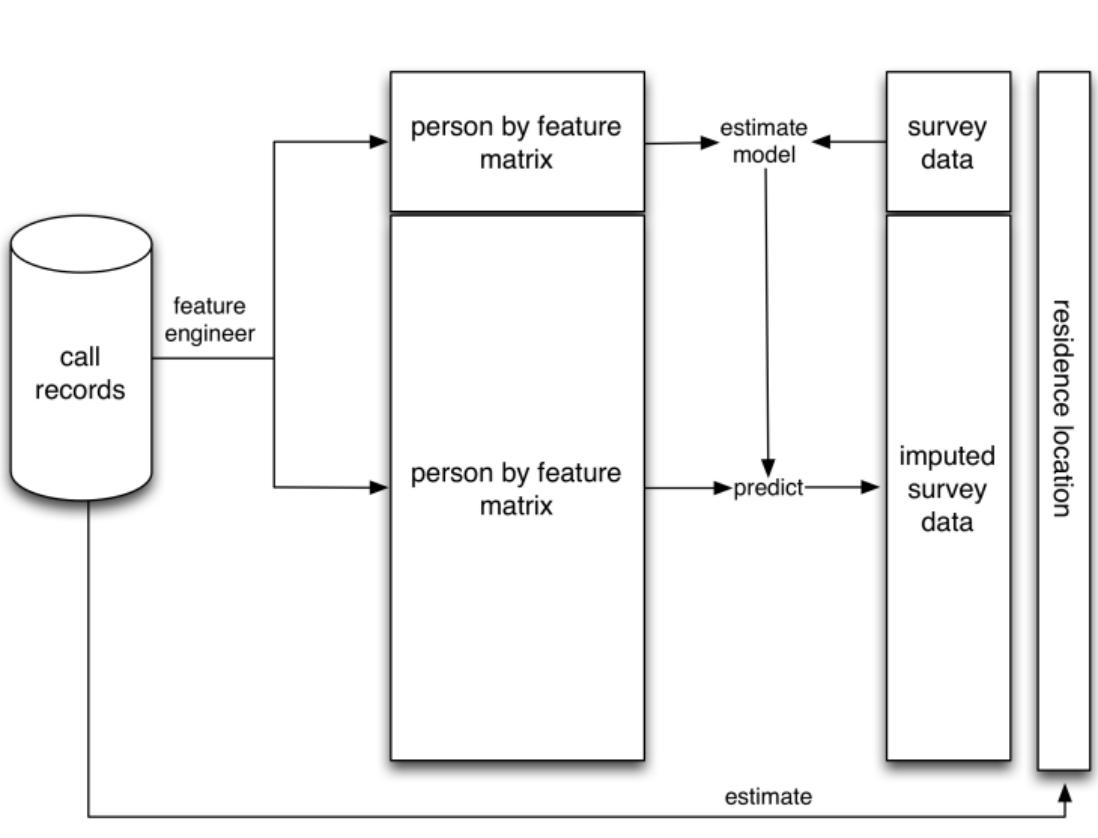
Combining satellite imagery and machine learning to predict poverty

Neal Jean,^{1,2*} Marshall Burke,^{3,4,5*} Michael Xie,¹ W. Matthew Davis,⁴
David B. Lobell,^{3,4} Stefano Ermon¹

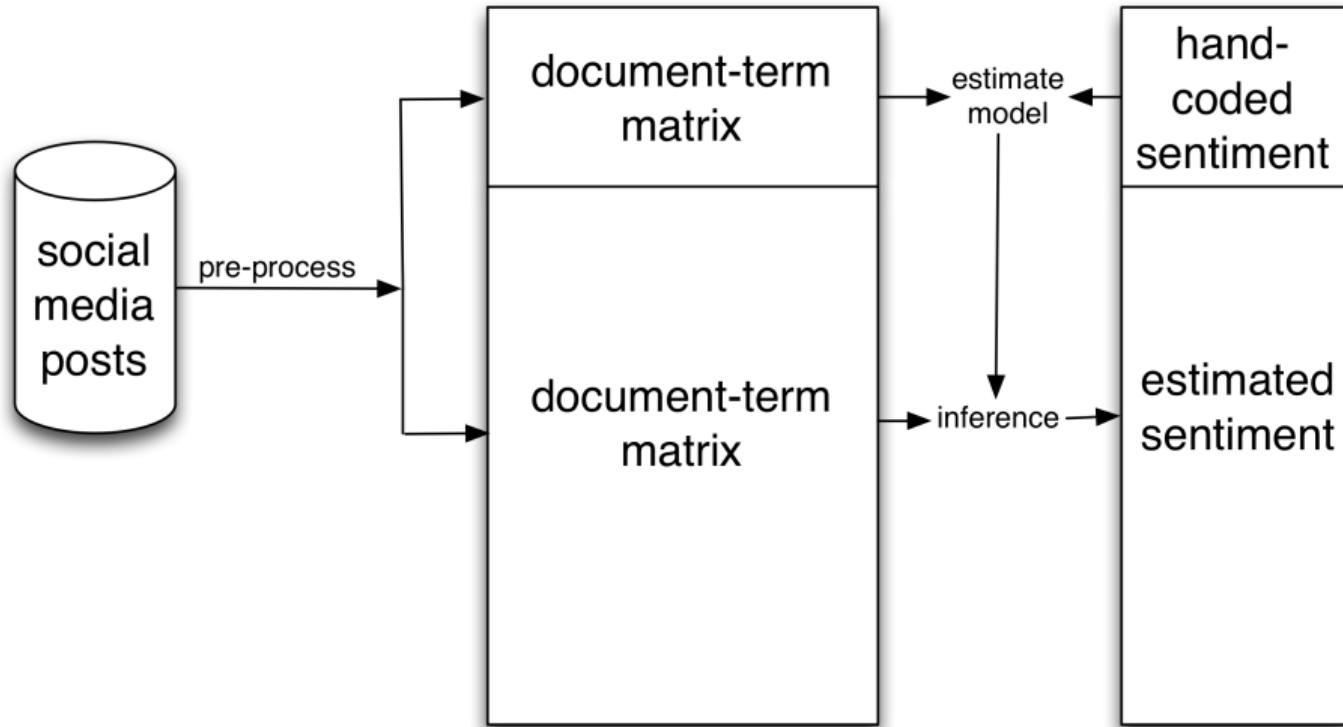
This paper is amazing and surprising (to me). First a digression

Supervised learning:

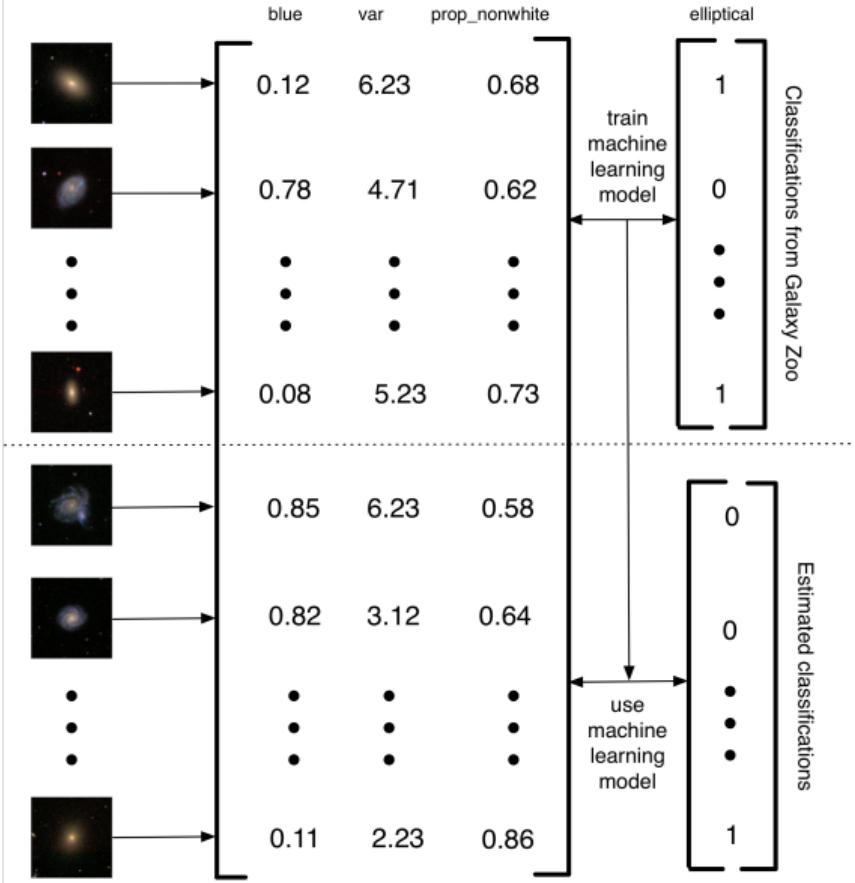
Lots of input-output pairs; goal is to develop a function that will predict the output from the input



See Chapter 3 of Salganik (2016)



See Chapter 2 of Salganik (2016)



See Chapter 5 of Salganik (2016)

Supervised learning:

Lots of input-output pairs; goal is to develop a function that will predict the output from the input

What if rather than engineering the features you could “learn” them automatically?

Deep learning

Yann LeCun^{1,2}, Yoshua Bengio³ & Geoffrey Hinton^{4,5}

<http://dx.doi.org/10.1038/nature14539>

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Artificial Intelligence Is Predicting Human Poverty From Space

August 18, 2016 // 02:00 PM EST

<http://dx.doi.org/10.1126/science.aaf7894>

https://motherboard.vice.com/en_us/article/artificial-intelligence-is-predicting-human-poverty-from-space

Live demo:

<https://www.google.com/maps/place/Kigali,+Rwanda/@-1.9546259,30.0345059,26517m/data=!3m2!1e3!4b1!4m5!3m4!1s0x19dca4258ed8e797:0xf32b36a5411d0bc8!8m2!3d-1.9705786!4d30.1044288>

But, most people had been using night lights



https://www.nasa.gov/multimedia/imagegallery/image_feature_2480.html

Prior research:

Nightlights + survey data to estimate wealth in places without surveys

Jean et al. (2016):
Day pictures + Nightlights + survey data to estimate wealth in places without surveys

Predicting poverty

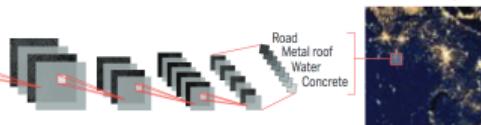
Satellite images can be used to estimate wealth in remote regions.

Neural network learns features in satellite images that correlate with economic activity

Daytime satellite photos capture details of the landscape



Convolutional Neural Network (CNN) associates features from daytime photos with nightlight intensity

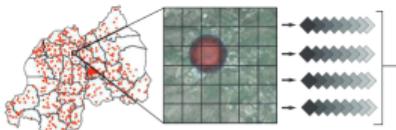


Satellite nightlights are a proxy for economic activity

Daytime satellite images can be used to predict regional wealth

Household survey locations

CNN processes satellite photos of each survey site



Features from multiple photos are averaged

Ridge regression model reconstructs ground truth estimates of poverty

- ▶ Start with CNN pretrained on ImageNet (e.g. hamsters and weasels)

Predicting poverty

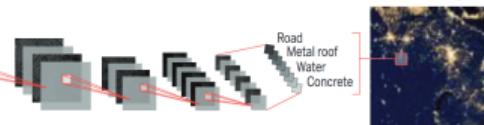
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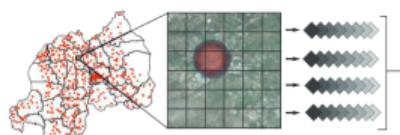
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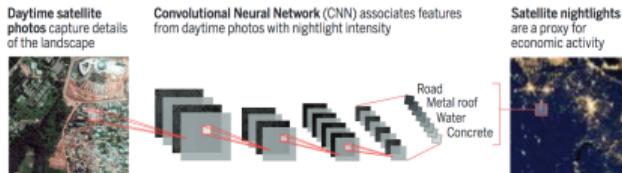
Ridge regression model reconstructs ground truth estimates of poverty

- ▶ Start with CNN pretrained on ImageNet (e.g. hamsters and weasels)
- ▶ Train CNN to predict nightlights from day pictures (lots of training data)

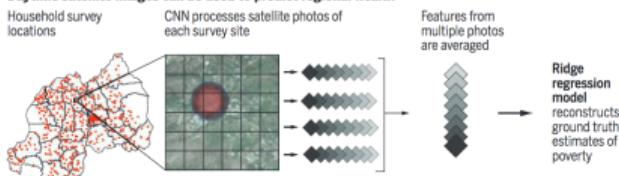
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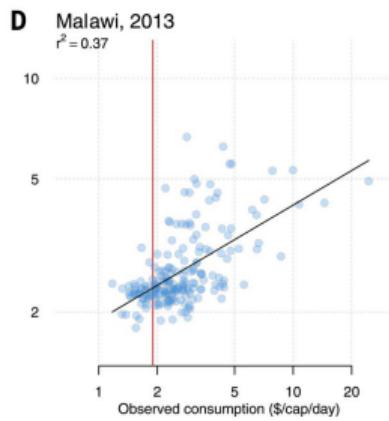
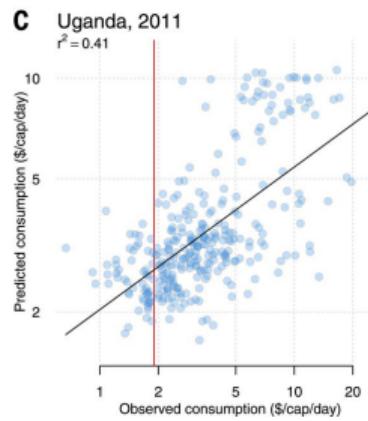
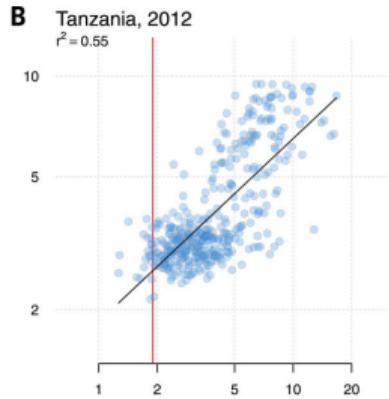
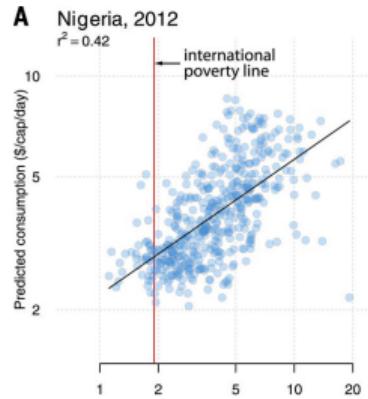


Daytime satellite images can be used to predict regional wealth

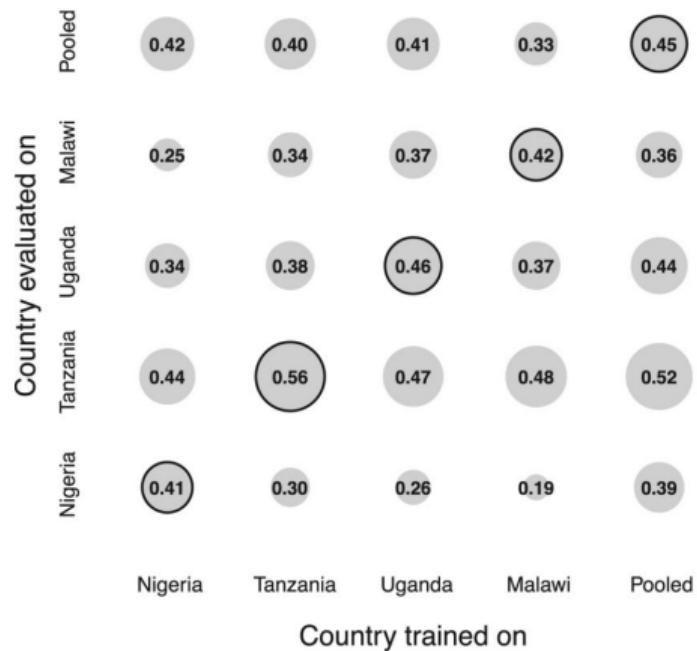


- ▶ Start with CNN pretrained on ImageNet (e.g. hamsters and weasels)
- ▶ Train CNN to predict nightlights from day pictures (lots of training data)
- ▶ Take features from CNN and train ridge regression to predict cluster mean survey response

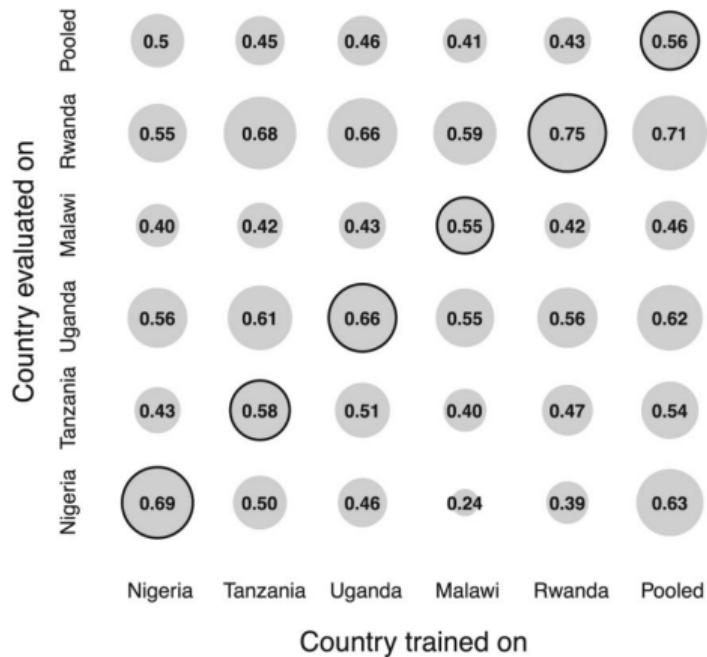
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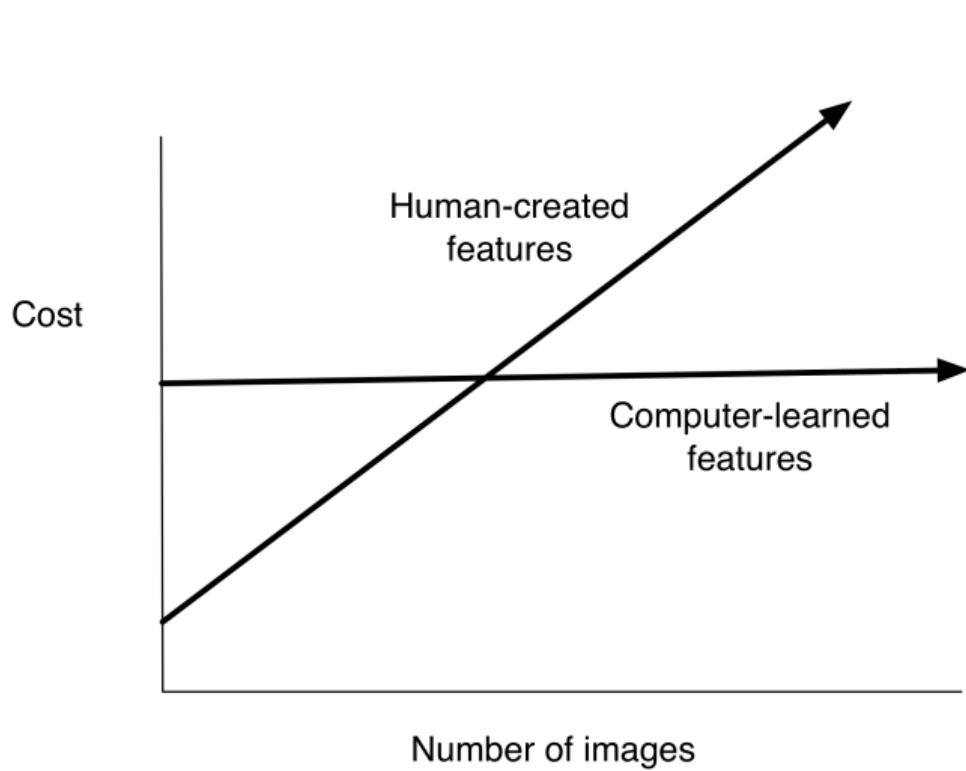


A Consumption expenditures



B Assets





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Combining satellite imagery and machine learning to predict poverty

 18 commits  1 branch  0 releases  4 contributors  MIT

Branch: [master](#) [New pull request](#) [Create new file](#) [Upload files](#) [Find file](#) [Clone or download](#)

 imthexie	select middle of pixel	Latest commit 975fddc on Mar 27
 data/input	Clean replication code	10 months ago
 figures	Fixing cluster prefix in fig_utils.py	7 months ago
 model	Clean replication code	10 months ago
 scripts	select middle of pixel	3 months ago
 .gitignore	Clean replication code	10 months ago
 LICENSE	MIT License	6 months ago
 README.md	Update README.md	8 months ago
 requirements.txt	Clean replication code	10 months ago

<https://github.com/nealjean/predicting-poverty>

Wrap-up:

- ▶ Surveys and big data are compliments not substitutes

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- ▶ Surveys and big data are compliments not substitutes
- ▶ Sometime we do “enriched asking” and sometimes “amplified asking” (role of big data source is different in both cases)
- ▶ Learn more: see “what to read next” in Ch 3 of Bit by Bit.