Image as Data: Automated Visual Content Analysis for Political Science

Authors:
Jungseock Joo, Zachary C Steinert-Threlkeld

Presented by, Recep Erol
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About Paper

- Written by, Jungseock Joo, Zachary C Steinert-Threlkeld
- UCLA, Department of Communication and Department of Political Science
- Found this paper via Twitter
- Zachary C Steinert-Threlkeld has been working on analysis of political situation via social media data. His another study is;
  - The Future of Event Data is Images (Couldn’t access)
- The similar paper;
  - Text as Data: The Promise and Pitfalls of Automatic Content Analysis Methods for Political Texts

About Paper

Paper link : https://arxiv.org/pdf/1810.01544.pdf

Jungseock Joo : http://home.jsjoo.com/

Zachary C. Steinert-Threlkeld : https://luskin.ucla.edu/person/zachary-c-steinert-threlkeld

-> https://zacharyst.com/

Things to Highlight

- The importance of images for Event Analysis (Political)
- Analysing events through images (videos)
- Applications of Computer Vision (CV) in Political Science Research
  - Political Behavior
  - Political Communication
  - Development
  - Subnational Conflict
- Using text and image data together
- Measuring Crowd Size
- South Korea and Hong Kong Protests in More Detail (Crowd analysis)

Outline

- Introduction: From Text to Image
- Computer Vision and Deep Learning
- Tasks in Computer Vision
- Training and Validation
- Applications in Political Science Research
- Demonstrations: Protest Analysis with Images
- Conclusion and Future Work

Text vs Image

Table 1: Distinct Characteristics between Text and Image Data

Text	Image
• One dimensional: a sequence of words • Low uncertainty at word level • Small size; easy to transfer and store • Known dictionary • Language specific • Elaborative • More logical	• Two dimensional: an array of pixels • High uncertainty at any level • Bigger size • Unknown dictionary • Universal • Intuitive and immediate • More emotional

History of Computer Vision

- Manual feature extraction for images
- Classifying features with shallow systems
- Inaccurate outputs to describe images
- Due to computation cost, it’s expensive to work in this field
- Popularity of using pattern recognition algorithms

History of Deep Learning

- Linear Regression to Logistic Regression
- Logistic Regression to Artificial Neural Networks (ANN)
- ANN to Neural Networks (NN)
- NN to Deep Neural Networks (DNN)
- DNN to Deep Learning (DL)
- DL for Computer vision and other fields such as speech recognition or text generation
- Super smart DNN for all kinds of data types

Progress on Computer Vision and Deep Learning

- Better algorithms for processing
- Better and bigger computational devices
- Community growth
- Industry support
- Application areas
  - License plate detection and recognition
  - Face detection (Facebook started using on early 2000’s)
- Active research on different fields
  - Health, Agriculture, Video production, Security
- Availability of data for products from products
  - Number of software increase gives us more data
  - With more data we have more and better products
- Transfer Learning (Knowledge, feature, and model transfer)

Traditional vs Deep Learning for Classification

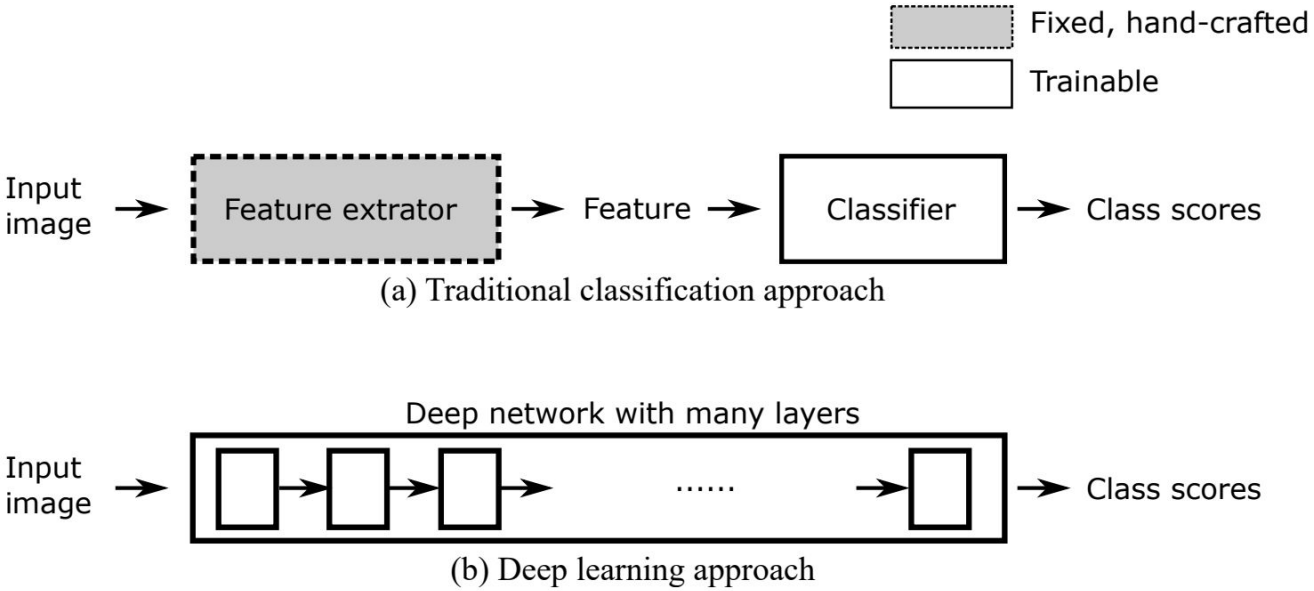


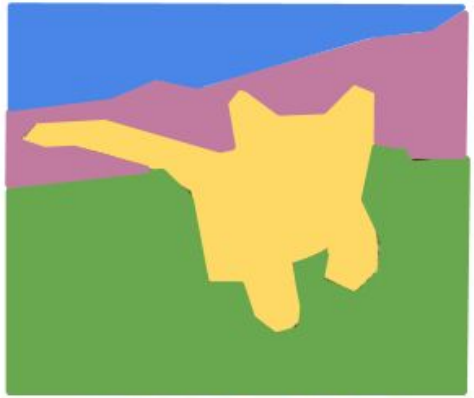
Figure 6: Comparing Deep Learning to Previous Computer Vision Methods

Tasks in Computer Vision

- Image Segmentation
- Image Classification
- Object Detection
  - Face Detection
  - Face Recognition
- Semantic Segmentation
- Human Pose Estimation

Other Computer Vision Tasks

Semantic Segmentation



GRASS, CAT, TREE, SKY

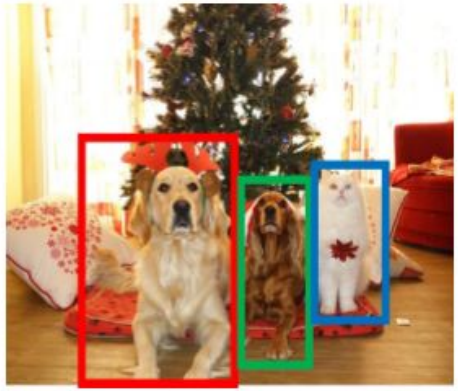
No objects, just pixels

Classification + Localization

CAT

Single Object

Object Detection

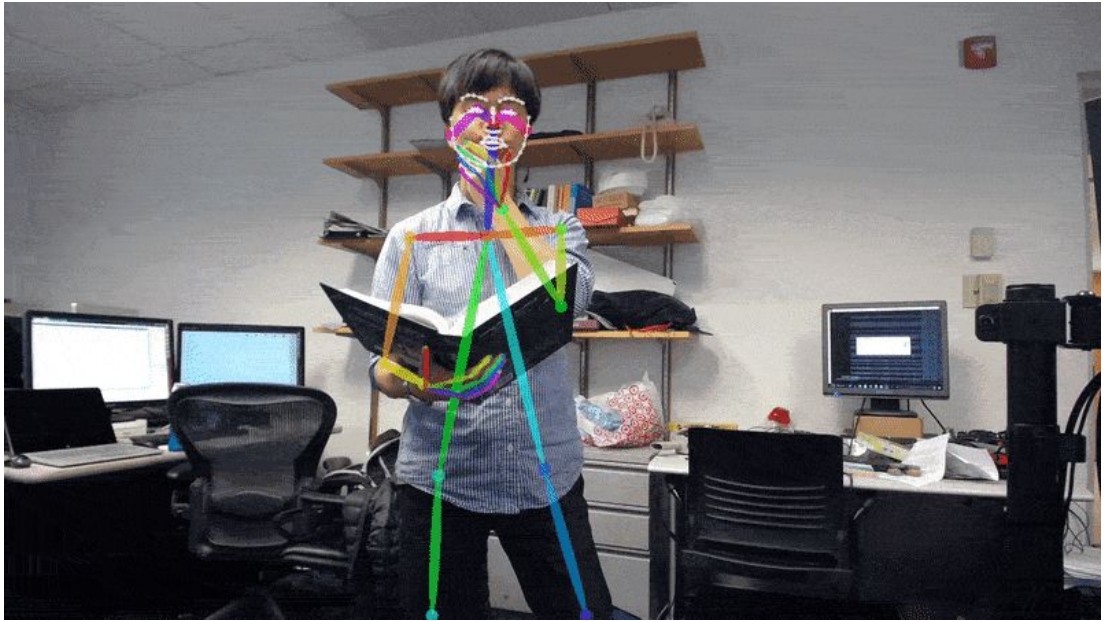


DOG, DOG, CAT

Instance Segmentation

DOG, DOG, CAT

Multiple Object



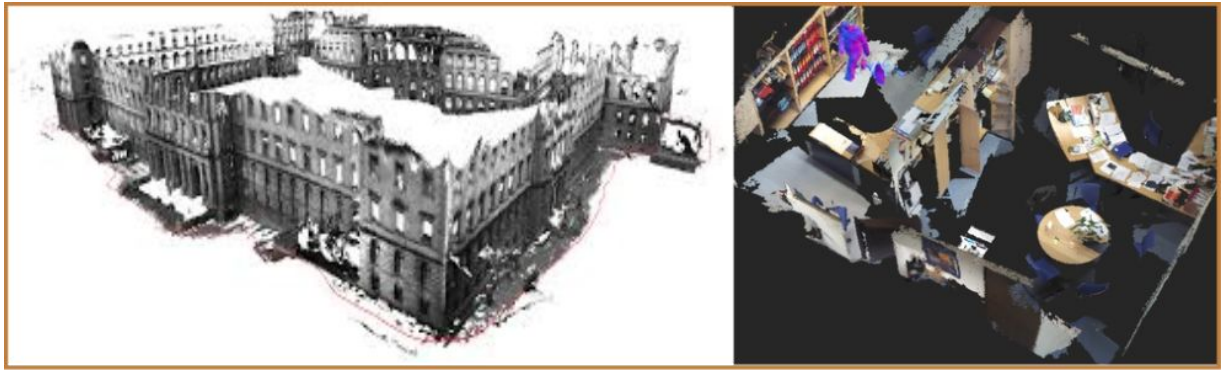
ANYLINE

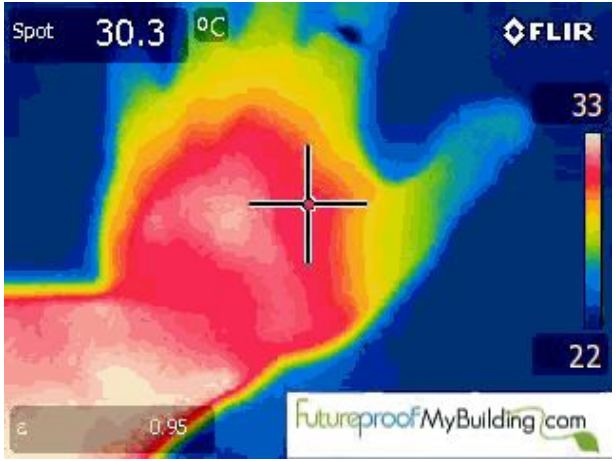
Augmented
Object Recognition

Navigation to Barcode
and Meter Counter

Live Text Recognition
of Detected Fields

powered by wikitude





Tasks in Computer Vision

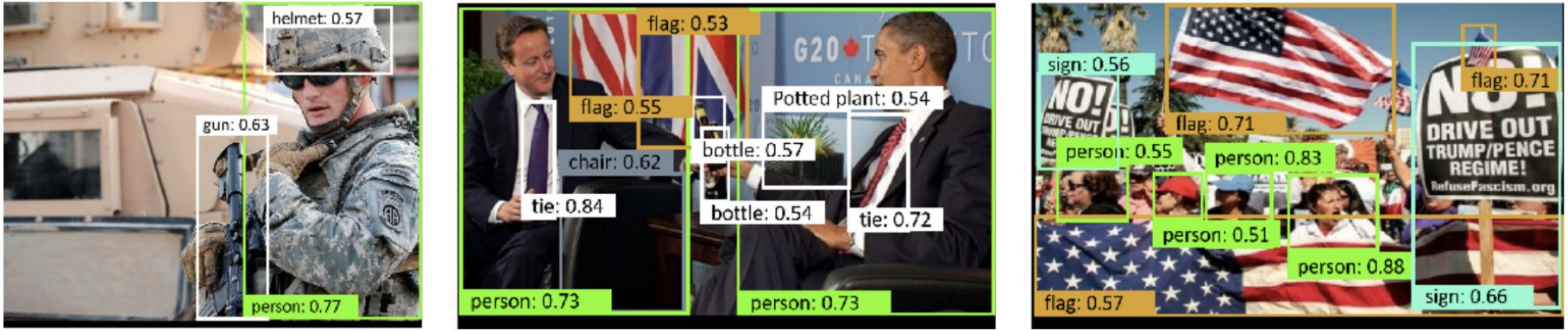


Figure 8: Example results of object detection.

Human Attribute Classification

Face image can give you;

- Emotions (Happy, Sad, Angry, etc)
- Race
- Gender
- Age (young, baby, old, teenager, etc)
- Expressions
- Reactions (shock, surprise, etc)
- Human attributes (cry, kiss, Lip reading)

Tasks in Computer Vision

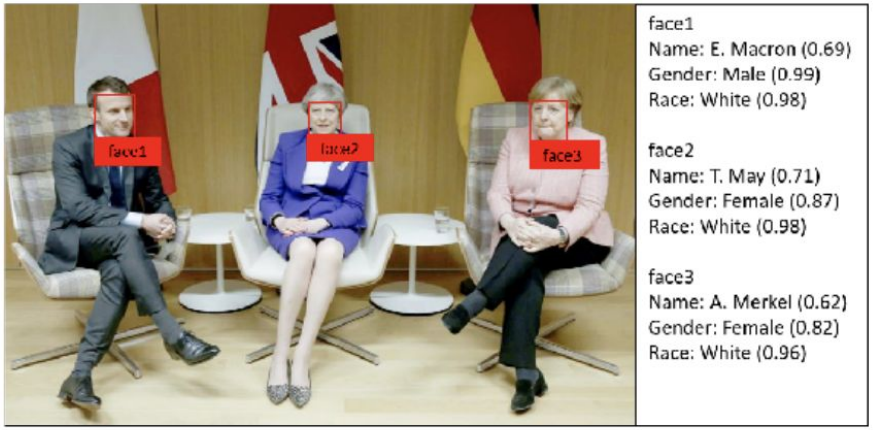


Figure 9: Example results of face detection, recognition, and attribute classification.

Text and Image Together

- Text on image as caption
  - Can’t describe the image itself, it’s an expression for the moment
- Text on images
  - Text on banner
  - Text on memes
  - Text on Police wears, gears, etc
  - Organization name, logo, slogan, etc

CV Applications on Political Science

- Crowd analysis
- Demographic information gathering through face feature extraction
  - Diversity analysis on airports
- Politician analysis from face expressions and behaviors
- Understanding development on political events
  - Remote sensing data
  - Especially research studies on socioeconomic indicators
  - Distribution of building types on a city and land use in rural area
  - Determining temporal changes in cities large areas (recovery on natural disasters)
- Measure socioeconomic variables using photographs of places taken by people

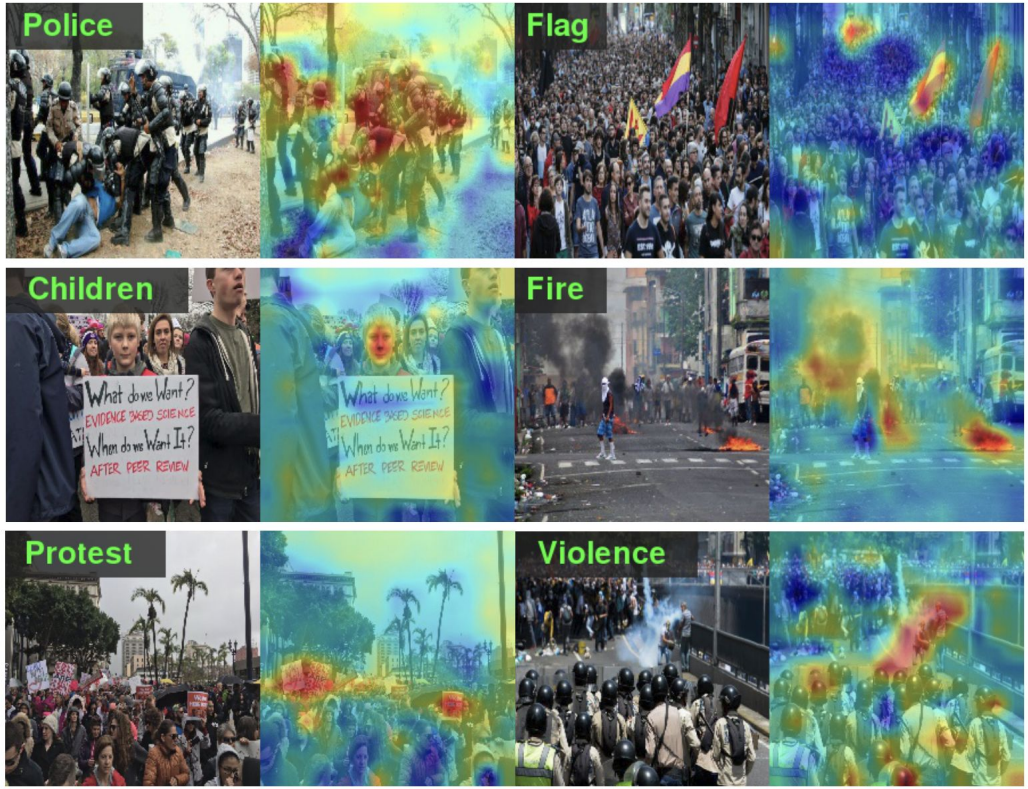


Figure 11: Visualization of region importance to visual concept classification by Grad-CAM (Selvaraju et al., 2017). Examples are taken from a recent protest image analysis (Won, Steinert-Threlkeld and Joo, 2017). Important regions are marked by red color.

CV Applications on Political Science

More broadly, it should be possible to measure socioeconomic variables using photographs of places taken by people. Manual analysis of Google Street View (GSV) imagery shows that photographs of cities taken at random times as Google's vehicles map them recovers public health data in the United States (Odgers et al., 2012, Wilson et al., 2012). A model trained on GSV images recovers income by block in New York City (Glaeser et al., 2018), and a deep learning model of cars in GSV images can measure income, race, and education at the precinct level (Gebru et al., 2017).

CV Applications on Political Science

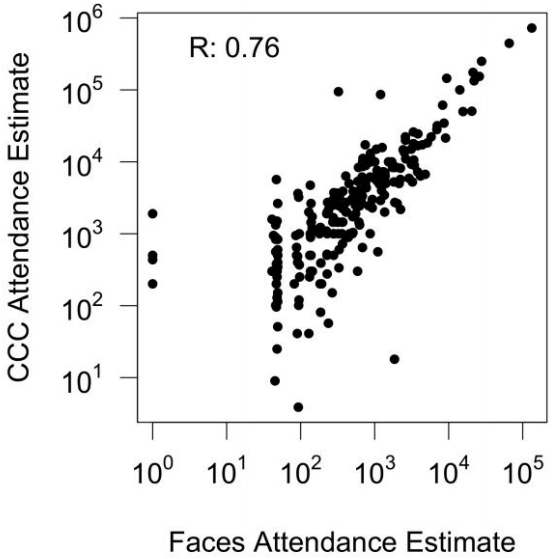
- Measuring technological growth/change by analysing photos.
  - Time based comparison for cities
  - Population change
  - Weather change
  - Types of jobs
  - People’s habit (crowd change from number of people to number of cars)

CV Applications on Political Science

vide a more definitive answer to these dynamics. For an example of what these data would look like, see Won, Steinert-Threlkeld and Joo (2017) and Steinert-Threlkeld, Won and Joo (2018). For examples of work that automatically code protest data from images, see as well Torres (2018) and Zhang and Pan (2018).[7] As of this writing, Won, Steinert-Threlkeld and Joo (2017) is the only one that is published.

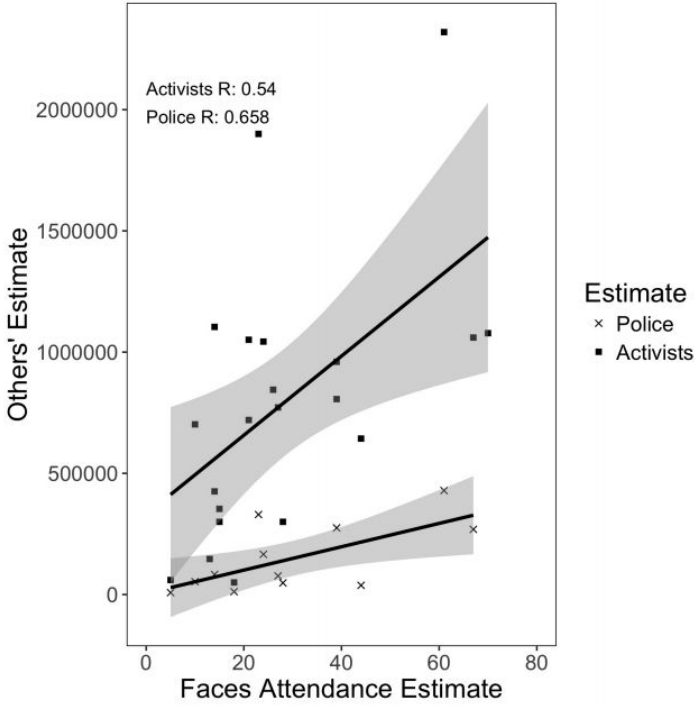
Figure 12 shows that our measure of protest size correlates with these protest estimates very well (.76 when logged) for the 2017 United States Women's March. Figure 13 does the same for South Korea's 2016-2017 protests against President Park Geun-hye. Using crowd size estimates provided by police and activists, as reported on Wikipedia, Figure 13 shows that the same procedure works in South Korea, though the police appear to provide more accurate estimates than activists.[9]

Figure 12: Summing Number of Faces Accurately Measures Protest Size in the United States

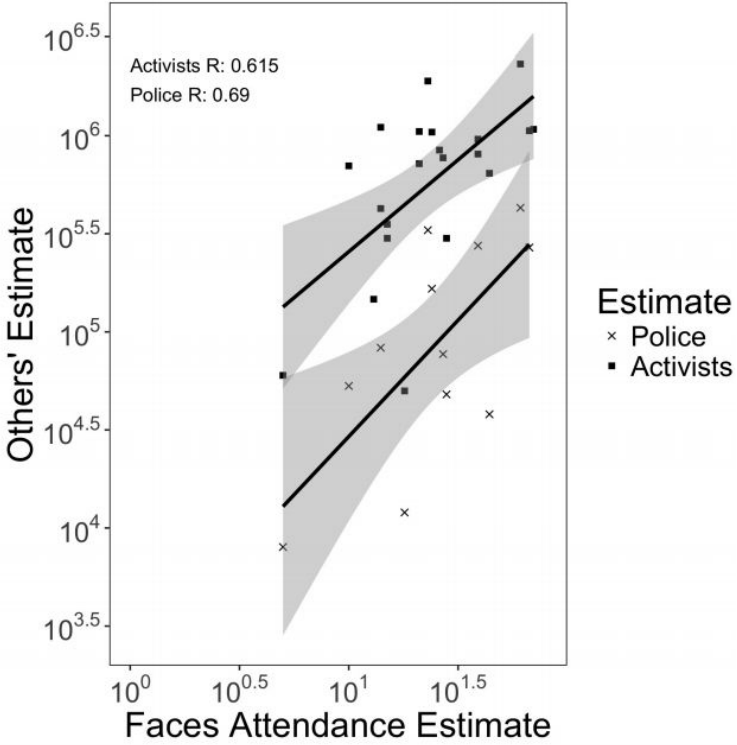


(a) Logged Correlation

Figure 13: Summing Number of Faces Accurately Measures Protest Size in South Korea

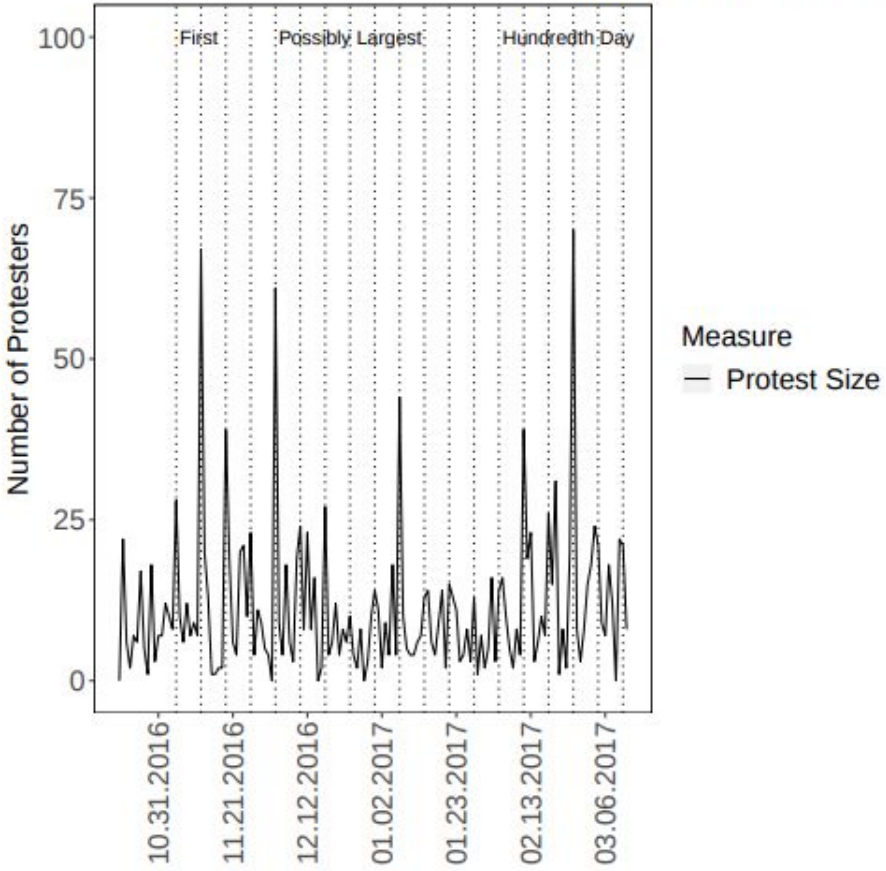


(a) Raw Correlation

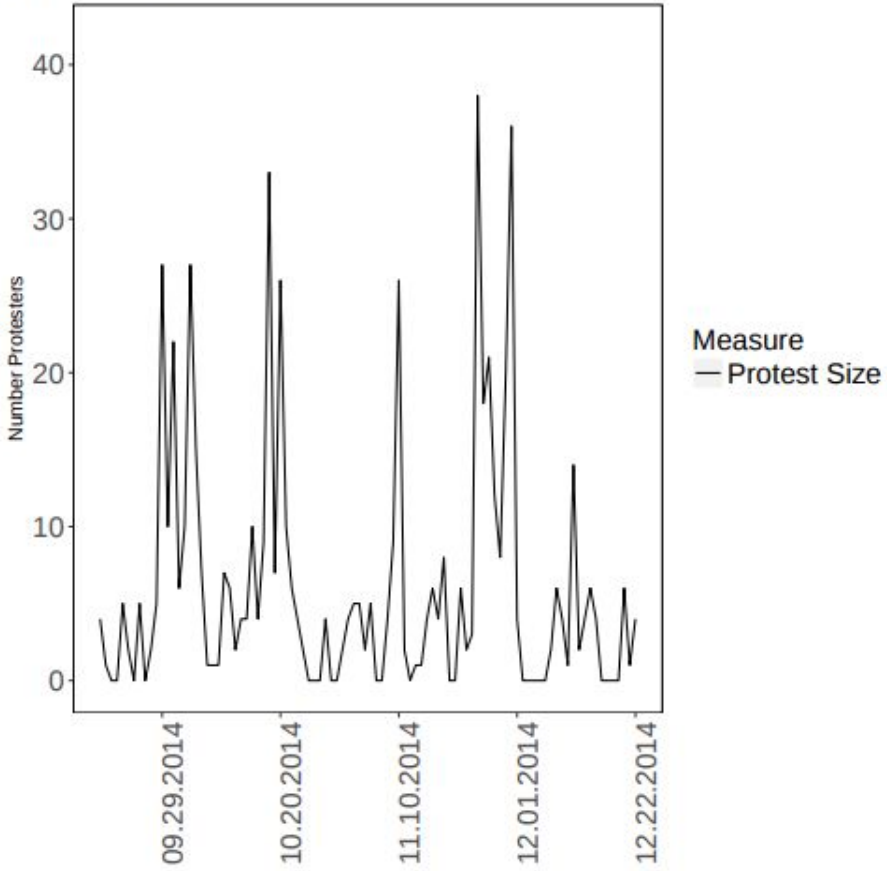


(b) Logged Correlation

Figure 14: Change in Protest Size

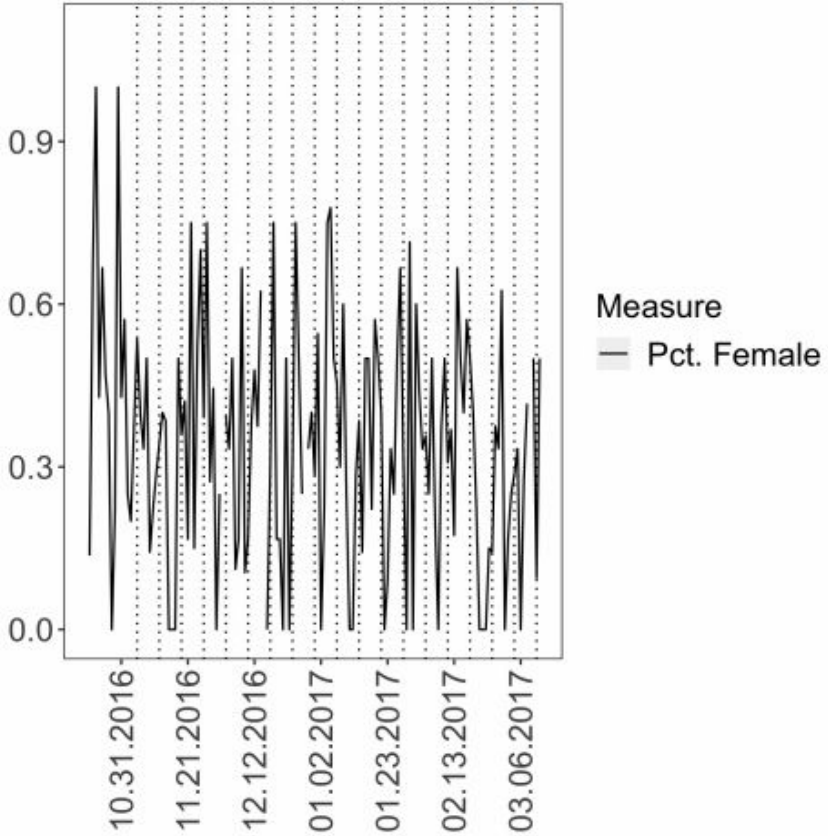


(a) South Korea

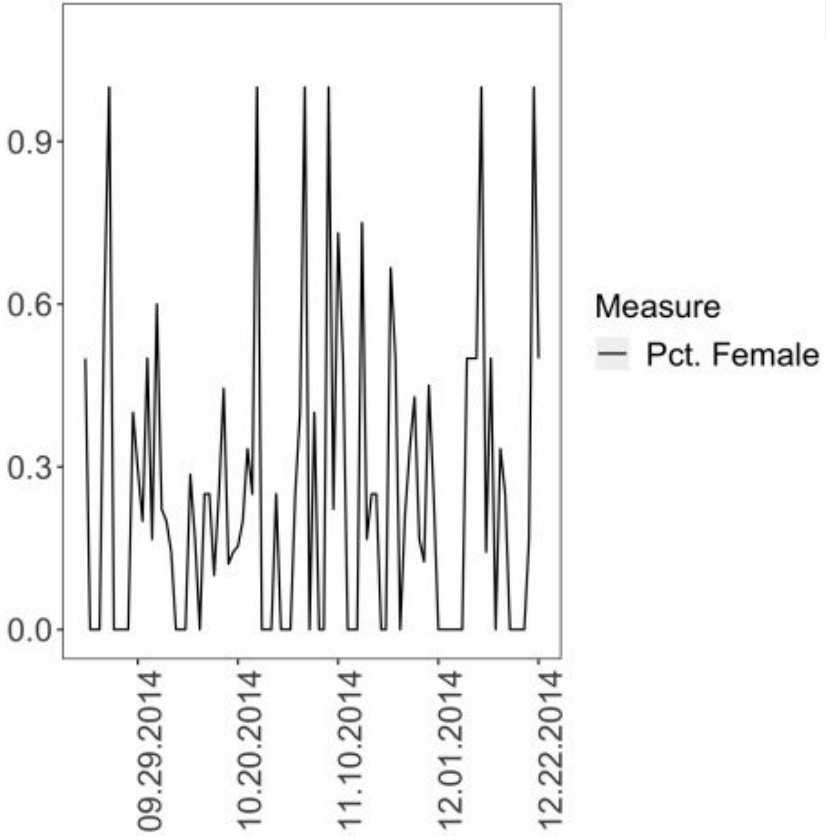


(b) Hong Kong

Figure 15: Percent of Female Faces

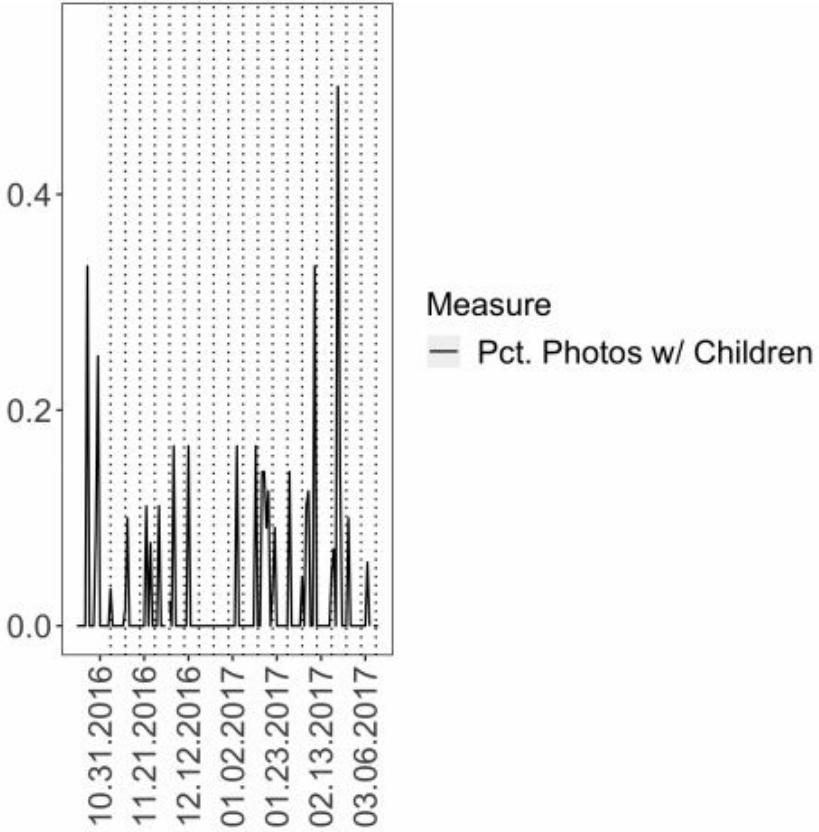


(a) South Korea

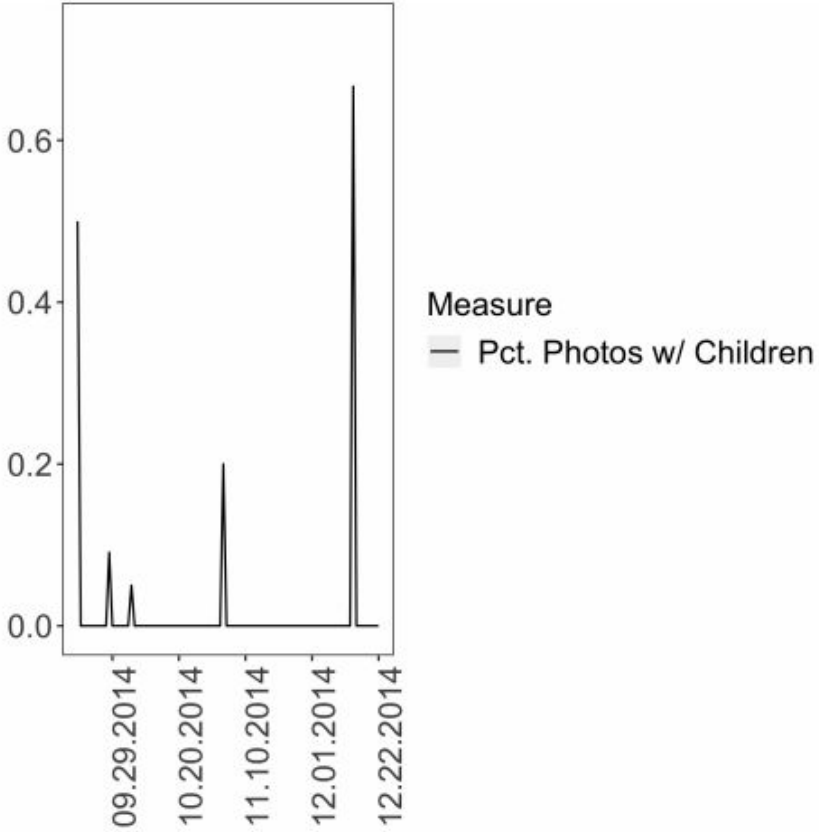


(b) Hong Kong

Figure 16: Percent of Photos with a Child

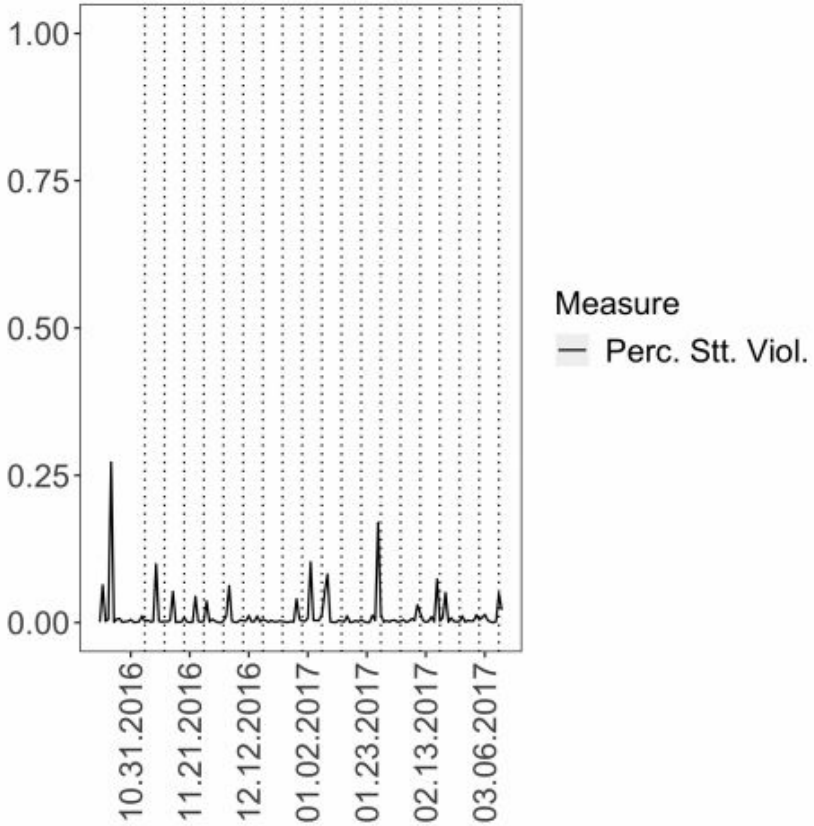


(a) South Korea

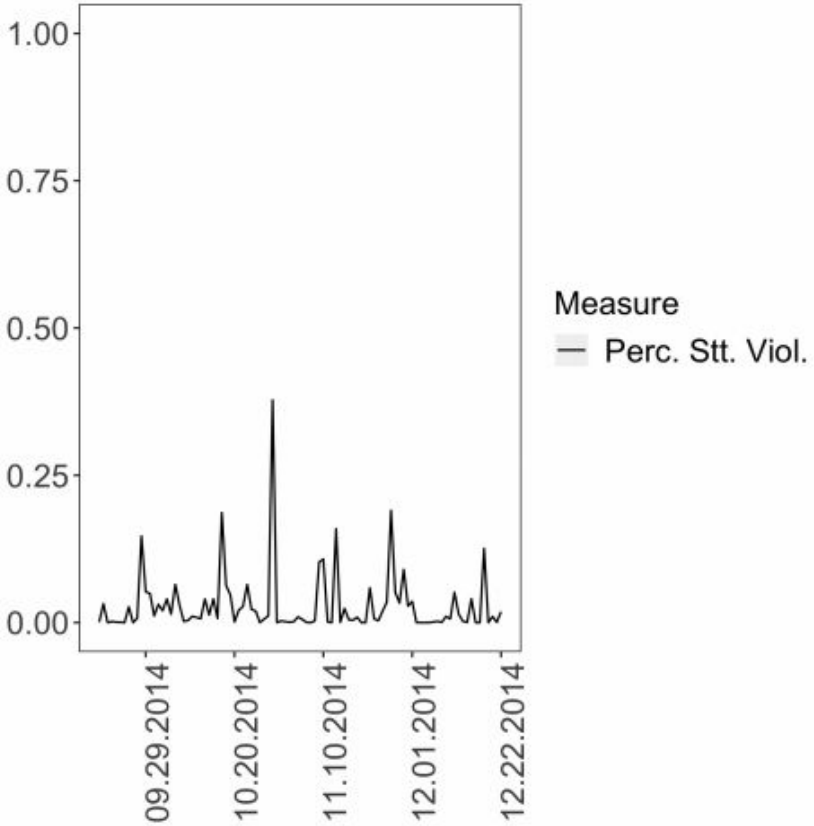


(b) Hong Kong

Figure 17: Perceived State Violence

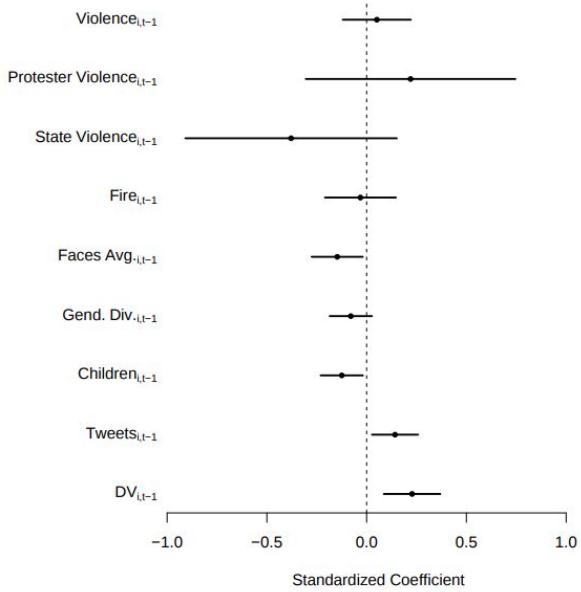


(a) South Korea



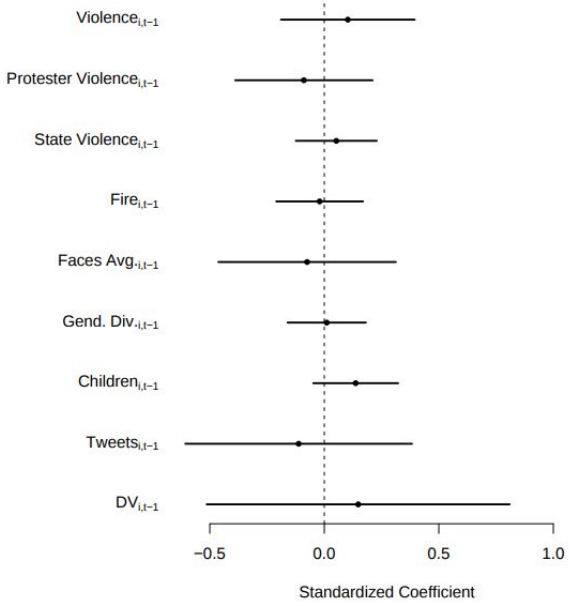
(b) Hong Kong

Figure 18: Regression Results. DV is $Log_{10}(Faces_i)$

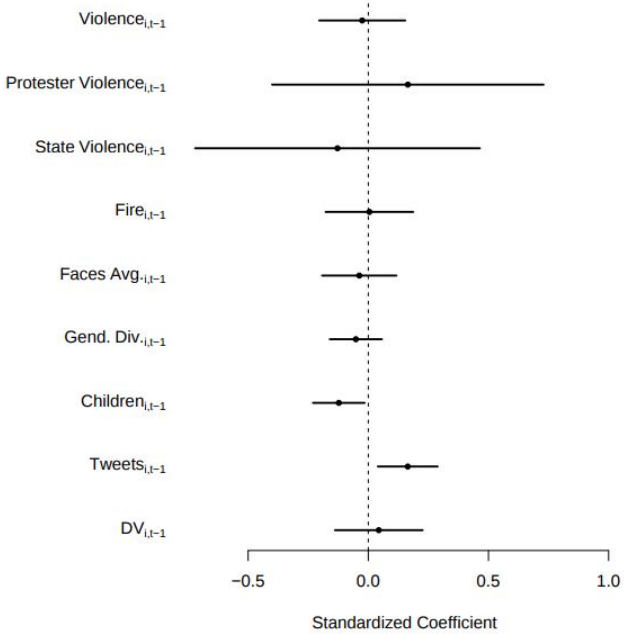


(a) South Korea and Hong Kong

Figure 19: Regression Results. DV is $Log_{10}(Faces_i)$.



(a) South Korea



(b) Hong Kong

Future Studies CV for Political Science

- Determine whether a car is being driven by ai or a human
- Drone monitoring of cities to measure changes on public
- Job shifting effect on public/economy after robotizing redundant jobs
- Community changes on small cities and growth/change on small cities

Questions

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