Perspectives on Analyzing Images for Social Science

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Abstract

Computer Vision has enabled numerous engineering applications such as autonomous vehicles and medical robotics. Meanwhile, many social scientists are applying the contemporary data analysis techniques in their researches and projects (a.k.a, Computational Social Science), such as text mining and machine learning. The focus of this project is to explore how computer vision are currently used in several projects, and what are potential opportunities and problems of this new approach.

Motivations

- **Digitized Society**
  More amount of open-access images, such as Google Satellite Map, Online Newspaper, Social Media (Facebook, Twitter, Instagram, Vimeo...)
- **Deep Learning**
  Developments of methods in CV and Machine Learning enabled tasks like clustering, comparison, objects detection and recognition.
- **Empirical Research**
- Increasing amount of research analyze data to validate and discover models to understand people's behaviors and social systems.

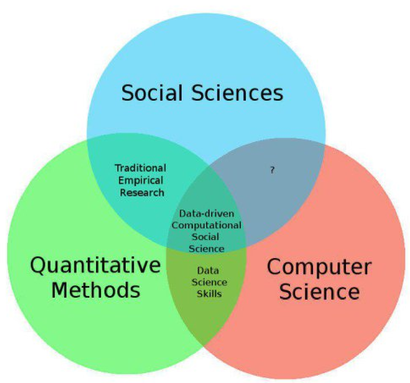

Figure 1: What is Computational Social Science (Conway, 2014)

Case 1: "Combining satellite imagery and machine learning to predict poverty"@ Stanford

- Goal: Estimate consumption expenditure and asset wealth in the developing world
- Data: Demographic and Health Surveys; Satellite data from five African countries
- Method: CNN (explain 75% of the variation in local-level economic outcomes)
- Impact: Transform traditional efforts to track and target poverty in developing countries

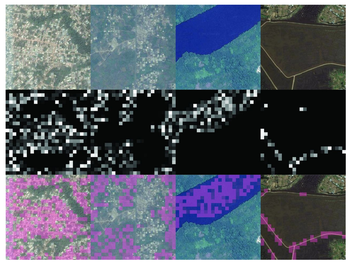

Figure 2: Visualization of features using CNN (Jean et al., 2016)

Case 3: "Streetscore - Predicting the Perceived Safety of One Million Streetscapes"@ MIT

- Goal: Predict the perceived safety of a streetscape
- Data: Training data from an online survey with contributions from 7000+ participants
- Method: SVM, Geometric Texton and Color Histograms along with GIST
- Impact: Create maps of perceived safety for 21 cities in the U.S. (scoring 1 million images)

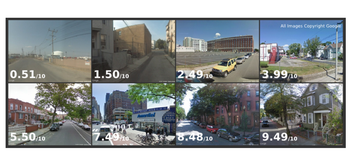

Figure 4: Ranked images on their perceived safety(qs) between 0 and 10 (Naik et al., 2014)

Case 2: "Measuring Economic Growth from Outer Space "@ Brown

- Goal: Introduce economists to the science of remotely sensed data
- Data: Satellite data on night lights
- Method: GIS, Growth Model
- Impact: New proxy for economic activity at temporal and geographic scales

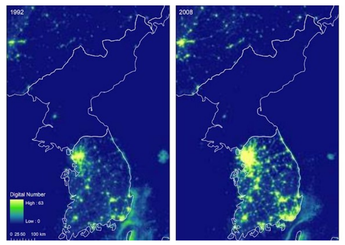

Figure 3: Long-Term Growth: Korean Peninsula, 1992 and 2008 (Henderson et al. 2012)

Case 4: "CV Uncovers Predictors of Physical Urban Change"@MIT

- Goal: Measure changes in the physical appearances of neighborhoods from street-level imagery
- Data: Image time-series from Google Street View
- Method: Regression model based on two image features: GIST and texton maps
- Impact: New tool to obtain socioeconomic measurements from millions of geospatial images

Figure 5: Streetchange: the difference between Streetscores in 2007 and 2014 (Naik et al., 2017)

Project Ideas

- Relationship Inference and Social Network Formation from Group Pictures (Sociology)
- Using Streetscapes as Predictors for House Prices (Business)
- Does avatars infer users' personalities? (Psychology)

Prospects

- More focus on causal inference, besides from descriptive and predictive purposes
- Analyzing non-traditional image sources, such as charts and graphs
- Collaboration among social scientists and computer scientists
- Solutions to deal with privacy and bias in algorithms

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