

ESTIMATING ECONOMIC TIME SERIES USING HIGH RESOLUTION SATELLITE IMAGES AND NEURAL NETWORKS

By Cooper Nederhood

DATA POOR DEVELOPING ECONOMIES

- Developing economies lacking official economic measures
 - Higher resolution than other economic statistics
 - Worldwide coverage
 - Low marginal cost
- Modern computer vision techniques to analyze images
- Jean et al (2016) “Combining satellite imagery and machine learning to predict poverty”

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SATELLITE DATA – LANDSAT

- Available from 1972 to today
- 30 meter resolution
- Cover entire Earth's surface every two weeks
- Access through Google Earth Engine API
 - Goldblatt et al, 2016

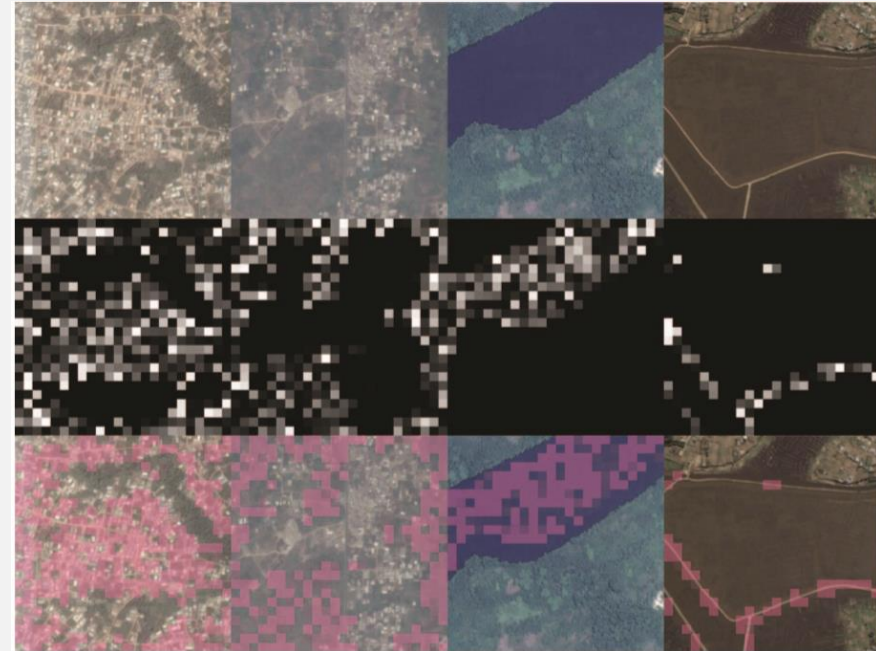


GROUND TRUTH DATA – DHS SURVEY

- “Demographic and Health Survey”
- Includes Wealth Index, composite index
- Uganda (2016, 2011, 2006, 2000-01, 1995, 1988-89)

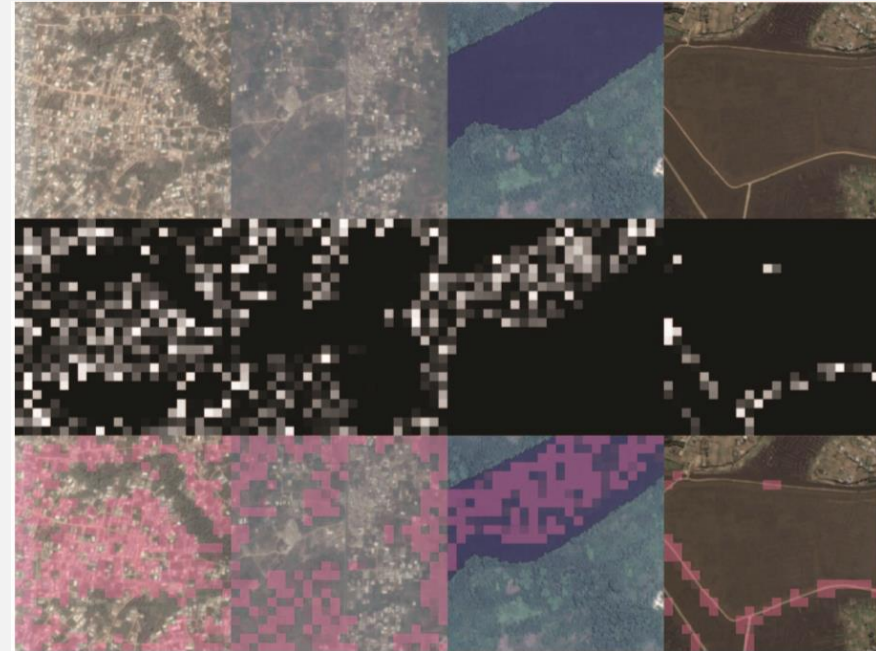
CONVOLUTIONAL NEURAL NETWORK

- Deep neural network used in computer vision
- Learns to identify image features relevant to economic activity
- Transfer learning from ImageNet
- Jean et al (2016) “Combining satellite imagery and machine learning to predict poverty”
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POTENTIAL RESULTS

- Much research in 'night lights' as a proxy for economic activity
- Convolutional Neural Nets much richer, complex
 - Success cross-sectionally
- “We however find poor prediction power of [nightlights and Landsat images] in the time-series which severely limits the usage of remote sensing for predicting economic changes over time at small geographies” (Goldblatt et al, 2017)
 - Simple model?
 - Or physical features not changing?

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VAST POSSIBILITIES IN USING SATELLITE DATA IN ECONOMICS

- “The View from Above: Applications of Satellite Data in Economics”,
Donaldson and Storeygard
- Questions?