

Presented by:



ACCELERATE AI EAST

BOSTON | April 30-May 4

2019

ISHA CHATURVEDI (Presenter)
DATA SCIENTIST, ERICSSON

THE LEADING DATA SCIENCE CONFERENCE

Automated Detection of Street-Level Product Displays

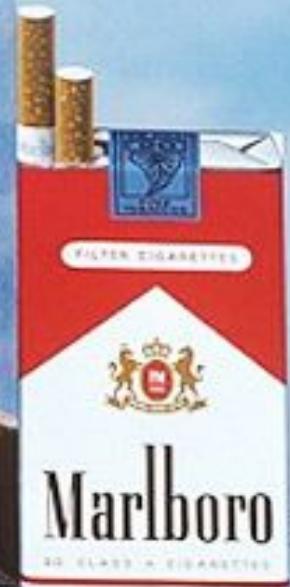
Sponsor: Dr. Tom Kirchner (NYU mHealth Lab)

Mentors: Dr. Federica Bianco & Dr. Gregory Dobler (NYU Center of Urban Science & Progress)

Team PANIC:

Prince Abunku, Andrew Chen, Neal Zhu,
Isha Chaturvedi & Charlie Moffett

Motivation



PACIFIC OUTDOOR

Newport

\$8.30

SPECIAL
OFFER
TAX INCLUDED



MAVERICK
THE REAL DEAL

\$7.50

EVERYDAY
LOW PRICE
TAX INCLUDED

OUR best Pyramid
BARGAIN

\$.665
Per Pack

300 PUFFS.
NO BUTTS.

NEW

ZOOM

ZOOM

FLAVOR
BEATS FIRE

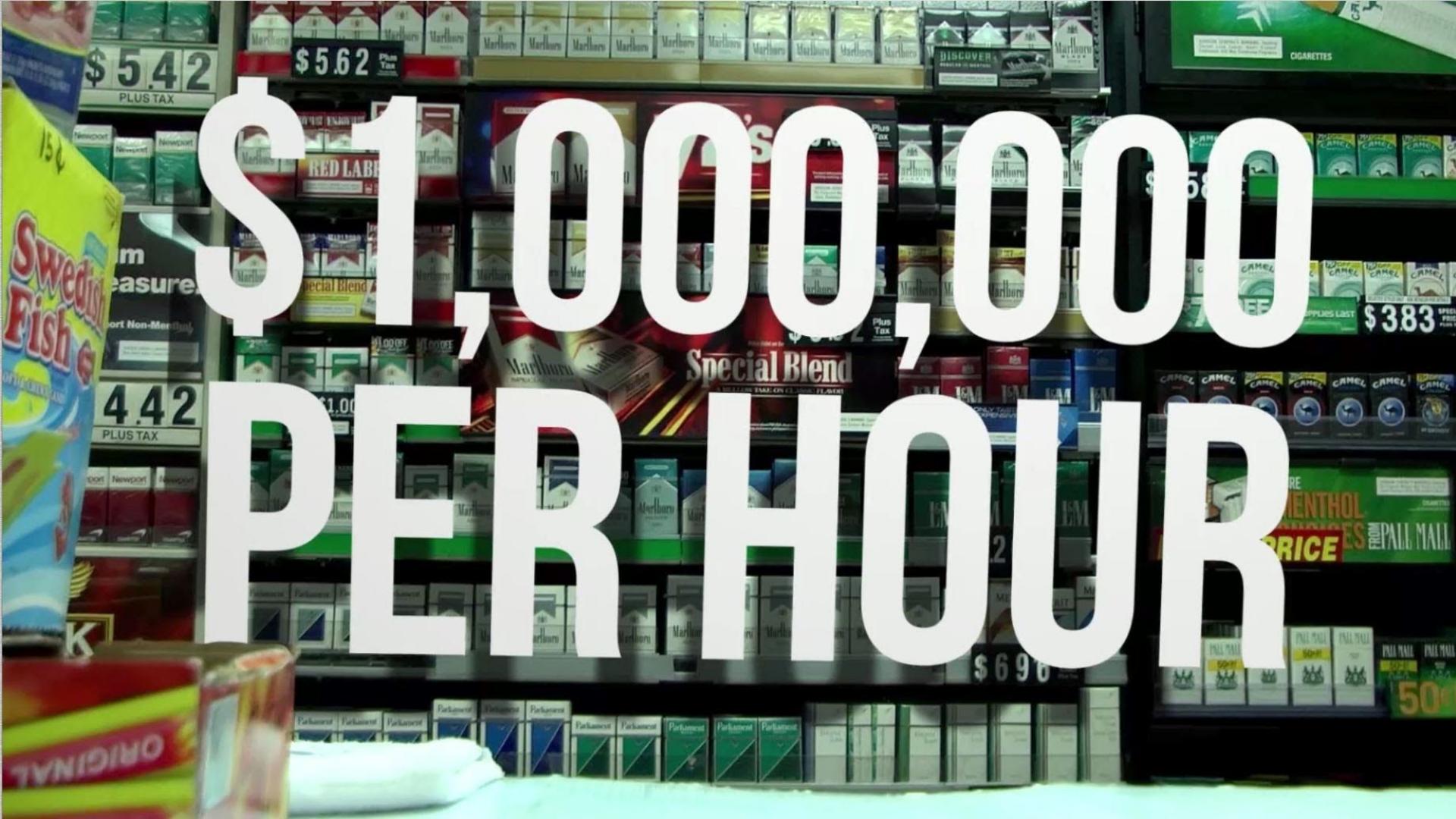
ZOOMEIGHS.COM

\$11.99

00



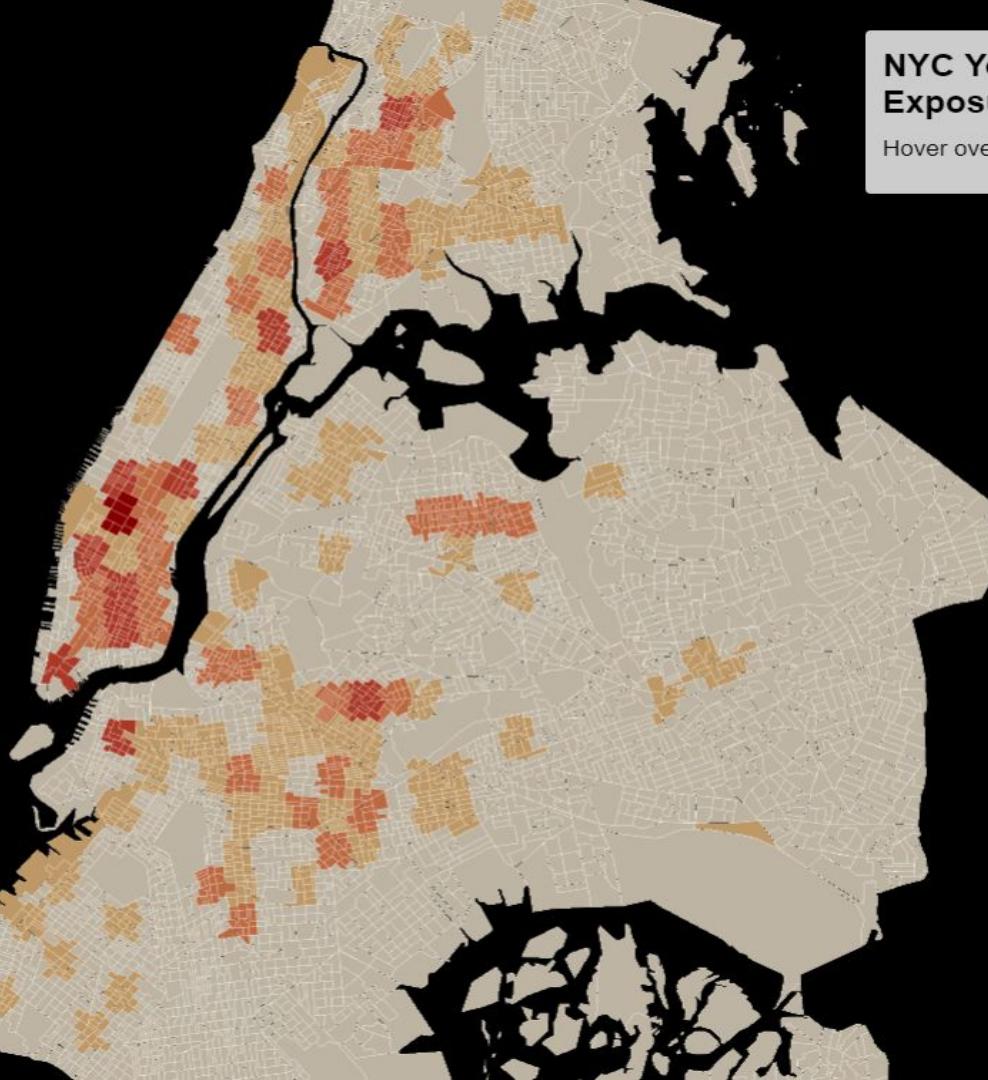
**\$1,000,000
PER HOUR**



+
-
▲
▼

NYC Youth POST Exposure by CBG

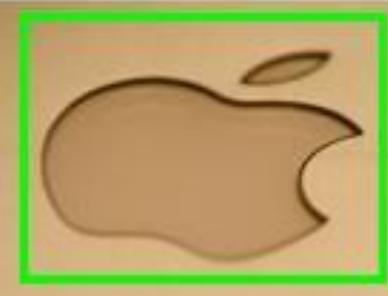
Hover over a Census block group!



- 0-0.53
- 0.53-1.23
- 1.23-1.92
- 1.92-2.76
- 2.76-6.62

Methodology

Detecting Objects in Images



Neural Networks

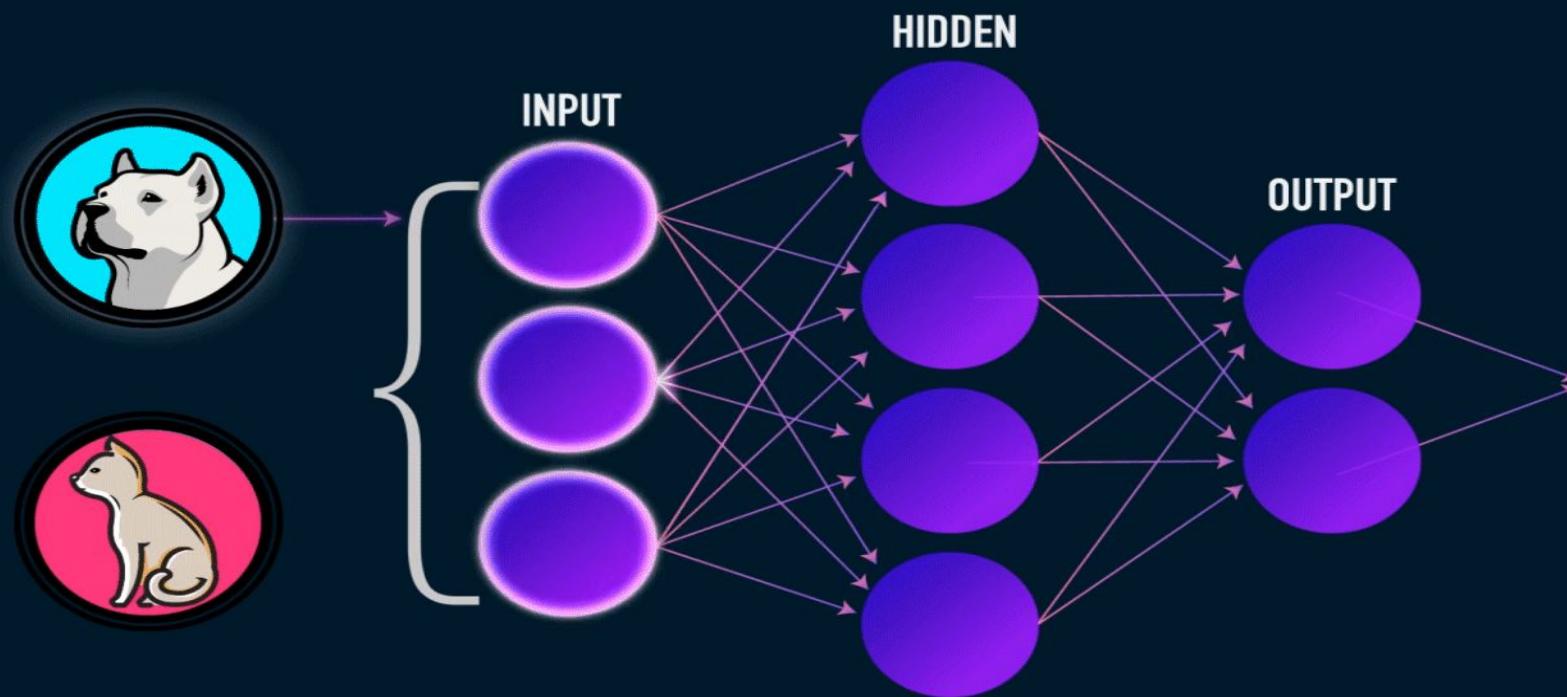


Image Complexity

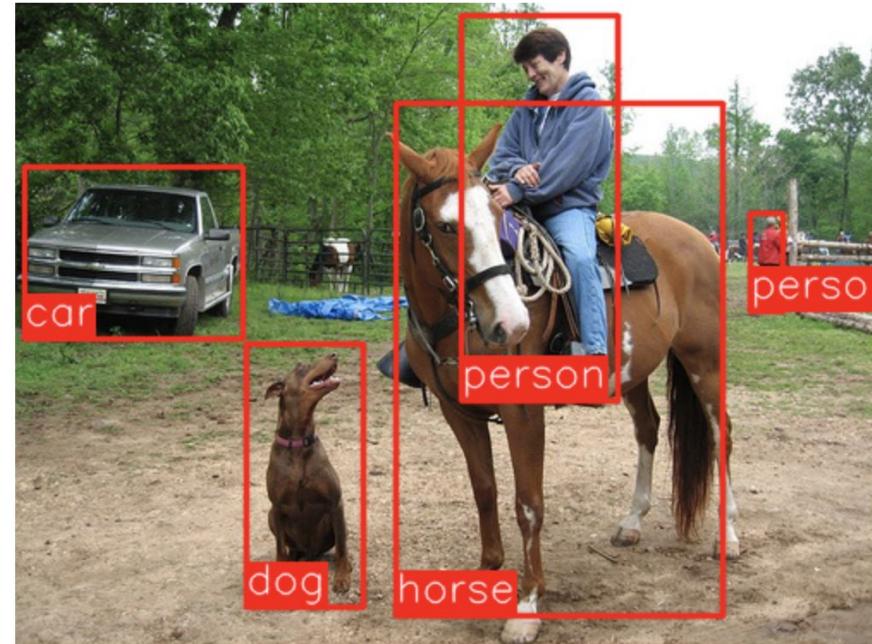


Single object



Overlapping objects and backgrounds

Region-based Convolutional Neural Network (R-CNN)



What is R-CNN?

- RCNN (region based convolutional neural network)
- **Inputs:** Image
- **Outputs:** Bounding boxes + labels for each object in the image.

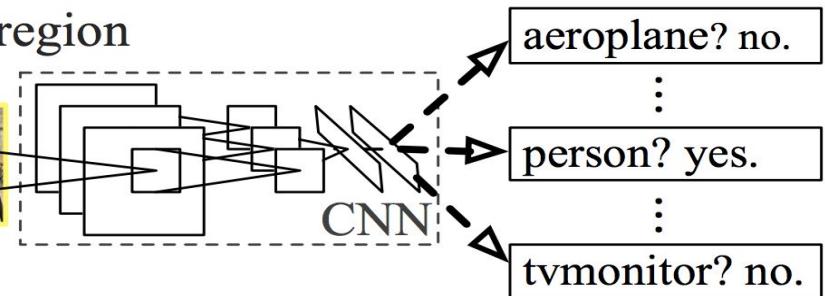
R-CNN: *Regions with CNN features*



1. Input image

2. Extract region proposals (~2k)

warped region



3. Compute CNN features

4. Classify regions

What the problem in R-CNN?

They are really quite slow!

- 2000 forward passes per image
- Train **3 separate models**:
 - **CNN**: for image feature extraction
 - **SVM**: for object classification
 - **Regression**: for bounding box tightening

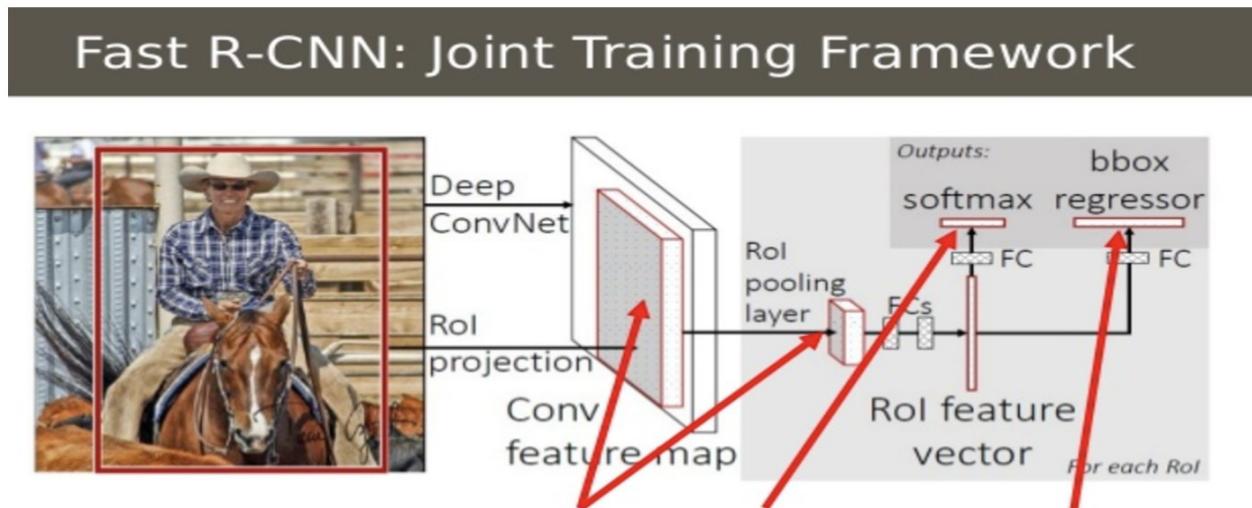
What the problem in Fast R-CNN?

Region Proposals:

running a separate search algorithm!

What's next?: Fast R-CNN

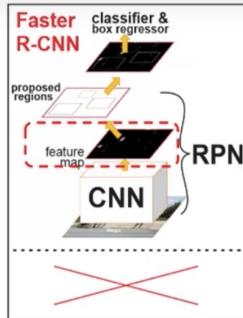
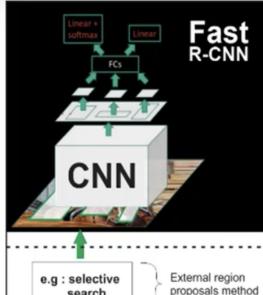
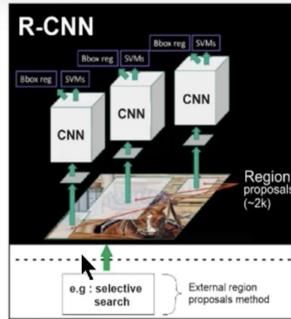
- Combine all models into one network!
- **Inputs:** Image with region proposals
- **Outputs:** Object classifications of each region along with tighter bounding boxes.



Joint the feature extractor, classifier, regressor together in a unified framework

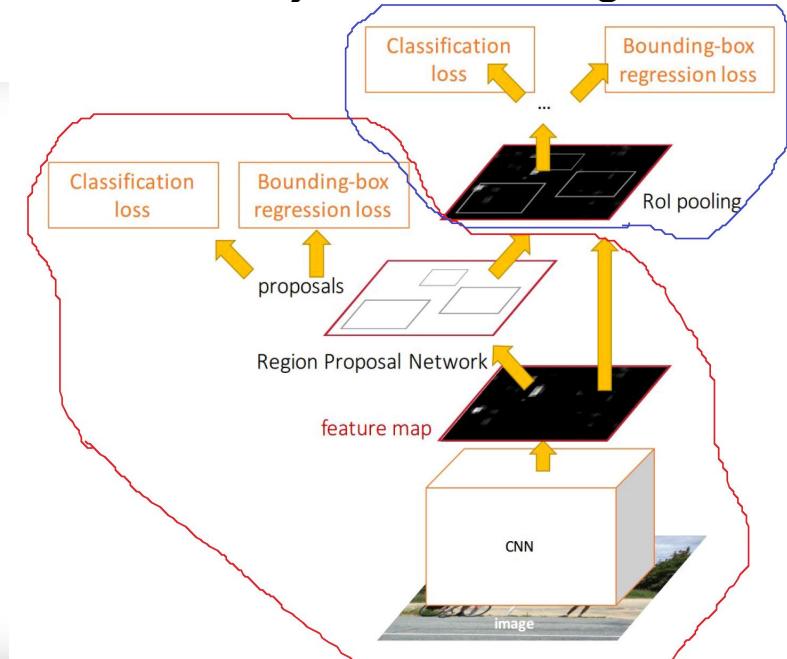
Faster RCNN

- **Inputs:** Images (Notice how region proposals are not needed).
- **Outputs:** Classifications and bounding box coordinates of objects in the images.



	R-CNN	Fast R-CNN	Faster R-CNN
Test time per image	50 seconds	2 seconds	0.2 seconds
Speed-up	1x	25x	250x
mAP (VOC 2007)	66.0%	66.9%	66.9%

* Stanford lecture notes on CNN by Fei Fei Li and Andrej Karpathy



Data

Sources

- **Health Data NY:** location of active retail tobacco vendors operating in New York
- **Google Street View API:** panoramic 360 degree views from designated roads
- **American FactFinder:** US Census Block Group geometries and youth population

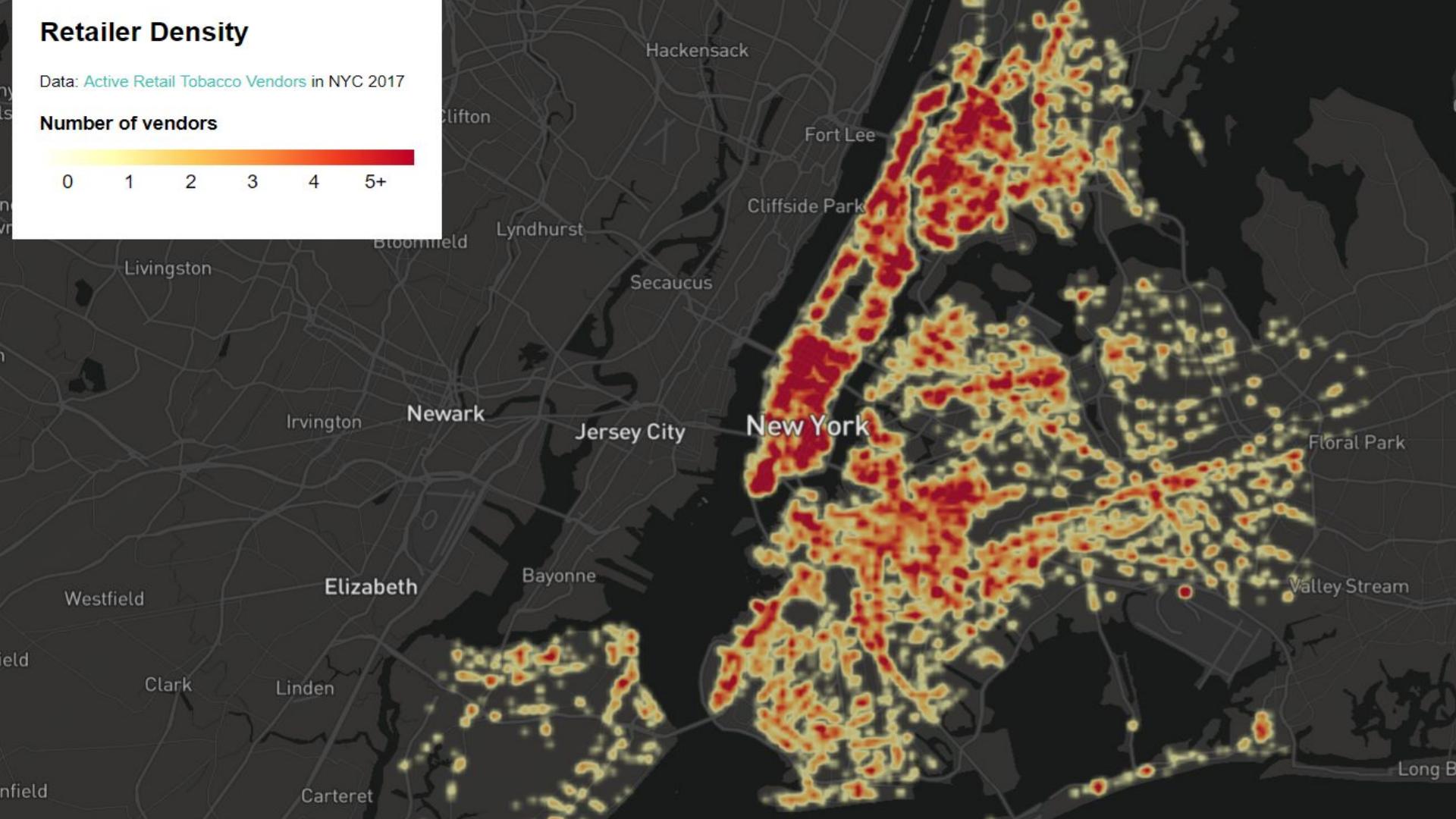


Retailer Density

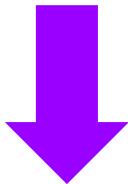
Data: Active Retail Tobacco Vendors in NYC 2017

Number of vendors

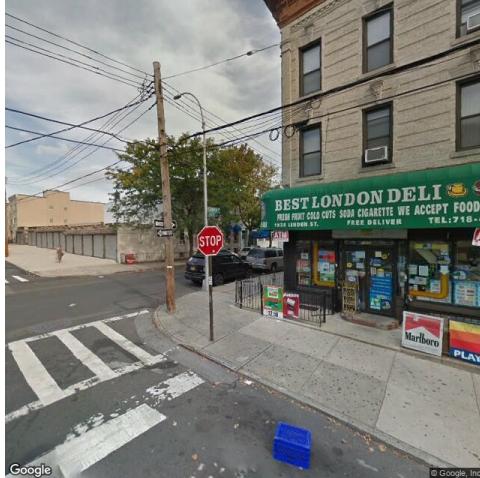
0 1 2 3 4 5+



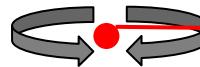
10,000+ Addresses



40,000 +
**Google Street View
Images**



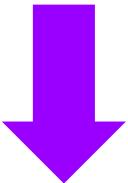
Street



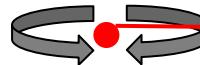
Address



Google Street View Images



Street

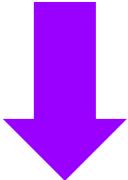


Address

Images containing shops



Images containing shops



Label the tobacco
advertisements

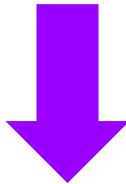


LabelImg

- Graphical image annotation tool
- Label object bounding boxes in images
- Written in Python & uses Qt for its graphical interface



	No. Total Vendor	No. Google Street View	No. Images labeled with tobacco ads
Population set	10,694	42,776	-
Sample set	4,424	17,696	104



**Image
manipulation**

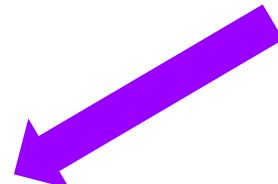
Image manipulation



PANIC18

	No. Total Vendor	No. Google Street View	No. Images labeled with tobacco ads
Population set	10,694	42,776	-
Population set	4,424	17,696	104

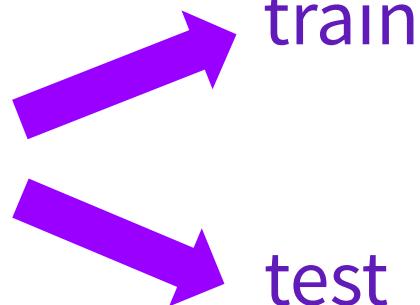
Image manipulation



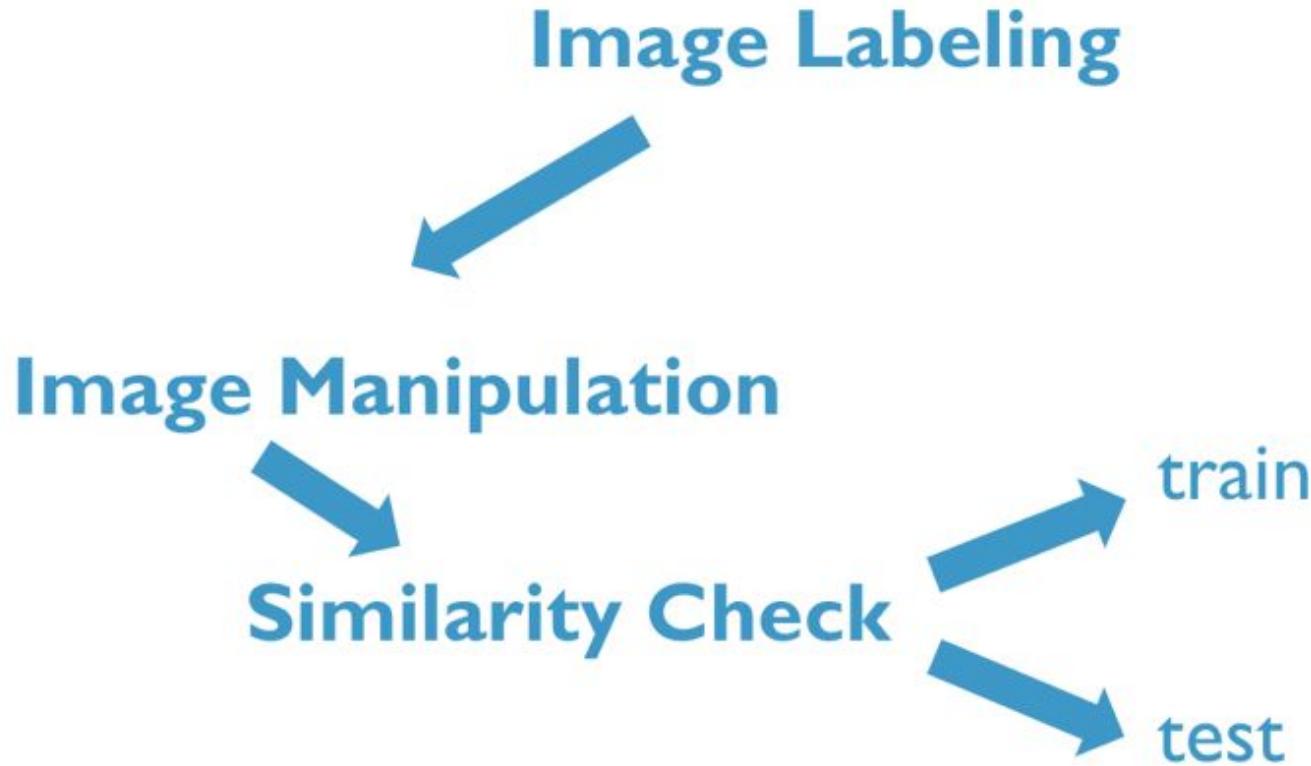
Similarity Check



980



Lets Recap!



Results

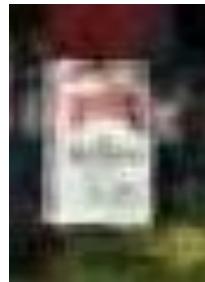
Detection Performance

Iterations	70K
mAP (mean Average Precision - metric for evaluating performance, precision for each class in our data that we are detecting)	62.0%
Pretrained Model	Res101 (neural network with 101 residual layers)

True Positive Detections



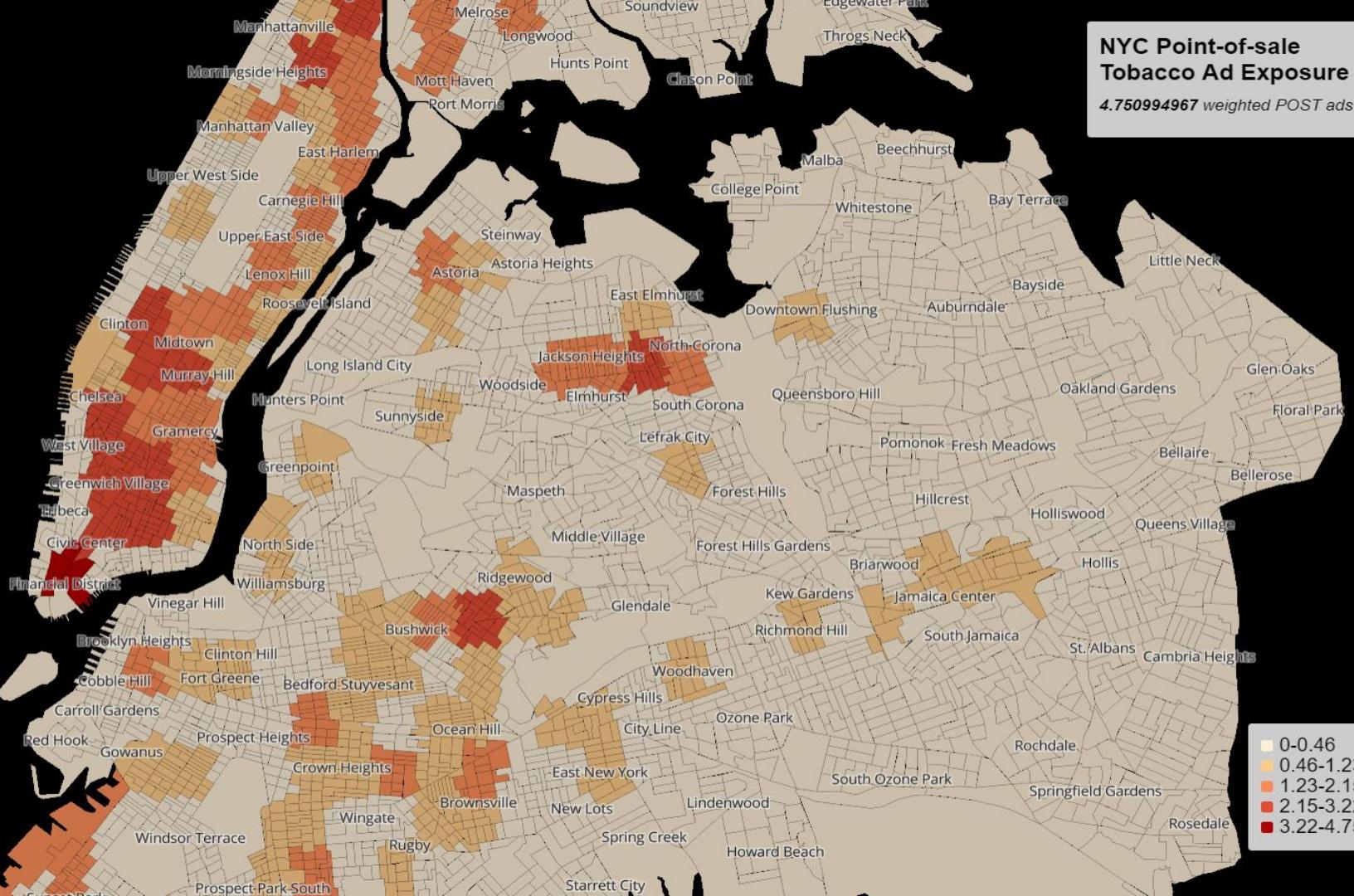
False Positive Detections



Conclusion

NYC Point-of-sale Tobacco Ad Exposure

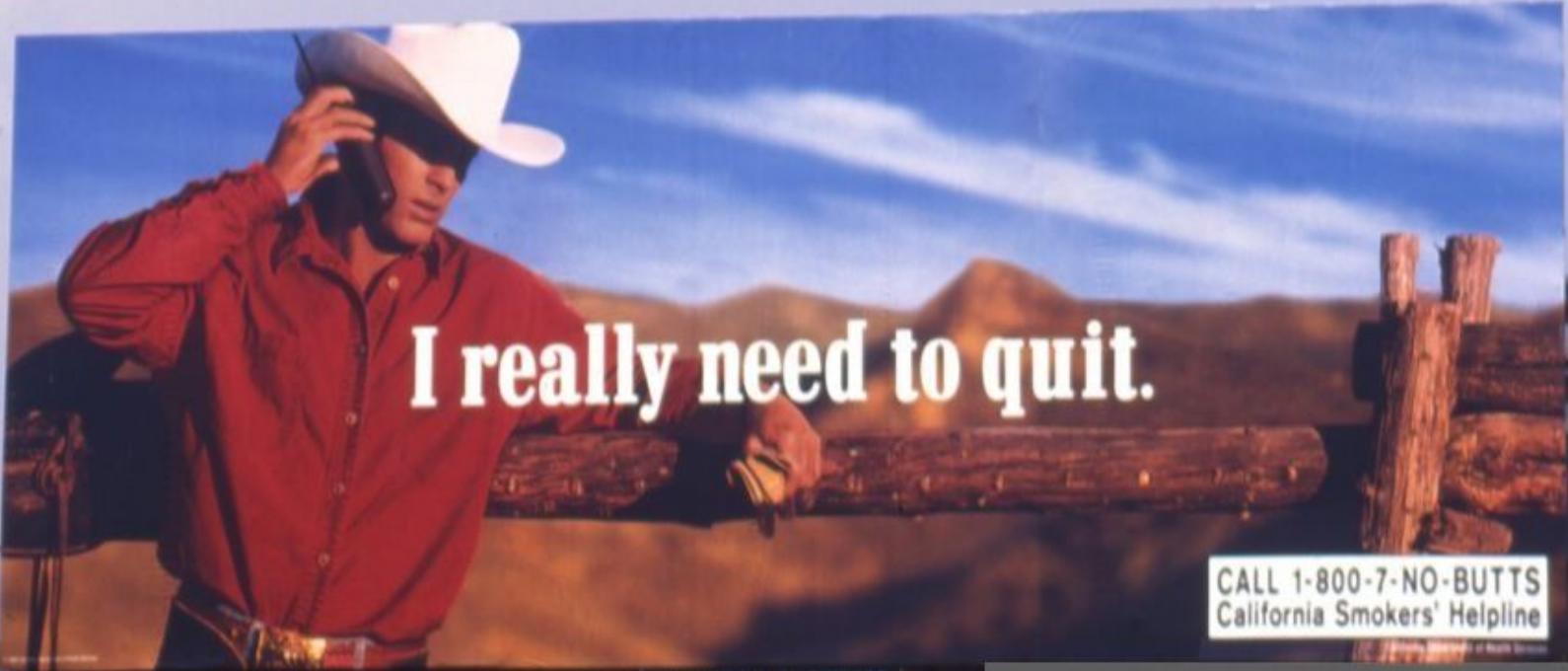
4.750994967 weighted POST ads



Improvements

- Higher resolution images
- Increased time on labeling
- Diversity of images





OUTDOOR SYSTEMS

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California Smokers' Helpline

gettyimages®

Donaldson Collection

EASY
AUTO PARTS
RECYCLING

Further Details :

https://cuspccapstones.github.io/Automated-detection-of-street-level-product-displays_2018/

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Presented by:

