



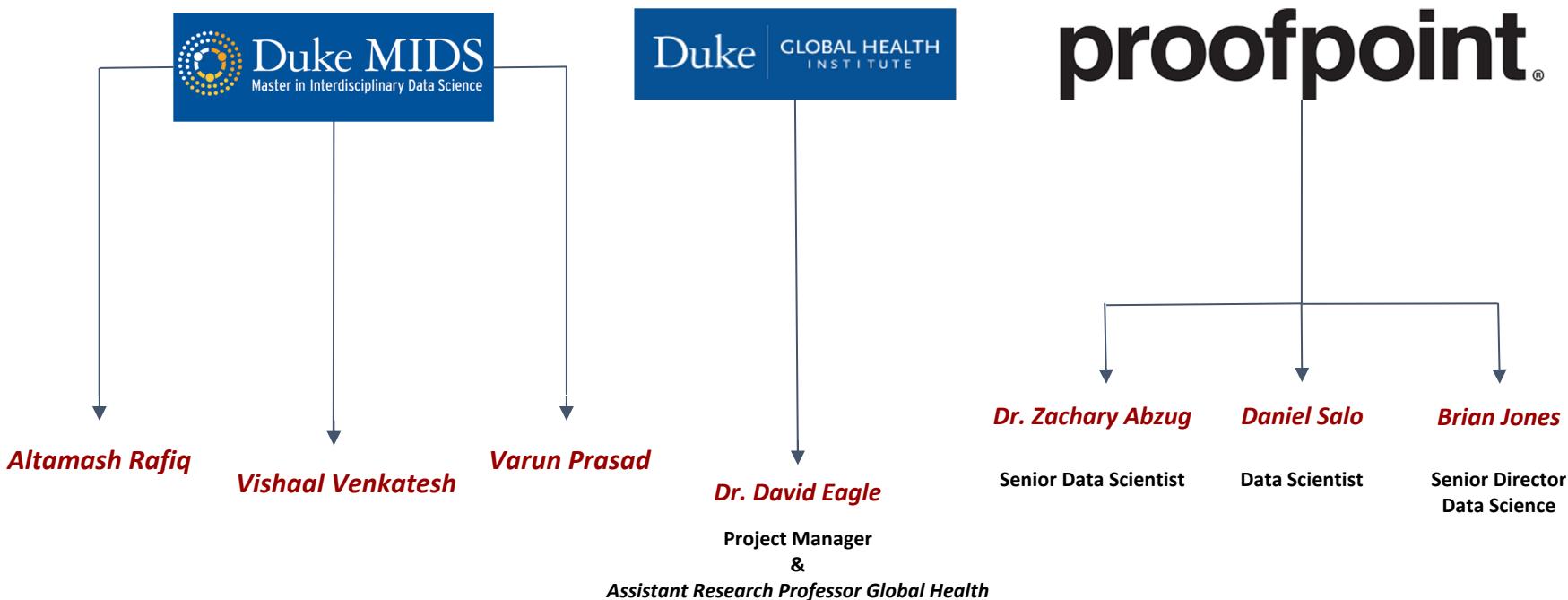
Open-World Logo Detection & Classification

Client Presentation

April 22nd, 2021

Duke

The Duke Team



Duke

Brief Problem Overview

Duke

Project Goals/Significance

- Brand impersonation is common in phishing attacks
- Additional tool for Proofpoint to combat brand impersonation
- Curate well-annotated database of website screenshots and logos
- Develop robust models that both detect logos and identify the brand



<https://highperformanceadvocates.com/goal-person-system-person/>

Duke

Real Logo



"Costco's" logo is just a bit off. This is what the Costco logo is supposed to look like.



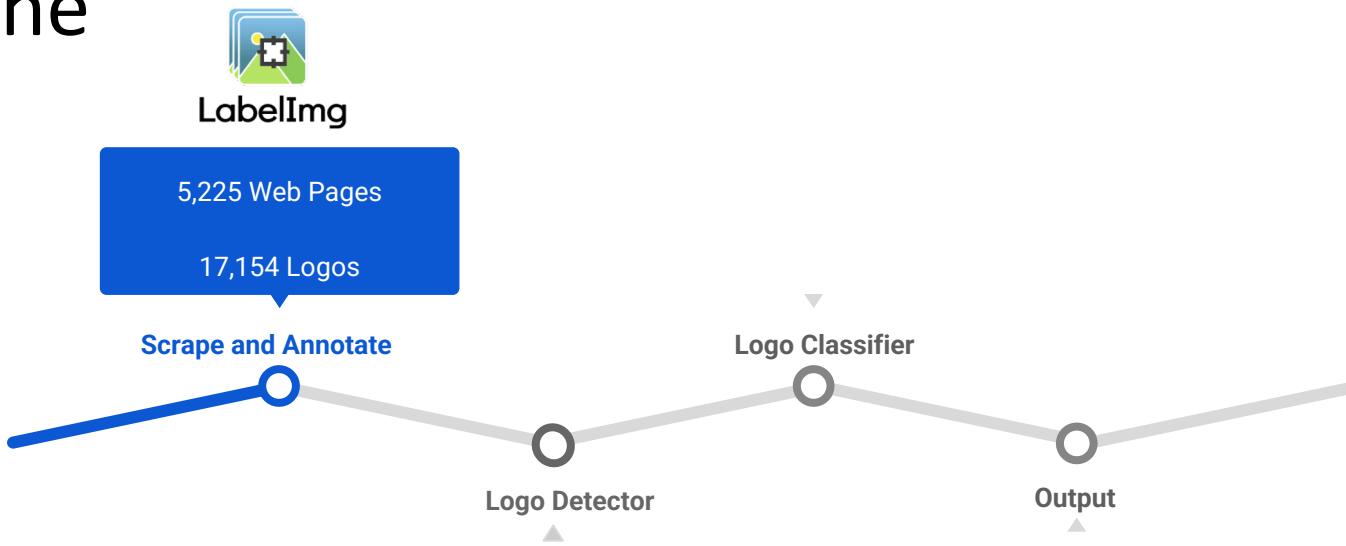
See the difference? Subtle, no?

Duke

Pipeline

Duke

Pipeline



[News](#)[Products](#)[Contact](#)

Search

[News in Focus](#)[Business & Money](#)[Science & Tech](#)[Lifestyle & Health](#)[Policy & Public Interest](#)[People & Culture](#)

Equinix Expands Rio de Janeiro Data Center

New phase will nearly double the total capacity to meet customer demand for data center colocation

**EQUINIX**

WHERE OPPORTUNITY CONNECTS

NEWS PROVIDED BY

[Equinix, Inc. →](#)

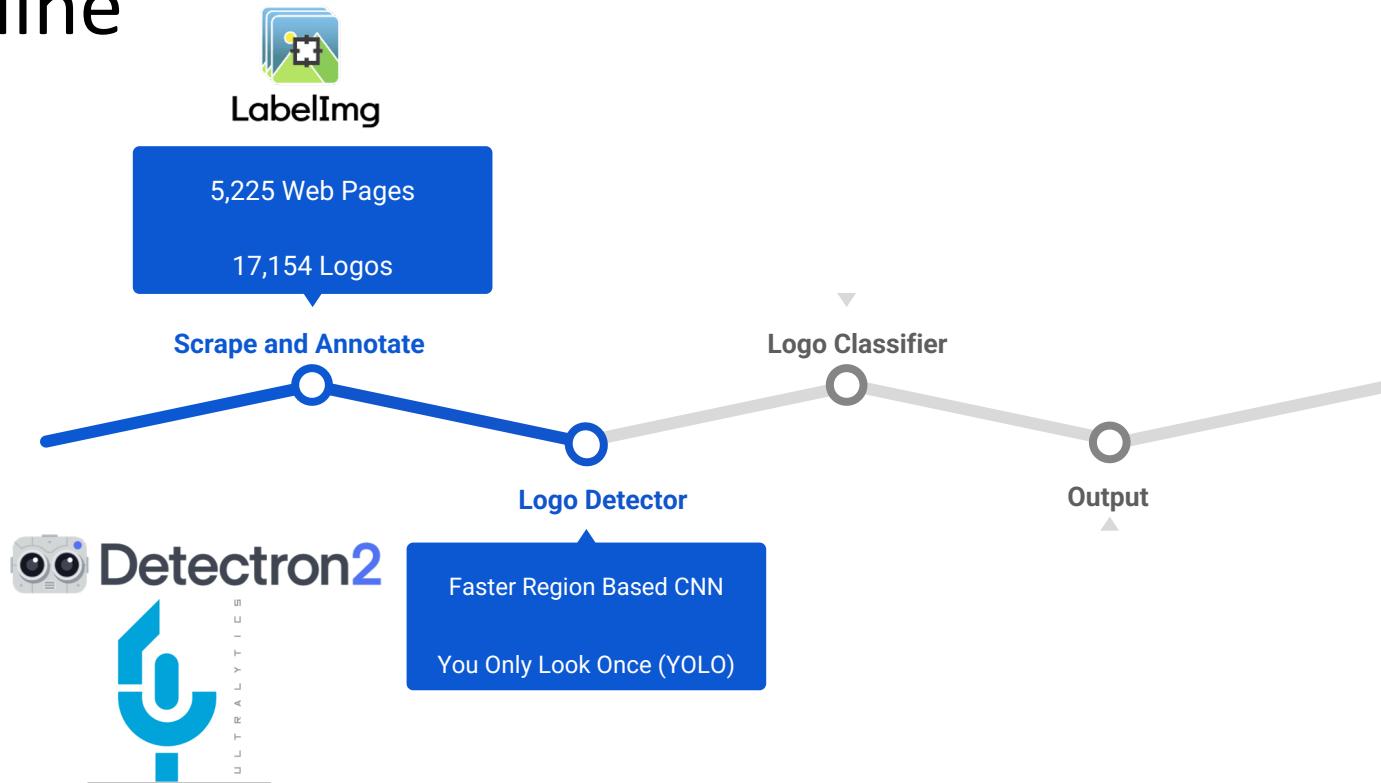
Mar 31, 2015, 07:00 ET

SHARE THIS ARTICLE



REDWOOD CITY, Calif. and RIO de JANEIRO, March 31, 2015 /PRNewswire/ -- [Equinix, Inc.](#) (Nasdaq: [EQIX](#)), the global interconnection and [data center company](#), today announced it is expanding its [Rio de Janeiro data center](#) known as RJ2. This new phase of expansion is scheduled to open in Q3 of this year and will enable Equinix to continue to meet

Pipeline





News

Products

Contact

Search

News in Focus

Business & Money

Science & Tech

Lifestyle & Health

Policy & Public Interest

People & Culture

Equinix Expands Rio de Janeiro Data Center

New phase will nearly double the total capacity to meet customer demand for data center colocation



NEWS PROVIDED BY

[Equinix, Inc. →](#)

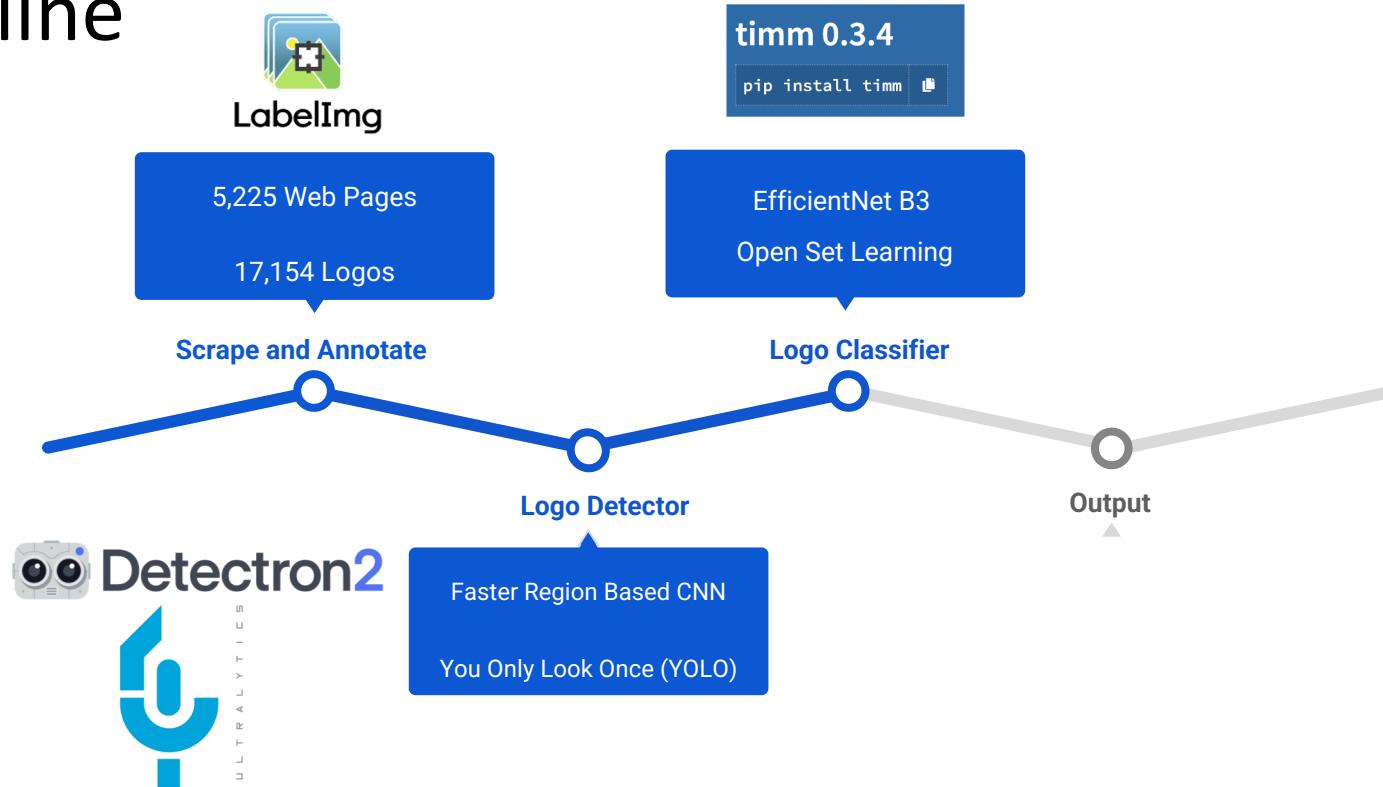
Mar 31, 2015, 07:00 ET

SHARE THIS ARTICLE



REDWOOD CITY, Calif. and RIO de JANEIRO, March 31, 2015 /PRNewswire/ -- [Equinix, Inc.](#) (Nasdaq: EQIX), the global interconnection and [data center company](#), today announced it is expanding its [Rio de Janeiro data center](#) known as RJ2. This new phase of expansion is scheduled to open in Q3 of this year and will enable Equinix to continue to meet

Pipeline



Resources Blog Journalists

Log In Sign Up Data Privacy Send a Release

Unknown



News

Products

Contact

Search

News in Focus

Business & Money

Science & Tech

Lifestyle & Health

Policy & Public Interest

People & Culture

Equinix Expands Rio de Janeiro Data Center

New phase will nearly double the total capacity to meet customer demand for data center colocation



NEWS PROVIDED BY

[Equinix, Inc. →](#)

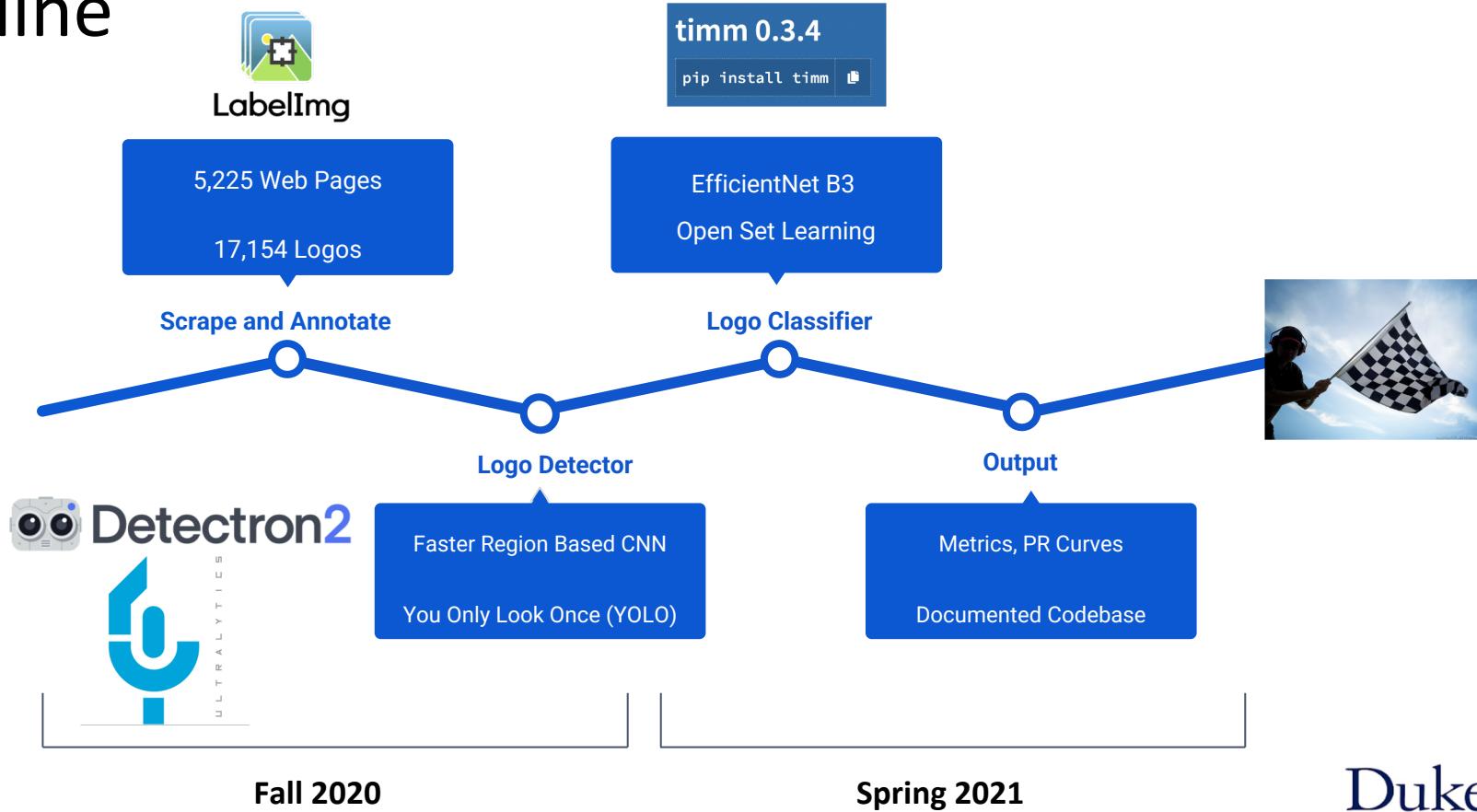
Mar 31, 2015, 07:00 ET



REDWOOD CITY, Calif. and RIO de JANEIRO, March 31, 2015 /PRNewswire/ -- Equinix, Inc. (Nasdaq: EQIX), the global interconnection and data center company, today announced it is expanding its Rio de Janeiro data center known as RJ2. This new phase of expansion is scheduled to open in Q3 of this year and will enable Equinix to continue to meet

uke

Pipeline

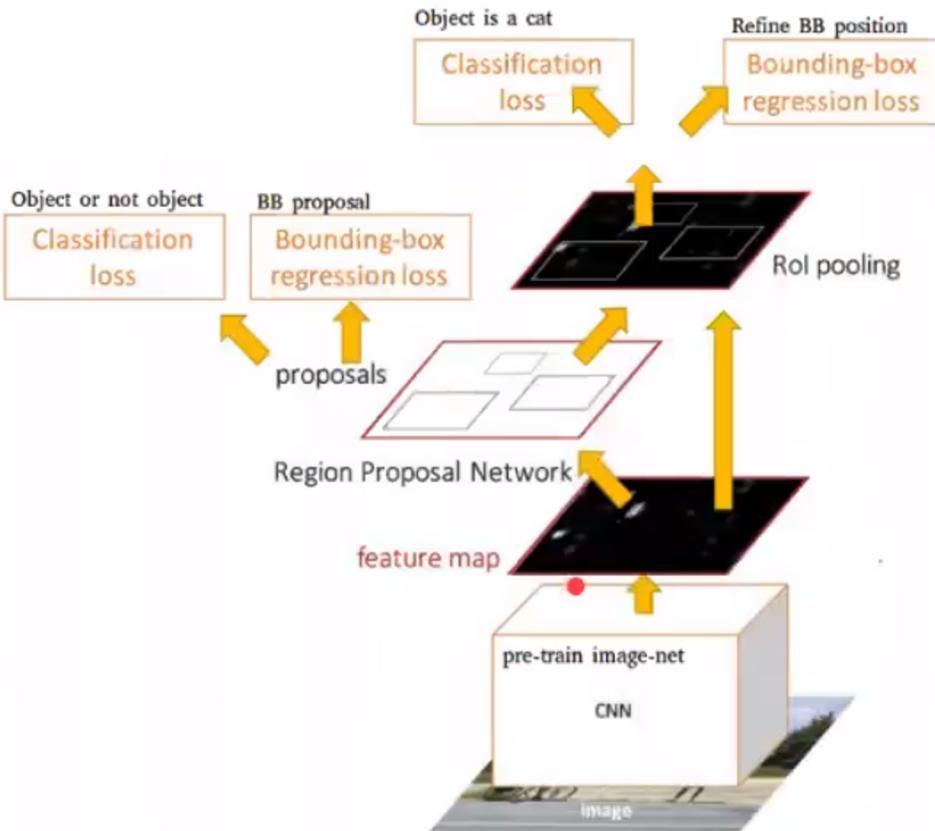


Models

Duke

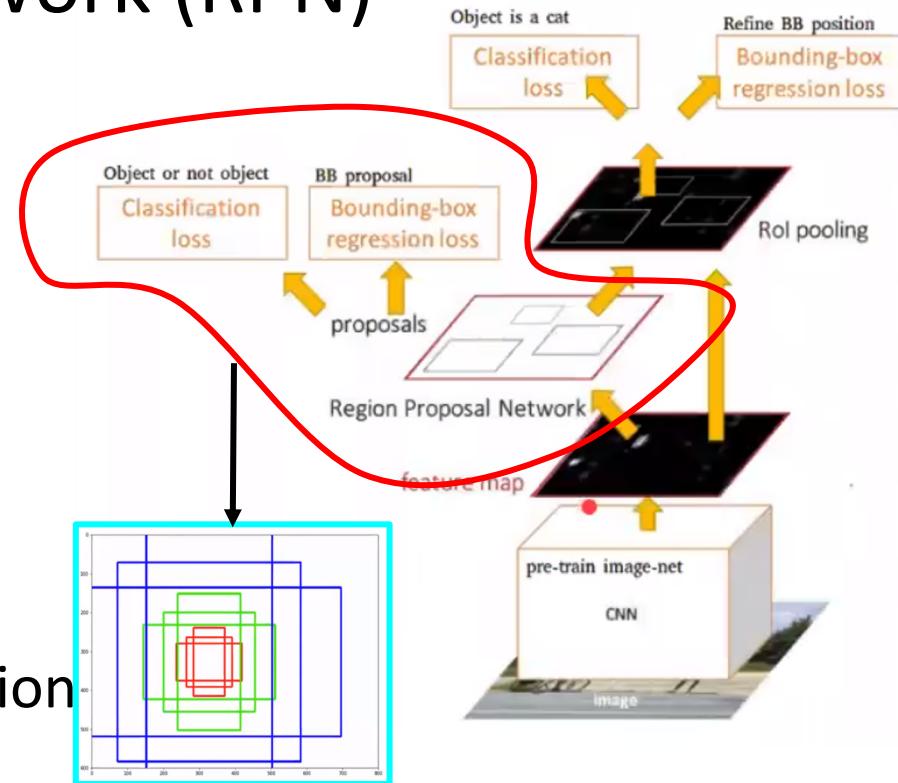
Faster R-CNN (2016)

- Two Stage Process
- Slower but more accurate
- ResNeXt 101 + FPN



Region Proposal Network (RPN)

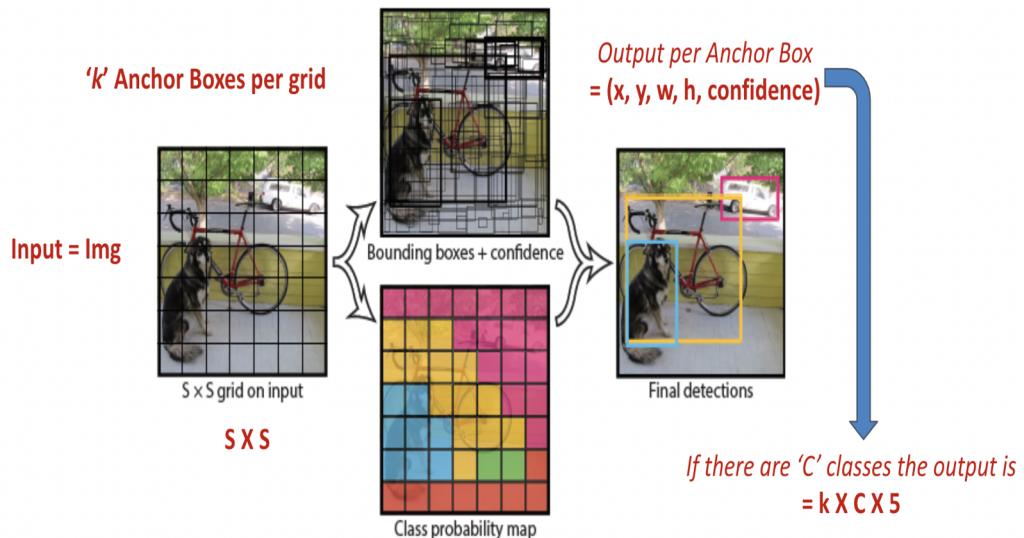
- Guesses object location
- Makes use of anchor boxes
- Two-Component Loss Function



Duke

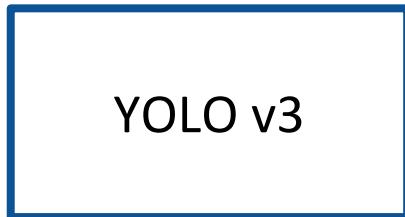
YOLO v3

- One Stage Process
- Faster but less accurate
- DarkNet 53 + SPN



Duke

Why Train Both YOLO and RCNN?



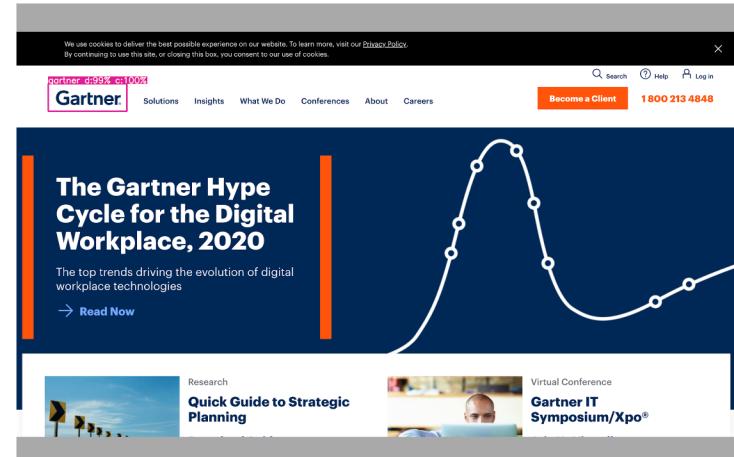
3.4x Faster



0.044s / image



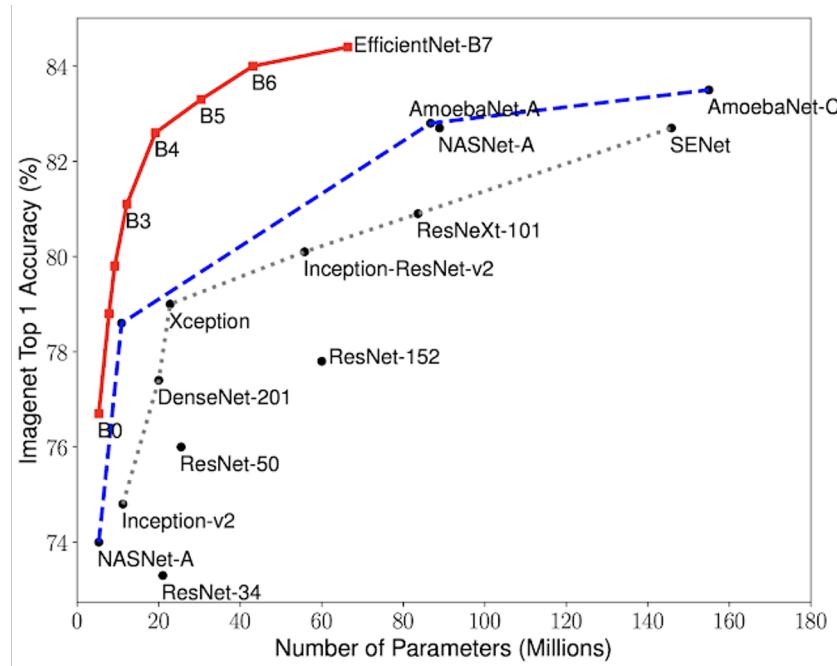
0.149s / image



*Using Tesla V100-SXM2-16GB

Duke

Classifier Architecture: EfficientNet



Data Summary Statistics

Duke

Detector Data

1. Train - 3,935 Images
 - a. Regular: 78.4%
 - b. University: 16.5%
 - c. PDF: 5.1%
2. Val - 646 Images
 - a. Regular: 77.2%
 - b. University: 15.5%
 - c. PDF: 7.6%
3. Test - 644 Images
 - a. Regular: 77.6%
 - b. University: 15.5%
 - c. PDF: 6.9%

2021

Instructions for Form 1042-S

Foreign Person's U.S. Source Income Subject to Withholding

Section references are to the Internal Revenue Code unless otherwise noted.

Future Developments
For the latest information about developments related to Form 1042-S and its instructions, such as legislation enacted after they were published, go to [IRS.gov/Form1042S](#).

General Instructions

What's New

Exemption code 02. Chapter 3 exemption code 02 has been revised to read as follows "Exempt under IRC." New footnote 7 has been added to clarify that exemption code 02 "should only be used if no other specific chapter 3 exemption code applies." As a result of the addition of footnote 7, all subsequent footnotes have been renumbered.

Exemption code 24. New chapter 3 exemption code 24 (exempt under section 892) has been added.

Requests for extension of time to provide statements to recipients. The IRS has changed the manner in which requests for an extension of time to provide statements to recipients may be made. See [Recipient copies](#), later, for details.

Withholding rates. The rate of withholding under section 1446 by a publicly traded partnership on a distribution of income effectively subsequent year with respect to a foreign partner's or beneficiary's share of income for the prior year may designate the deposit of the withholding as attributable to the preceding year and in some cases a partnership is provided an extended due date for filing and furnishing Form 1042-S. See the instructions for [Box 7c](#), later.

- **Adjustments to overwithholding under the reimbursement and set-off procedures.** A withholding agent may make adjustments to overwithholding using either the reimbursement or set-off procedures until the extended due date for filing Form 1042-S (unless the Form 1042-S has already been filed or furnished). Additionally, a withholding agent may use the extended due date for filing a Form 1042 to claim a credit for any adjustments made to overwithholding. See the instructions for [Box 9](#), later.

Box 12f (country code). If the withholding agent is a U.S. person or a foreign branch of a U.S. person, filers must now enter "US" in box 12f (even though "US" is not a code on the list at [IRS.gov/CountryCodes](#)). See the instructions for [Box 12f, Country code](#), later, for details.

Withholding rates. The rate of withholding under section 1446 by a publicly traded partnership on a distribution of income effectively

Unknown  Department of the Treasury
Internal Revenue Service

See also Notice 2020-2 (2020-3 I.R.B. 327), available at [IRS.gov/irb/2020-03_IRBNOT-2020-2](#), which extends the phase-in period provided in Notice 2018-72, 2018-40 I.R.B. 522, available at [IRS.gov/irb/2018-40_IRBNOT-2018-72](#), for certain provisions of the section 871(m) regulations for two years, including for certain requirements of a qualified derivatives dealer (QDD).

Foreign Account Tax Compliance Act (FATCA). Form 1042-S reports payments and amounts withheld under the provisions commonly known as FATCA or Chapter 4 of the Internal Revenue Code (chapter 4) in addition to those amounts required to be reported under Chapter 3 of the Internal Revenue Code (chapter 3). Form 1042-S requires the reporting of an applicable exemption to the extent withholding under chapter 4 did not apply to a payment of U.S. source fixed or determinable annual or periodical (FDAP) income (including deposit interest) that is reportable on Form 1042-S. For payments to intermediaries, flow-through entities, and recipients, Form 1042-S requires that the chapter 4 status (or classification) and, when the payment reported is a withholdable payment, the chapter 4 status, be reported on the form according to the codes provided in these instructions.

Classifier Data

- Brands
 - S&P 500, technology, financial, internet categories
 - Facebook, Twitter, Amazon, AMD, etc.
 - High resolution images from Bing image downloader
 - Extracted logos from our annotations
- Final Dataset (1098 Classes)
 - 12878 train, 4668 val, 1165 test
 - Data augmentation: cropping, rotating, color jittering
- Models
 - 1,098 Class (Brands) Model → deployment
 - 32 Class (Brands) Model → experimental

Sample Images for Classifier

Bing Downloader



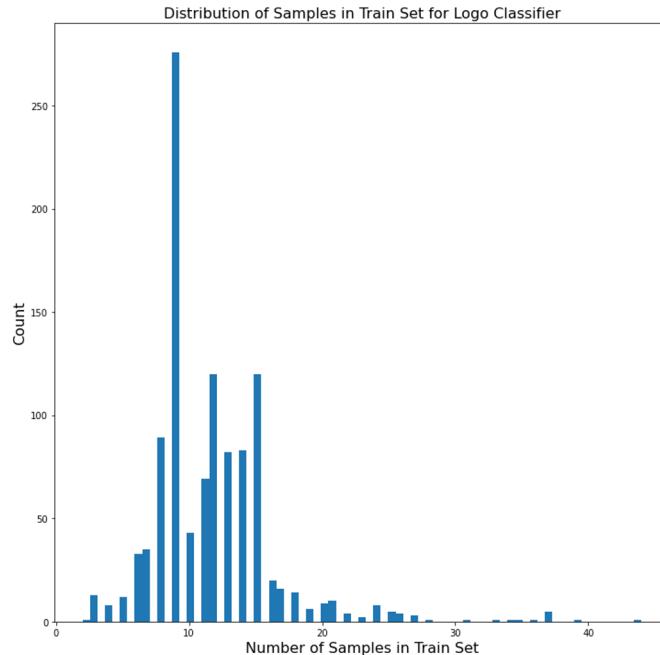
Annotation Extracted



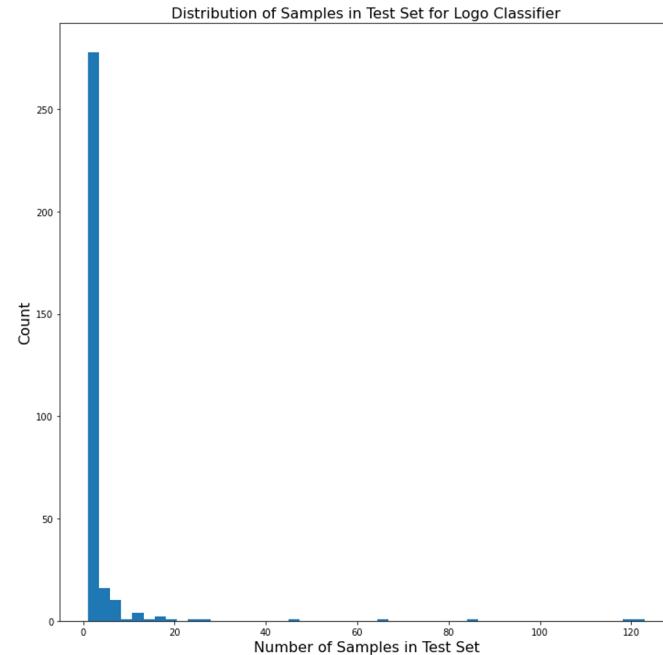
Duke

Classifier Data Distribution

Training Data



Test Data



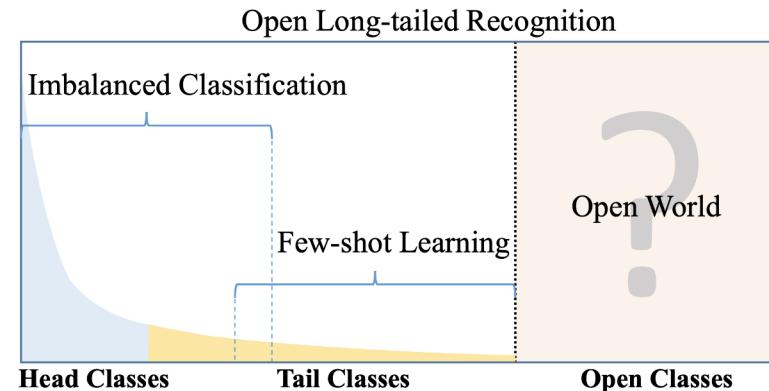
Duke

Open Set Learning

Duke

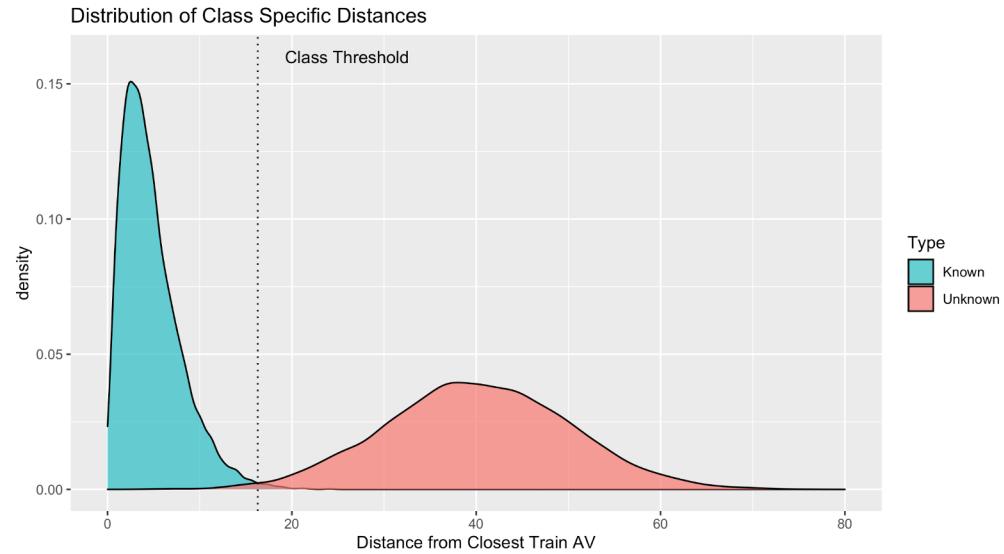
What is Open Set Learning?

- We want our model to be able to say “This is a logo I don’t recognize.”
- Drastically reduce the chances of misclassification into known categories.



Open Set K-Nearest Neighbors Classification

- Generate **Lookup Table of Activation Vectors**
- Generate **Per-Class Thresholds using Distances** to lookup table vectors

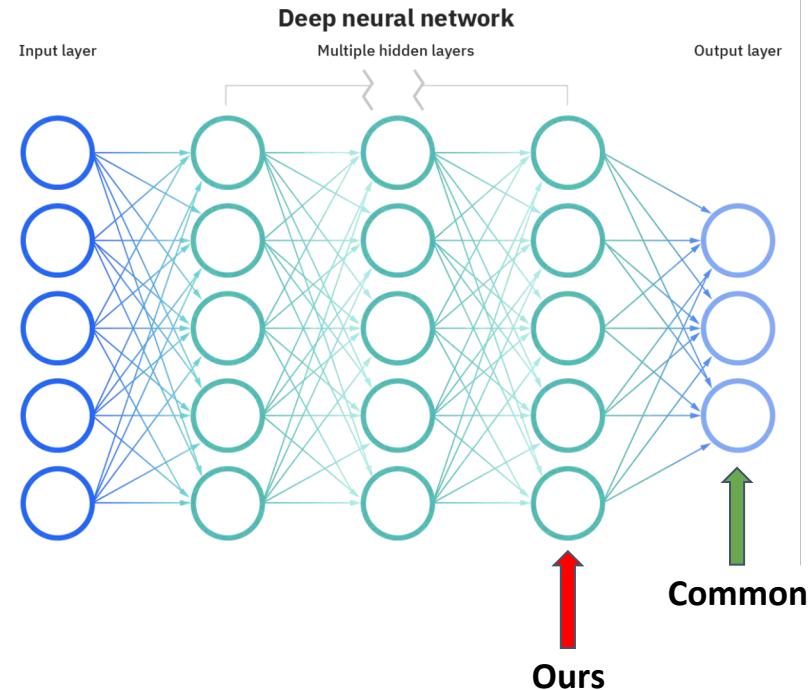


Comparison of Open-Set Learning Methods

	Correct Unknowns	Incorrect Unknowns	Accuracy Open Set
Unknown Class	84.4%	4.0%	94.5%
OLTR	88.9%	8.9%	90.7%
KNN	92.8%	9.1%	90.6%

Activation Vectors

- Generally the pre-activation output of last layer of a neural network.
- We use the second-to-last layer.
- Can be interpreted as a transformation of the image to a lower dimensional set of features, often called *direct* features.

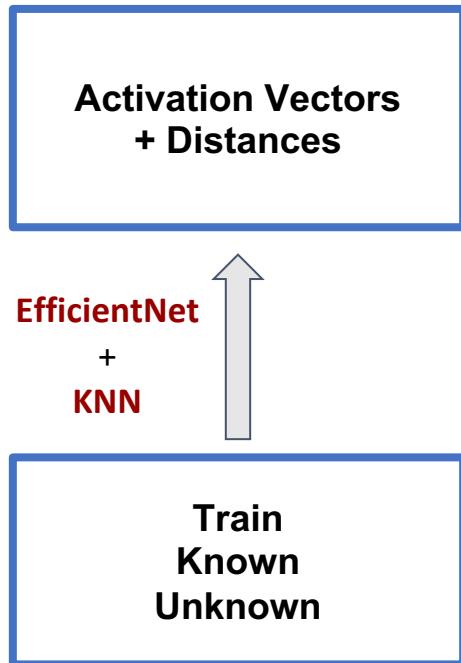


Open Set K-Nearest Neighbors Classification

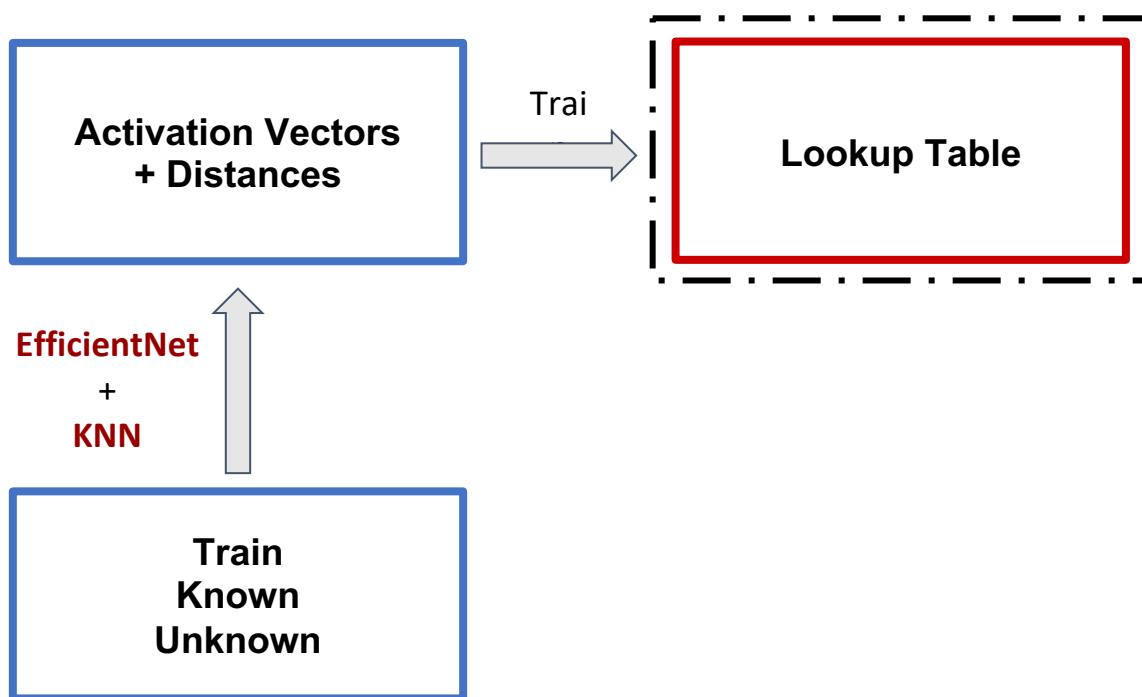
Train
Known
Unknown

Duke

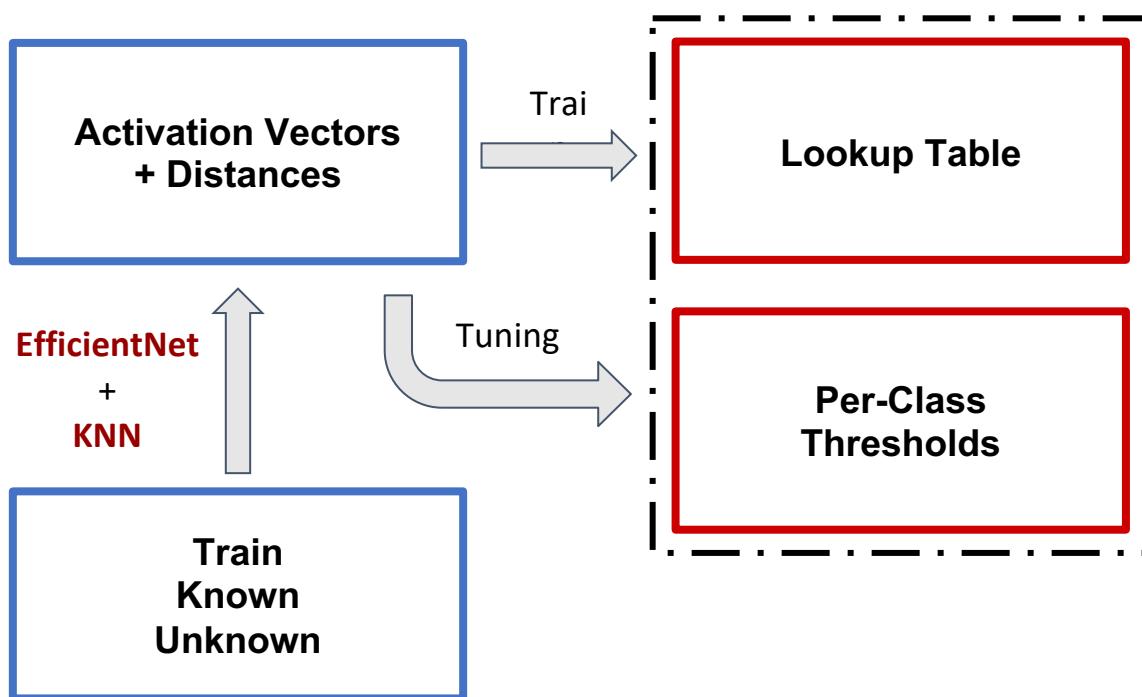
Open Set K-Nearest Neighbors Classification



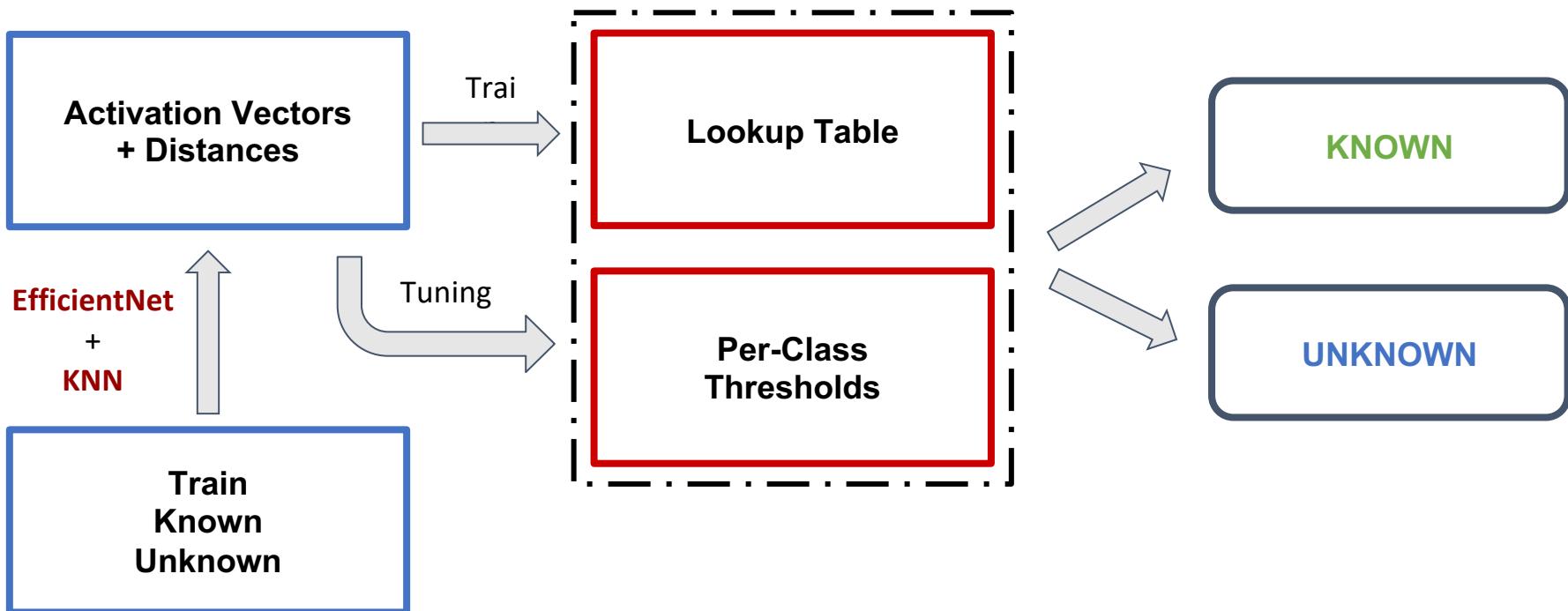
Open Set K-Nearest Neighbors Classification



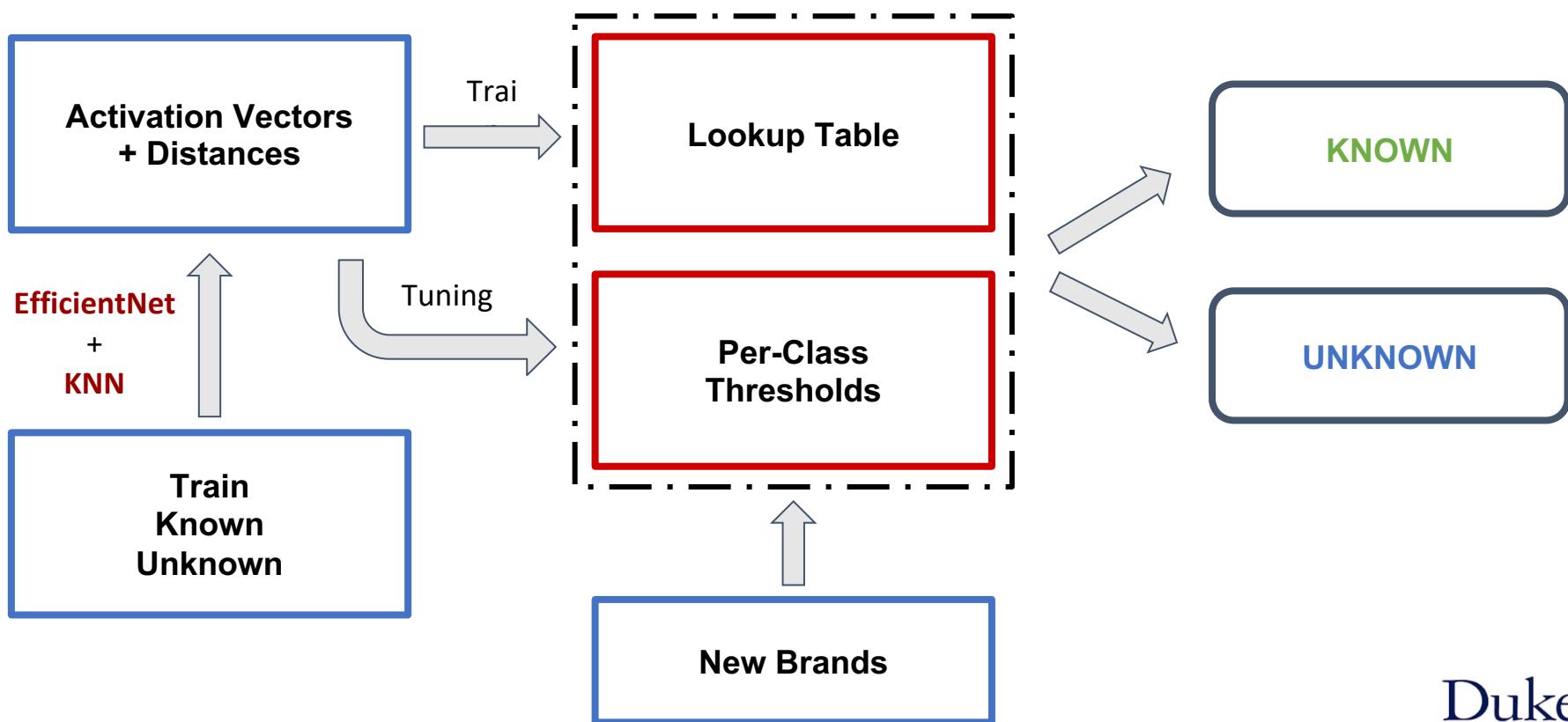
Open Set K-Nearest Neighbors Classification



Open Set K-Nearest Neighbors Classification



Open Set K-Nearest Neighbors Classification



Unknown



VERISIGN®

FOR REGISTRARS

VERISIGN.COM

CONTACT US

CORPORATE BRAND

DOMAINS

WEB

LEGAL

HOME

CORPORATE BRAND GUIDELINES

BRAND LOGO

VERISIGN GLOBAL BRAND GUIDELINES

Corporate Brand Guidelines

In this section, you'll find the core Verisign creative elements. By following these guidelines, you can design Verisign creative that is consistent, clear and strengthens our brand identity on a global scale.

THE BASICS

BRAND LOGO

CONTENT

uke



VERISIGN®

FOR REGISTRARS

VERISIGN.COM

CONTACT US

CORPORATE BRAND

DOMAINS

WEB

LEGAL

HOME

CORPORATE BRAND GUIDELINES

BRAND LOGO

VERISIGN GLOBAL BRAND GUIDELINES

Corporate Brand Guidelines

In this section, you'll find the core Verisign creative elements. By following these guidelines, you can design Verisign creative that is consistent, clear and strengthens our brand identity on a global scale.

THE BASICS

BRAND LOGO

CONTENT

uke

Drawbacks

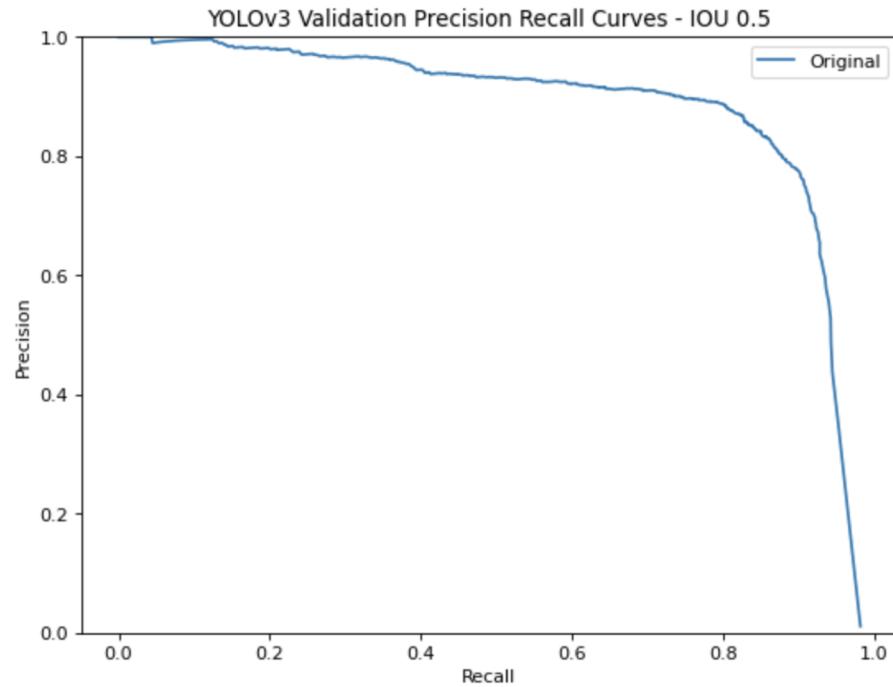
- **Large data set** of unknowns required:
 - getting sizable number of incorrect predictions into all classes of interest.
- **Slower** than other open-set learning methods:
 - requires comparison of each new observation with all Lookup Table entries.

Detector Results

Duke

Challenge of Quantifying Detector Results

- Detectors incorrectly call many **icons** and **headings** logos.
- **Open Set learning** correctly classifies these as **Unknown**.
- Need to make **adjustment** to PR curve to show improvement due to Open Set Learning.



Unknown

LOGOSAVE

Search 300.000+ vector logos!

SEARCH

Eg: Facebook, Google, Youtube, Apple, Gmail, Instagram, Whatsapp, Snapchat, Coca Cola, Pepsi, Samsung, Chevrolet, Renault, BMW

Brand Logos ▾ [+ Advanced Search]

facebook 1.5k twitter 1.0k google_plus 1.2k interest 140

Unknown



TAILOR BRANDS



Aloha SURF SHOP

DESIGN A LOGO IN 5 MINUTES



Logo > Category > Transport > Norfolk Southern Corp Logo Vector

Norfolk Southern Corp Logo Vector



ADVERTISEMENT

Unkn \$5 ONLY

DESIGN A LOGO STARTING AT \$5 ONLY

Unknown Unknown

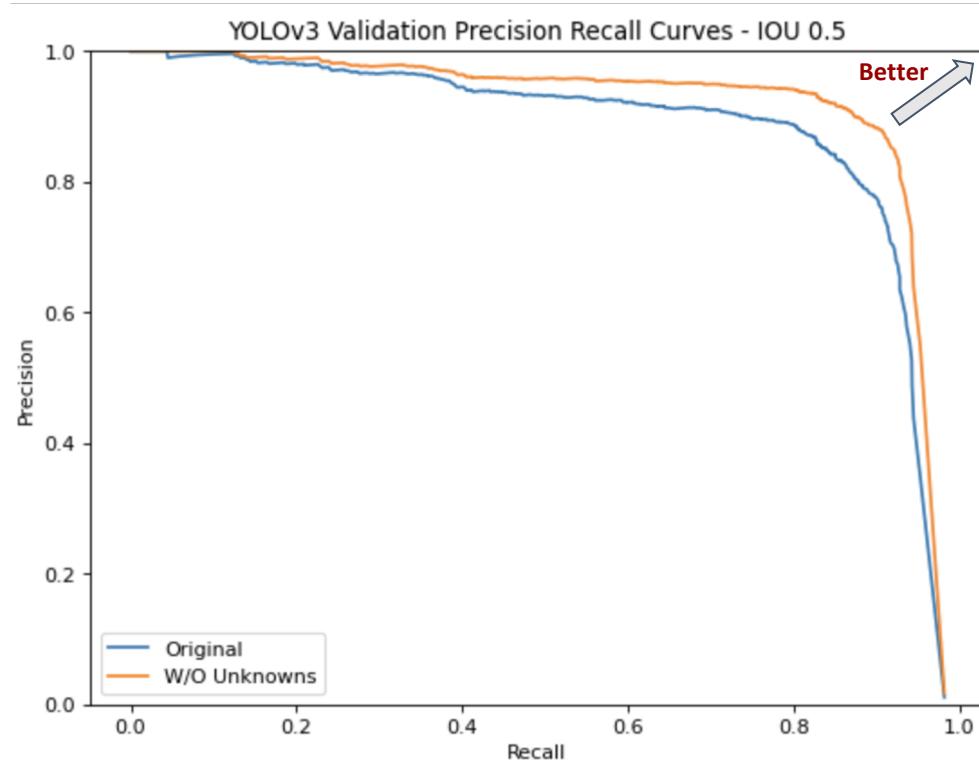


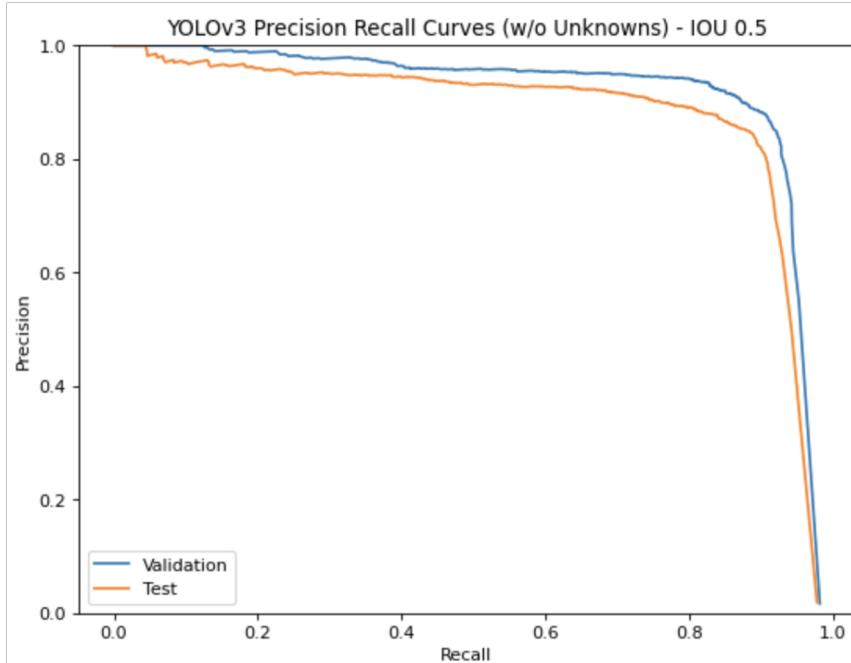
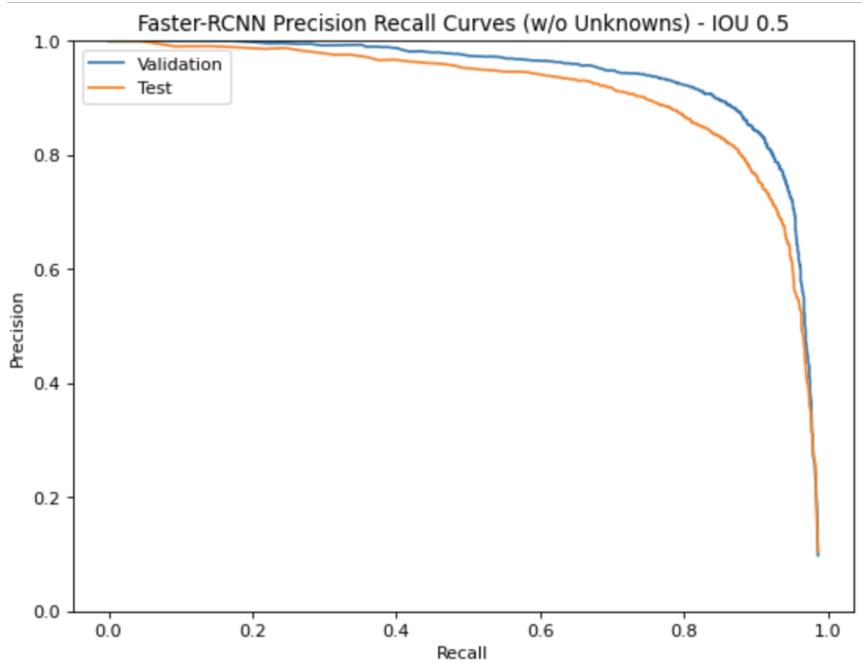
START NOW

uke

Adjustment from Open Set Learning

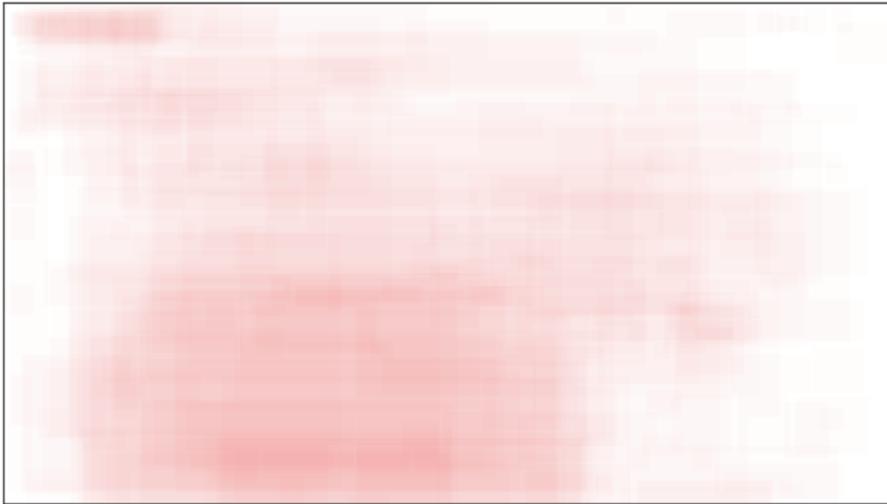
- Ignore false positives that are later classified as unknowns due to open set learning.



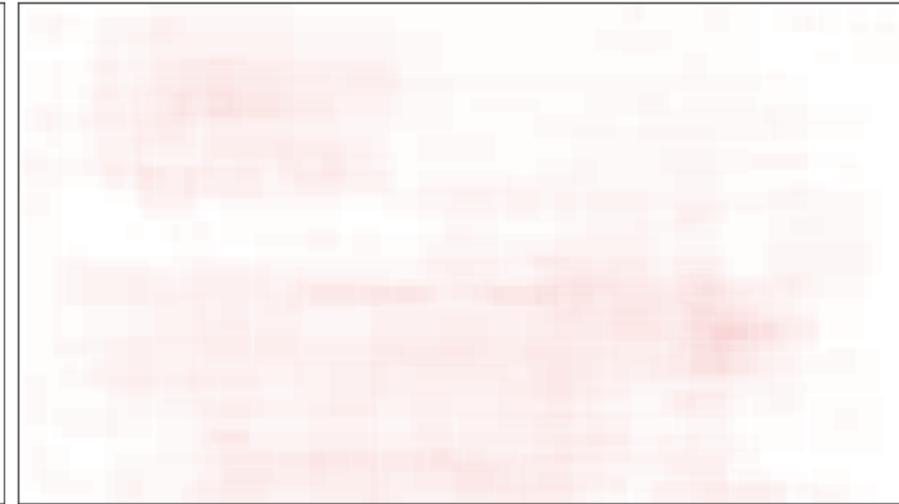


Duke

YOLO False-Negatives



Faster-RCNN False-Negatives

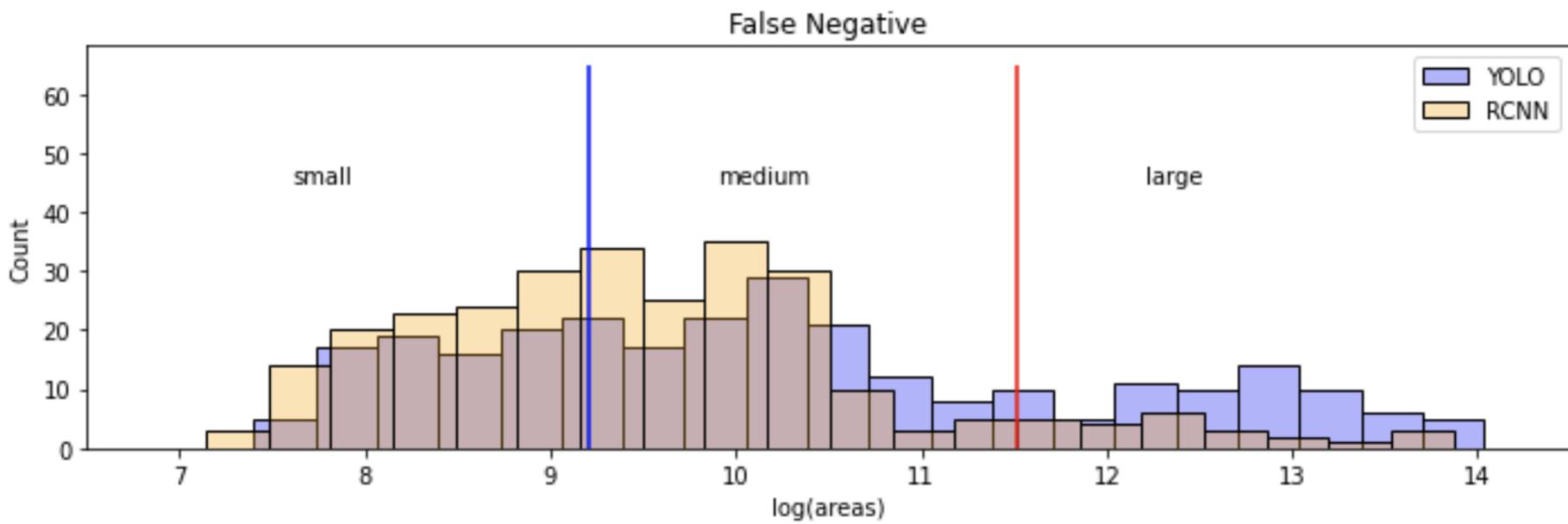


Fixed Recall: 0.87

YOLOv3 FN: 279

Faster-RCNN FN: 280

Duke



Fixed Recall: 0.87

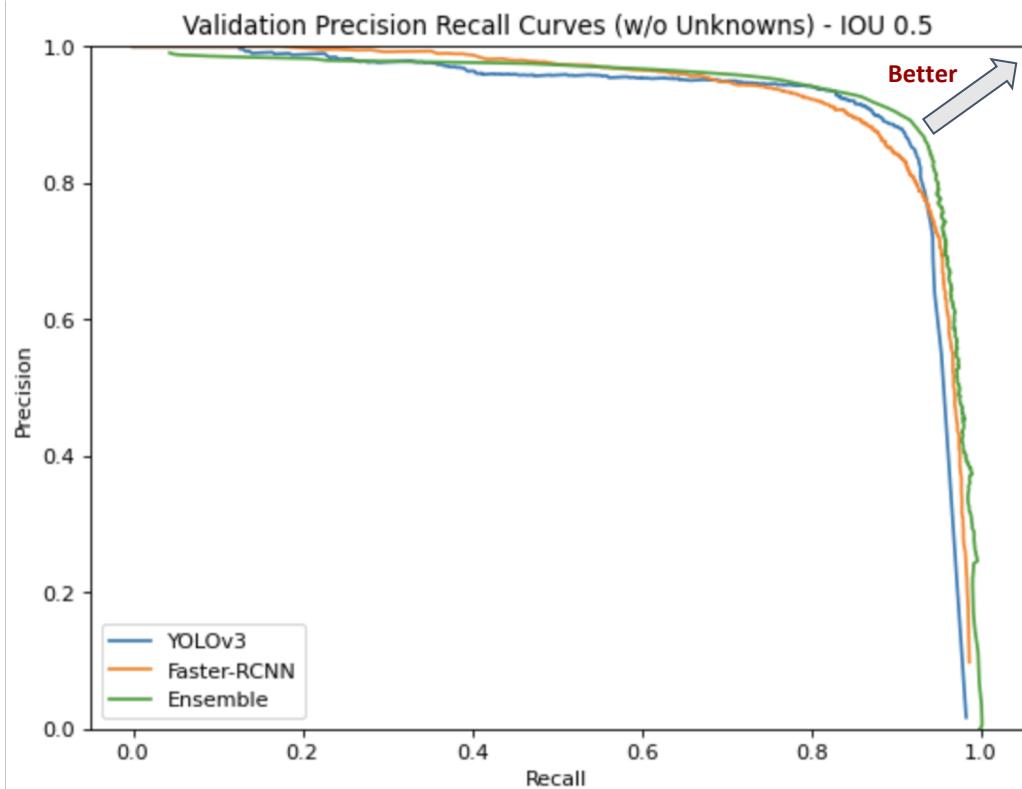
YOLOv3 FN: 279

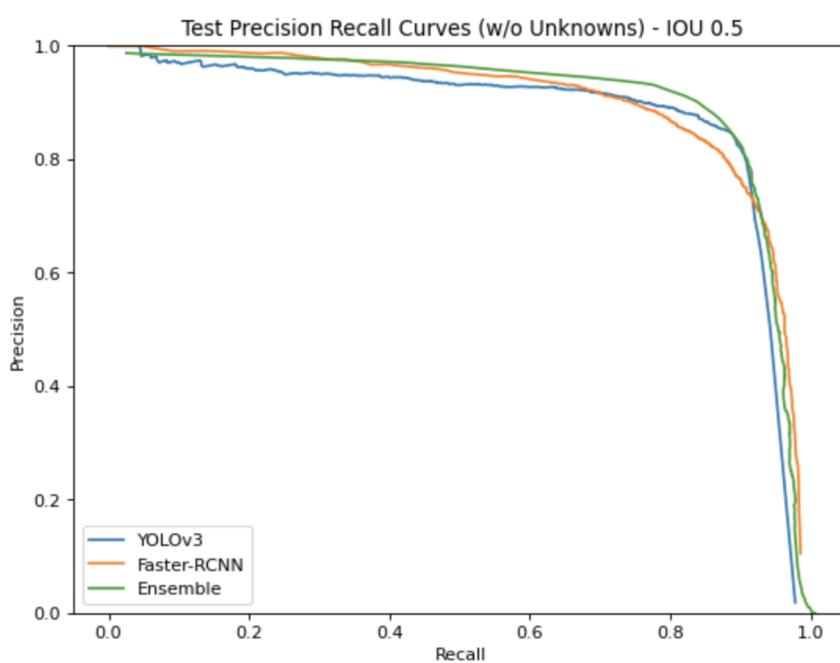
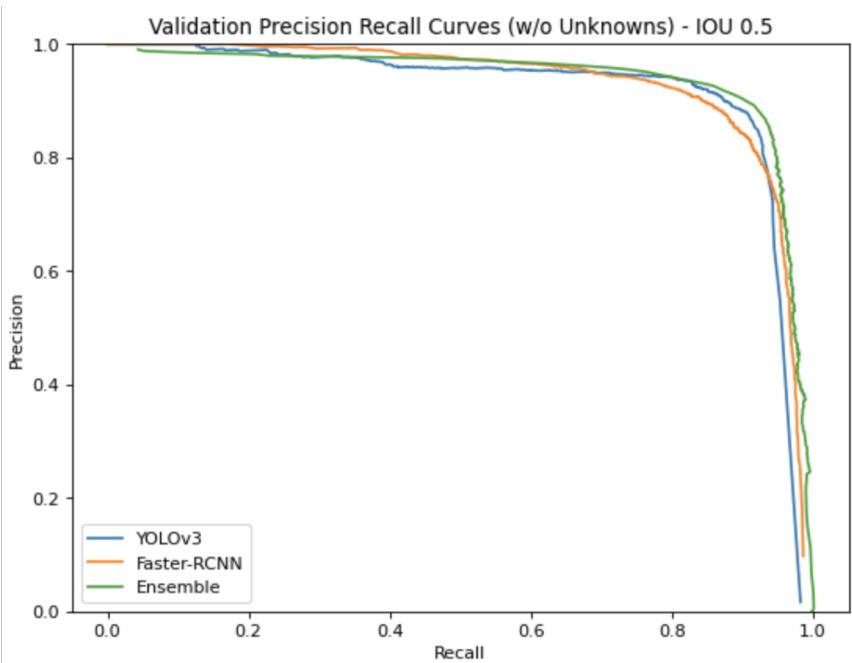
Faster-RCNN FN: 280

Duke

Ensembling

- Can combining the models make them better? **YES!**
- Ensembling YOLO and RCNN leads to better performance than both individually.





Duke

False Positives of Ensemble

Category 1

The
The
The,

Category 2

Nasdaq, Inc.
N E W S

Category 3



Duke

False Negatives of Ensemble

Category 1



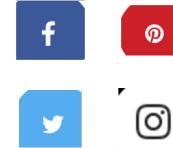
Category 2



Category 3



Category 4



Duke

Sample Predictions

Duke

Read the new Advancing Workforce Equity regional reports →



Unknown



search...



Donate

Login

About Us Our Network Our Solutions Our Publications CareerSTAT News Events

JPMorgan Chase & Co.

j.p._morgan_chase

JPMORGAN CHASE & CO.

JPMorgan Chase & Co. is a leading global financial services firm and one of the largest banking institutions in the United States, with \$2.0 trillion in assets, \$165.4 billion in stockholders' equity and operations in more than 60 countries as of December 31, 2009.

JPMorgan Chase is committed to managing its businesses to create value for its consumer and corporate clients as well as its shareholders, communities and employees and

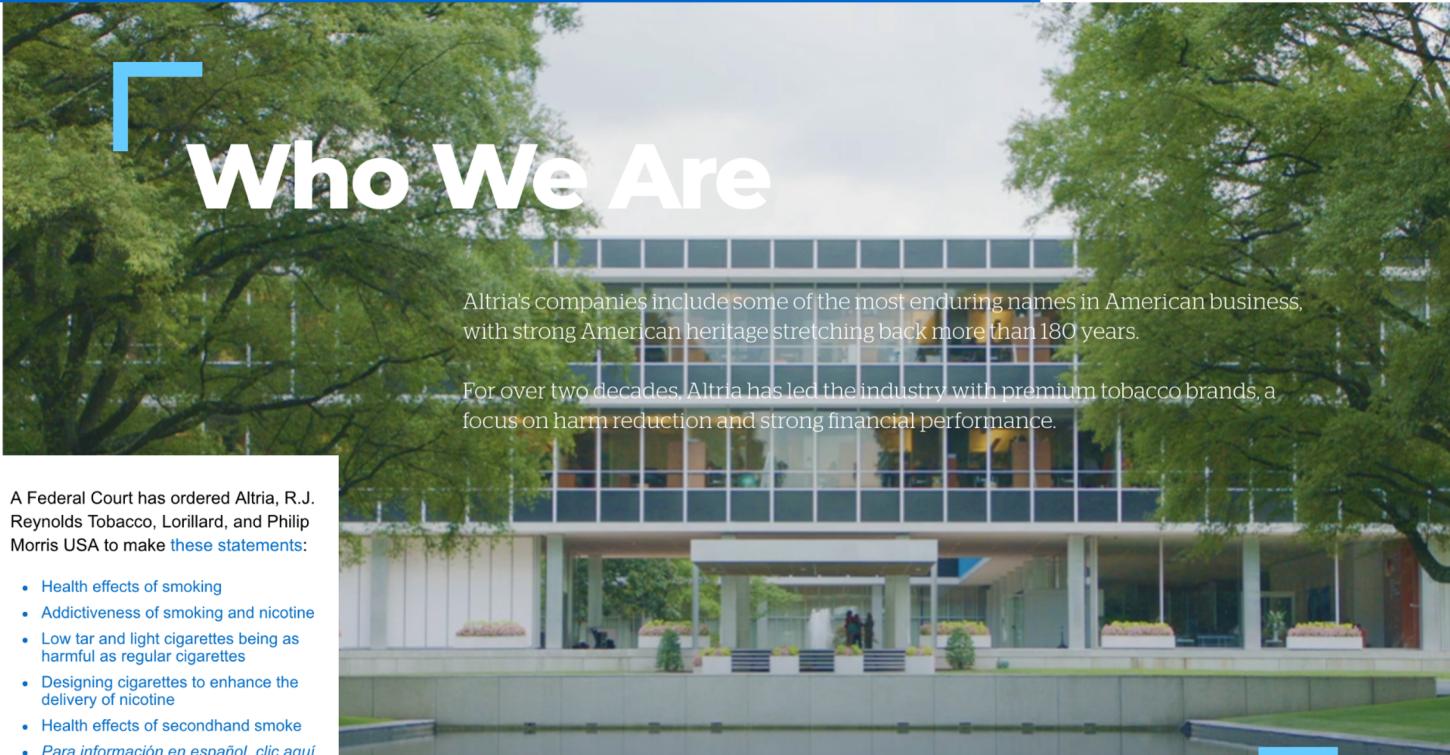




Who We Are

Altria's companies include some of the most enduring names in American business, with strong American heritage stretching back more than 180 years.

For over two decades, Altria has led the industry with premium tobacco brands, a focus on harm reduction and strong financial performance.



A Federal Court has ordered Altria, R.J. Reynolds Tobacco, Lorillard, and Philip Morris USA to make [these statements](#):

- Health effects of smoking
- Addictiveness of smoking and nicotine
- Low tar and light cigarettes being as harmful as regular cigarettes
- Designing cigarettes to enhance the delivery of nicotine
- Health effects of secondhand smoke
- *Para información en español, clic aquí*

Unknown

stocklight

Home > Stocks > United States > Manufacturing > Hanesbrands (HBI)

Hanesbrands
HANES
Brands Inc

NYSE:HBI (6.2B)
hanes.com/corporate

Zoom 5D 1M 3M 6M YTD 1Y 5Y MAX



May '16 Sep '16 Jan '17 May '17 Sep '17

Summary

John Ballard
Hanesbrands' (NYSE:HBI) first quarter saw sales and profits plunge over the COVID-19 outbreak. Through mid-March, sales were pacing ahead of management's expectations, but the store closures nationwide caused sales to drop 17% year over year for the quarter.

Hanesbrands Sees Big Opportunity Emerging in Medical Garments



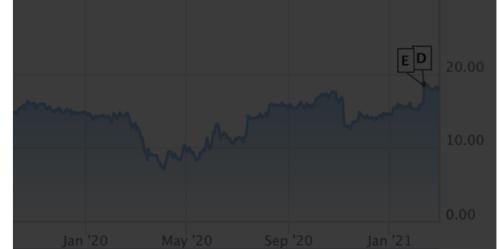
The company expects to make \$300 million off sales of face masks this year, but the long-term opportunity could be significantly bigger.

Get Updates

FAQ

Search (eg. AMZN)

17.69
-0.07 (-0.39%)
4:25pm EST
MARKET CLOSED



Jan '20 May '20 Sep '20 Jan '21

20.00
10.00
0.00

uke



im_smucker



PRODUCTS ▾

RECIPES ▾

ABOUT ▾



FATHER
NATURE™
TESTED,

*Mother Nature
Approved.*

With real fruit as the first ingredient, it's no wonder that Smucker's® Natural Strawberry Fruit Spread is natural enough for the Nature family.

[LEARN MORE](#)

uke

Unknown



Unknown

Call Us: +27 83 274 4882



Graders

Services

Benefits

Finance

Import

About

Blog

Contact

The History of Caterpillar

Categories

- [Construction projects](#)
- [Heavy machinery](#)
- [Motor graders](#)
- [Rebuilding & refurbishing](#)
- [Roads](#)
- [Tips and maintenance](#)

Latest Posts

- [Construction Technology Trends in 2021](#)
- [Top Challenges for South African Construction in 2021](#)
- [2021 Outlook for the South African Construction Industry](#)

caterpillar



like



All Auto Beauty Cryptocurrencies Education Fashion Finance Food & Drinks Games Hotels Industry Internet, Websites Jewelry
Manufacturing Media Medicine, Health Post, Transport Real Estate Retail Society Software Sport Technology Telecom Travel Misc

Home » Travel » Southwest Airlines

Southwest Airlines

Menu-modeled Atlanta Ad Agency

Turn challenger brands into market leaders

barberwarren.com

OPEN

southwest_airlines



See Also

- Mount Sunapee Resort
- Volotea
- EgyptAir
- Virgin America
- Amex Travel
- Azul
- Porto de Cabinda
- Portugal Turismo
- Atlas Air
- Ctrip

uke

Unknown

WORLDVECTORLOGO

ALPHABETICAL

MOST DOWNLOADED

facebook



+ ADD LOGO



For example: Facebook, Tesla or Coca Cola



Download Eli Lilly & Co vector (SVG) logo

berkshire_hathaway



uke

Unknown

WORLDVECTORLOGO

ALPHABETICAL

MOST DOWNLOADED

facebook



+ ADD LOGO



For example: Facebook, Tesla or Coca Cola



Download Eli Lilly & Co vector (SVG) logo



BERKSHIRE
HATHAWAY
HomeServices



uke

Monster Energy's Commitment to Equality: [LEARN MORE](#)

How Monster Beverage Corporation is responding to the Coronavirus Outbreak: [LEARN MORE](#)

X

Unknown



PRESS
RELEASES

SOCIAL
RESPONSIBILITY

EVENTS &
PRESENTATIONS

CORPORATE
GOVERNANCE

FINANCIAL
INFORMATION

STOCK
INFORMATION CONTACTS

Based in Corona, California, Monster Beverage Corporation is a holding company and conducts no operating business except through its consolidated subsidiaries. The Company's subsidiaries develop and market energy drinks, including Monster Energy® energy drinks, Monster Energy Ultra® energy drinks, Monster MAXX® maximum strength energy drinks, Java Monster® non-carbonated coffee + energy drinks, Espresso Monster® non-carbonated espresso + energy drinks, Caffé Monster® non-carbonated energy coffee drinks, Monster Rehab® non-carbonated tea + energy drinks, Muscle Monster® non-carbonated energy shakes, Monster Hydro® non-carbonated refreshment + energy drinks, Monster HydroSport Super Fuel® non-carbonated advanced hydration + energy drinks, Monster Dragon Tea® non-carbonated energy teas, Reign Total Body Fuel™ high performance energy drinks, Reign Inferno™ thermogenic fuel high performance energy drinks, NOS® energy drinks, Full Throttle® energy drinks, Burn® energy drinks, Samurai® energy drinks, Relentless® energy drinks, Mother® energy drinks, Play® and Power Play® (stylized) energy drinks, BU® energy drinks, Nalu® energy drinks, BPM® energy drinks, Gladiator® energy drinks, Ultra Energy® energy drinks, Live+® energy drinks and Predator® energy drinks.



Latest News

4th August, 2020

26th May, 2020

uke

Classifier Results

Duke

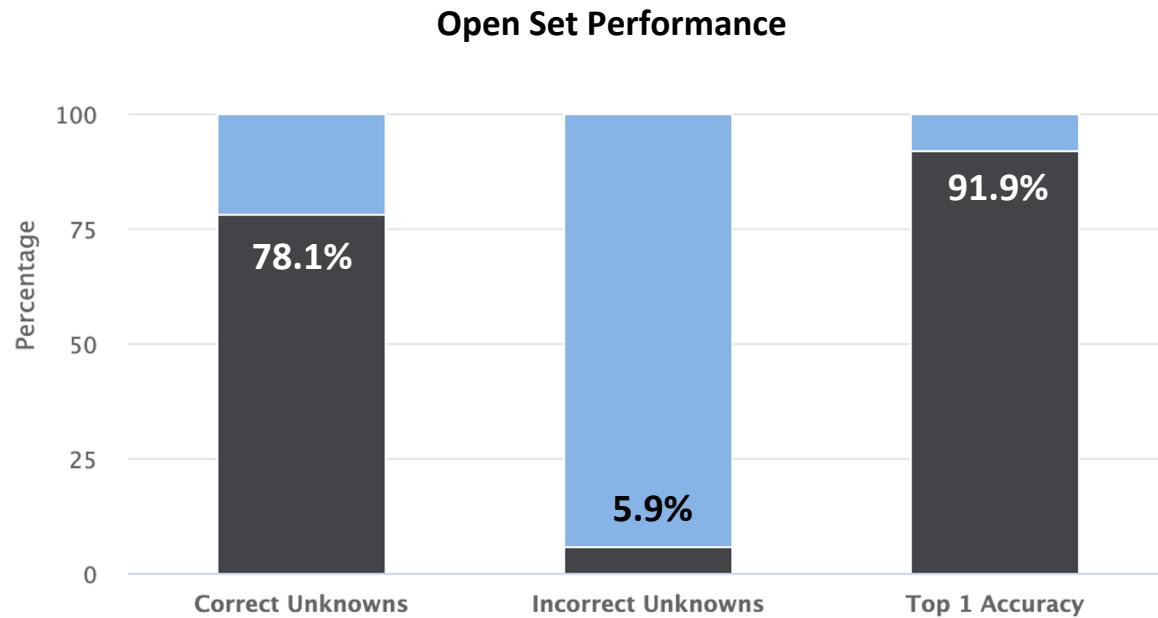
Closed Set Performance - 1098 Classes

	Accuracy	Precision*	Recall*	Support
Val	94.4%	95.3%	94.4%	4,668
Test**	94.5%	98.3%	94.5%	1,165

*Not all classes had a prediction

**Test set consisted of 320 classes common to both test annotations and train/val data

Open Set Performance - 1098 Classes



Acknowledgements



proofpoint[®]

Duke

Appendix

Duke

Variety Among Screenshots

- Screenshots have logos with a large amount of variety.
- Model needs to be able to detect logos in a wide variety of states.
- Catch all ‘generic logo’ label reserved for unfamiliar logos.



Size Variety Among Logos

This website uses cookies. If you continue without changing your settings, we'll assume that you are happy to receive all cookies on the vanillaplus.com website. [Dismiss](#)

The screenshot shows the homepage of vanillaplus.com. At the top, there's a dark banner for the "IoT GLOBAL AWARDS 2020" with a "ENTER NOW" button and a "SPONSOR" logo. Below this is a pink header with the "Vanilla+" logo, the text "THE GLOBAL VOICE OF TELECOMS IT", and a search bar. The main navigation menu includes Home, News, Verticals, Digital Edition, Events, Videos, VP Featured, Directory, Tech Trends, and Subscribe. A sub-navigation bar shows "You are here: Home > News Ericsson, RED Technologies and Qualcomm Inc. conduct the first Licensed Shared Access (LSA) pilot in France > Qualcomm-Logo.8.15". The main content area features a large image of the Qualcomm logo and a news article titled "Qualcomm-Logo.8.15" dated 08 January, 2016 at 8:39 AM. The article has social sharing icons. To the right is a sidebar with a "bics" logo and text about improving efficiency and throughput with seamless connectivity, along with a "DOWNLOAD case study" button. A vertical column on the far right contains social media icons for Facebook, LinkedIn, YouTube, and Twitter, and a "SUBSCRIBE" button.

IoT GLOBAL AWARDS 2020

ENTER NOW

SPONSOR

Vanilla+ THE GLOBAL VOICE OF TELECOMS IT

About Us | Privacy Policy | Contact us | Log in

How AI solves emerging COVID19 challenges facing the Retail Industry

Home News Verticals Digital Edition Events Videos VP Featured Directory Tech Trends Subscribe

You are here: Home > News Ericsson, RED Technologies and Qualcomm Inc. conduct the first Licensed Shared Access (LSA) pilot in France > Qualcomm-Logo.8.15

Qualcomm-Logo.8.15

08 January, 2016 at 8:39 AM

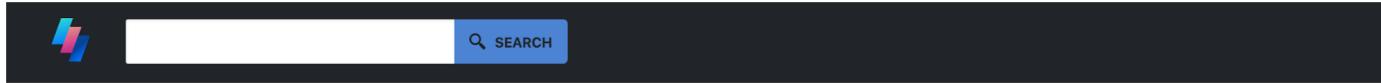
bics

Improve efficiency and throughput with seamless connectivity

DOWNLOAD case study

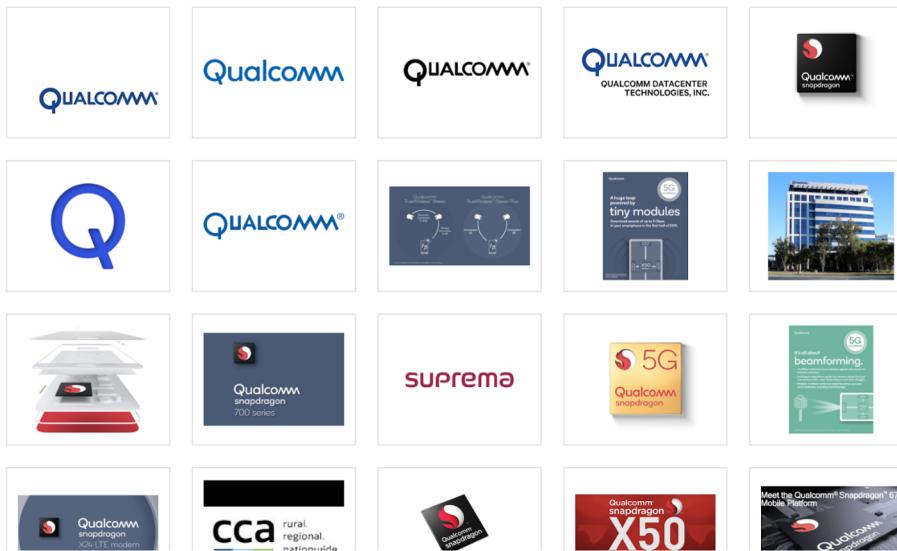
Duke

Logo Count & Location Variety (~3.3 / Image)



Qualcomm Technologies Inc Logo

We have found 35 **Qualcomm Technologies Inc** logos. Do you have a better **Qualcomm Technologies Inc** logo file and want to share it? We are working on an upload feature to allow everyone to upload logos!



Duke

Variety in Logo Density



Explore > Food and Drinks > Drinks > Non Alcoholic Drinks > **Monster Energy**



Article from [freelogovectors.net](#)

Monster Energy Logo Download Vector

Monster Energy Logo vector download, Monster Energy Logo 2020, Monster Energy Logo png hd, Monster Energy Logo svg cliparts



Article by **Nancy Anderson-Casey**

10

[Monster Energy Drink Logo](#) [Monster Energy Cake](#) [Monster Energy](#) >

People also love these ideas



Duke

Darkened Logos

MENU SEARCH

Linkage

+1 (781) 402-5555

GET IN TOUCH

SUCCESS STORIES

We use cookies to improve your browsing experience on our website. By closing this banner or interacting with our site, you acknowledge and agree to our Privacy Policy

GOT IT!

Creating Purposeful Leaders with Dentsply Sirona

INDUSTRY

Life Sciences

SOLUTION

Accelerating Purposeful Leadership

Dentsply and Sirona joined forces in 2016, to become

Duke

Occluded Logos

BrandNew

Search



Submit Tips/Work

Log in

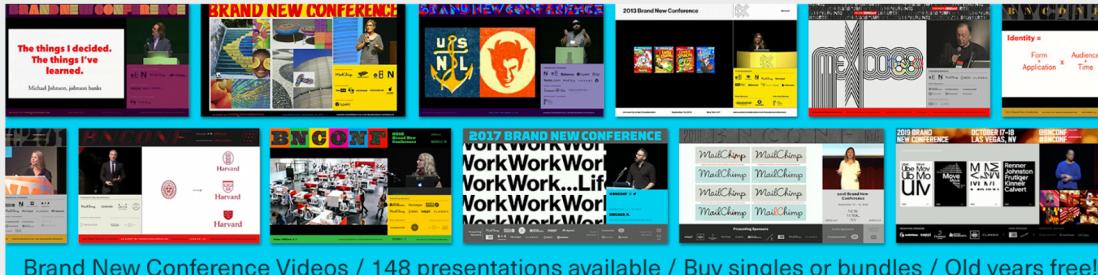


Browse



About

SUBSCRIBE



Brand New Conference Videos / 148 presentations available / Buy singles or bundles / Old years free!

Share >



New Name and Logo for Raytheon Technologies

Spotted

Raytheon



Duke

No Logos - 375 Screenshots

We are committed to serving you during this global pandemic. To visit Everest's website, click here.

Everest's 25th Anniversary | Careers | Contact Us | [Add your logo here](#) | Site Search | Everlink® Log In

Reinsurance ▾ Insurance ▾ Investors ▾ Insights ▾ Corporate Responsibility ▾ About Everest ▾

Positioned for success

Get an unmatched global network of professionals for:

[REINSURANCE →](#) [INSURANCE →](#)

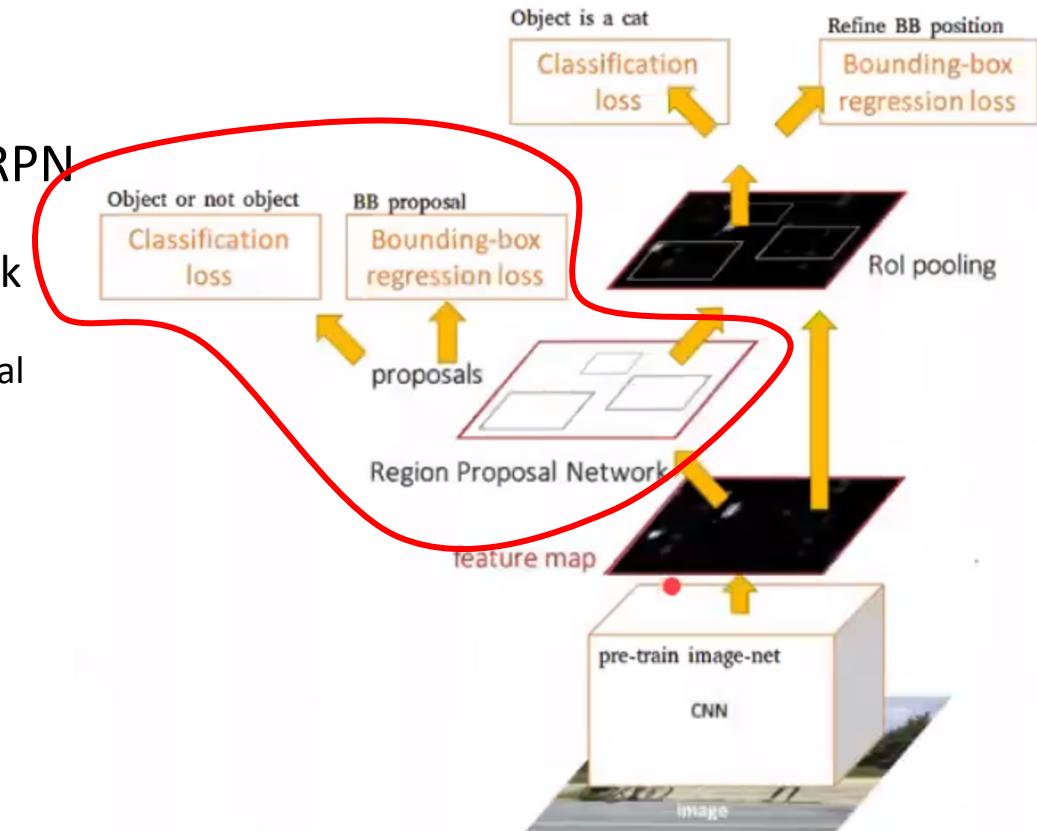
Strength and stability you can rely on.

You need rock-solid financial protection. With wise investments, solid ratings, and substantial reserves, we're your most reliable and resourceful partner yet.

Duke

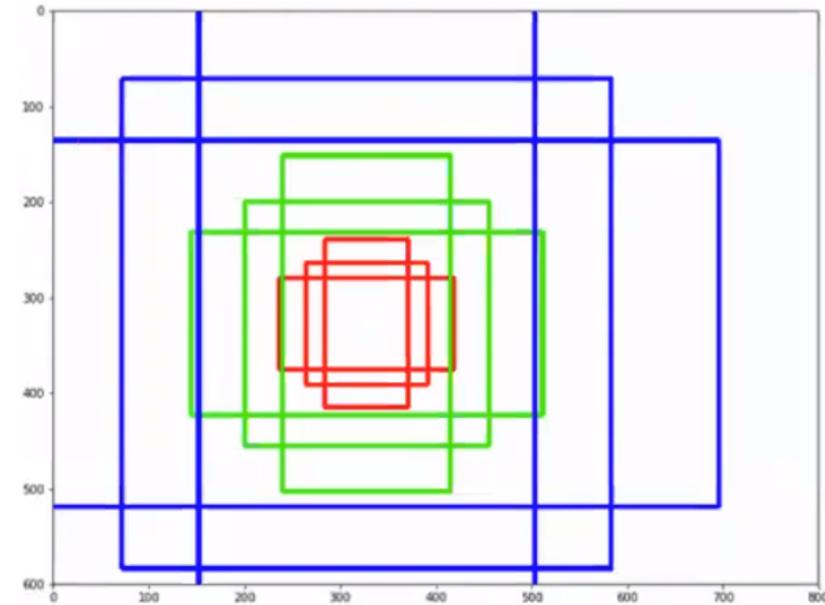
Faster R-CNN (2016)

- Region Proposal Network (RPN)
 - **Initial Guess**
 - Fully Convolutional Network
 - Outputs :
 - Rectangular Object Proposal
 - Objectness Score
- **RPN + Fast R-CNN**



How does RPN Work?

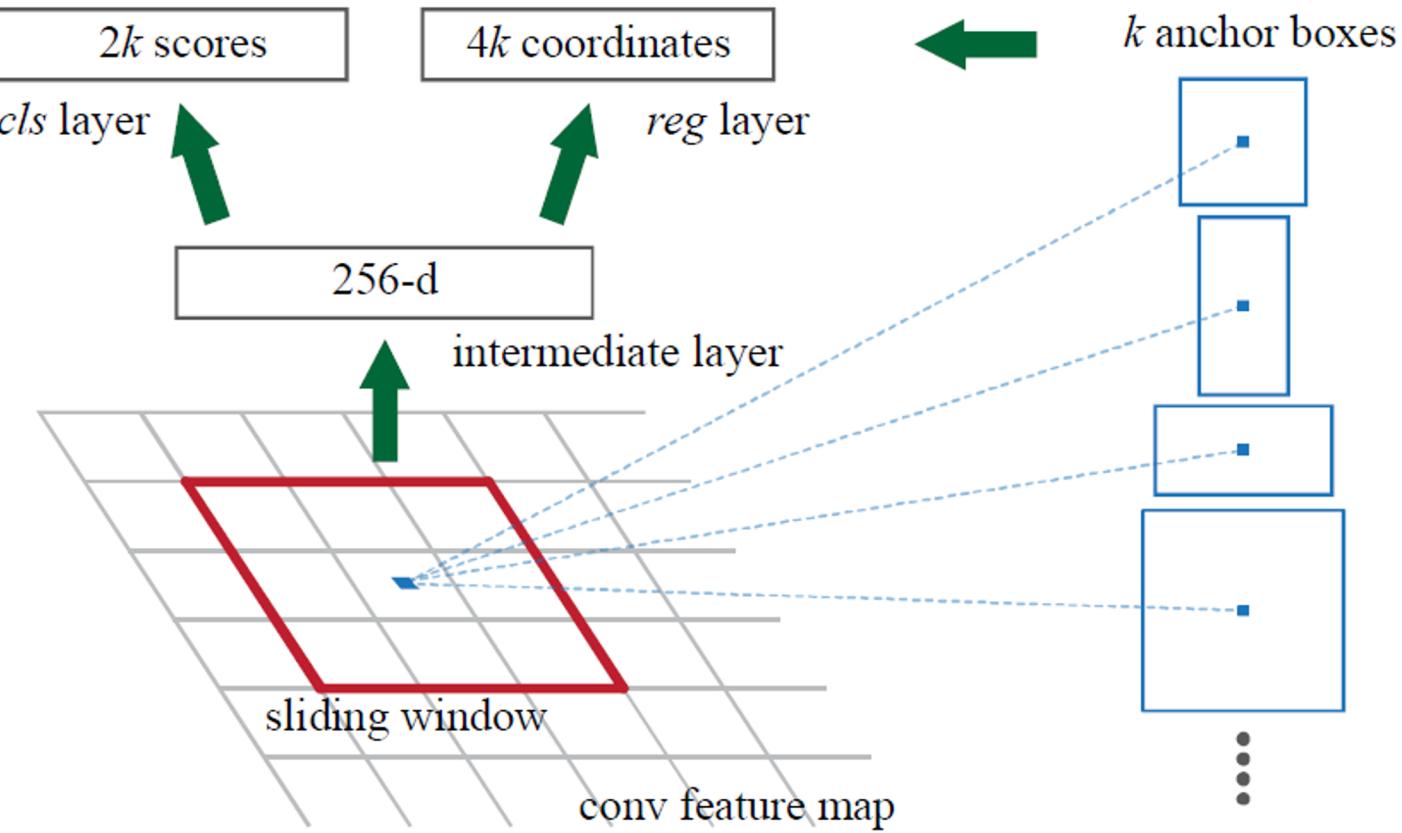
- Anchors
 - **Initial Initial guess** (Input to RPN)
 - Anchors are shapes and aspect ratios we place at every pixel on image
 - They are not meant to be close to the ground truth bounding box. They are just a starting point **proposal**. Hence Region Proposal Network (RPN)



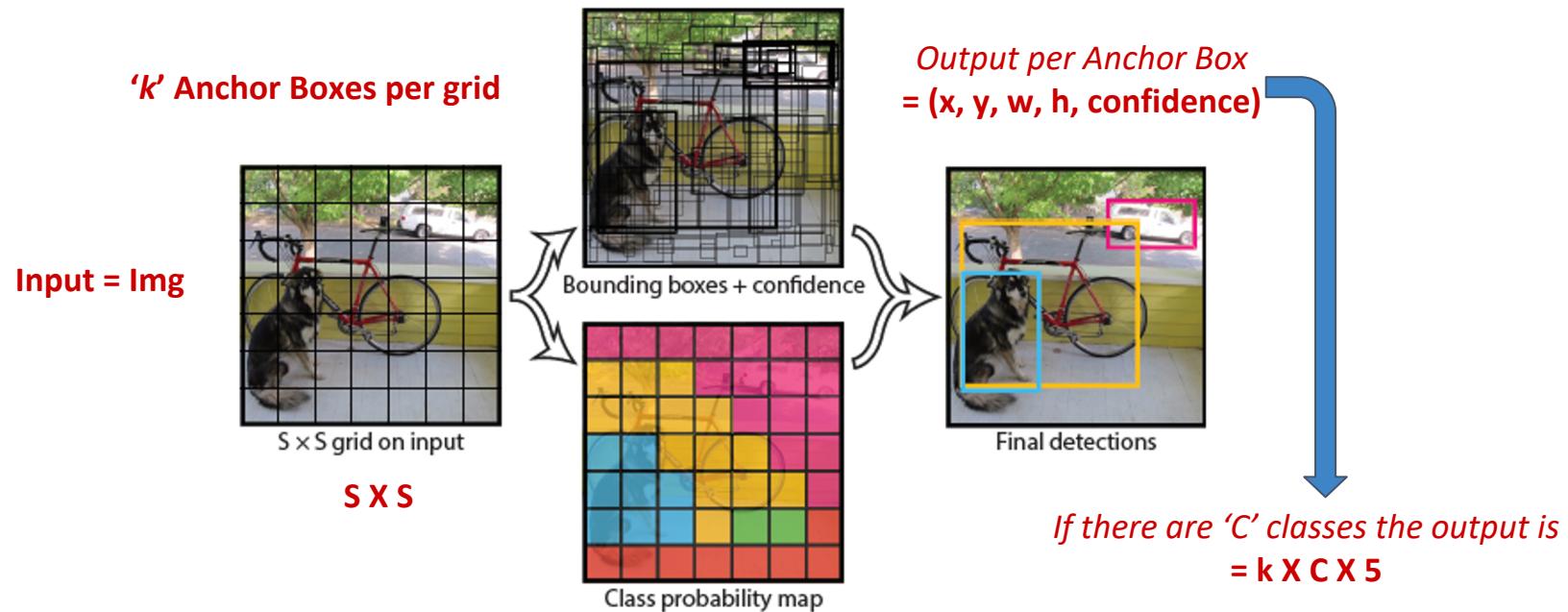
$$k = 9 \text{ anchor boxes per pixel}$$

Total Anchor Boxes = W * H * k

- **RPN prunes anchor boxes**

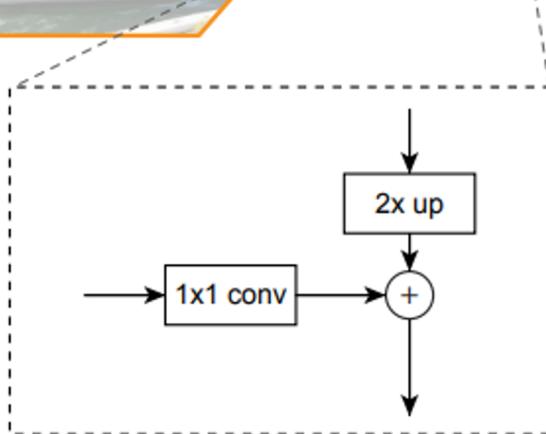
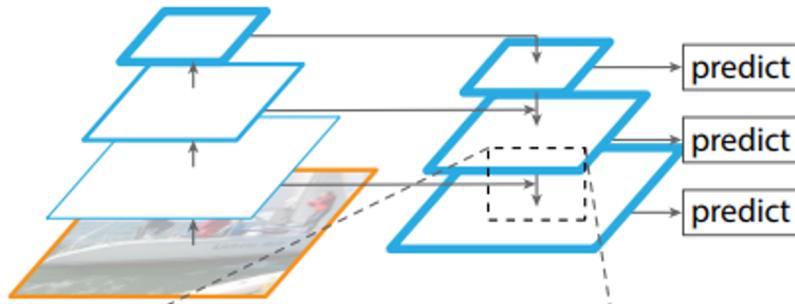


YOLO v3



Duke

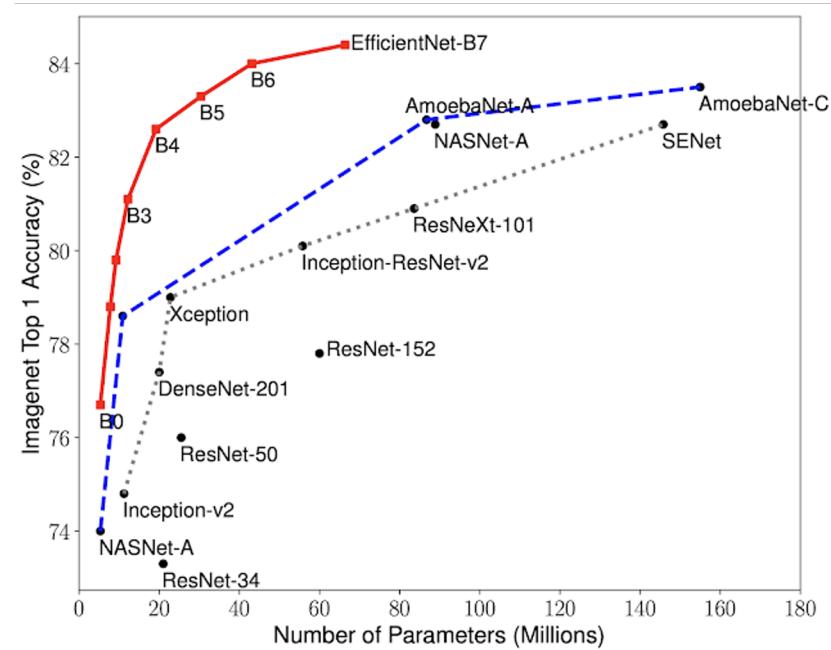
Feature Pyramid Network (FPN)



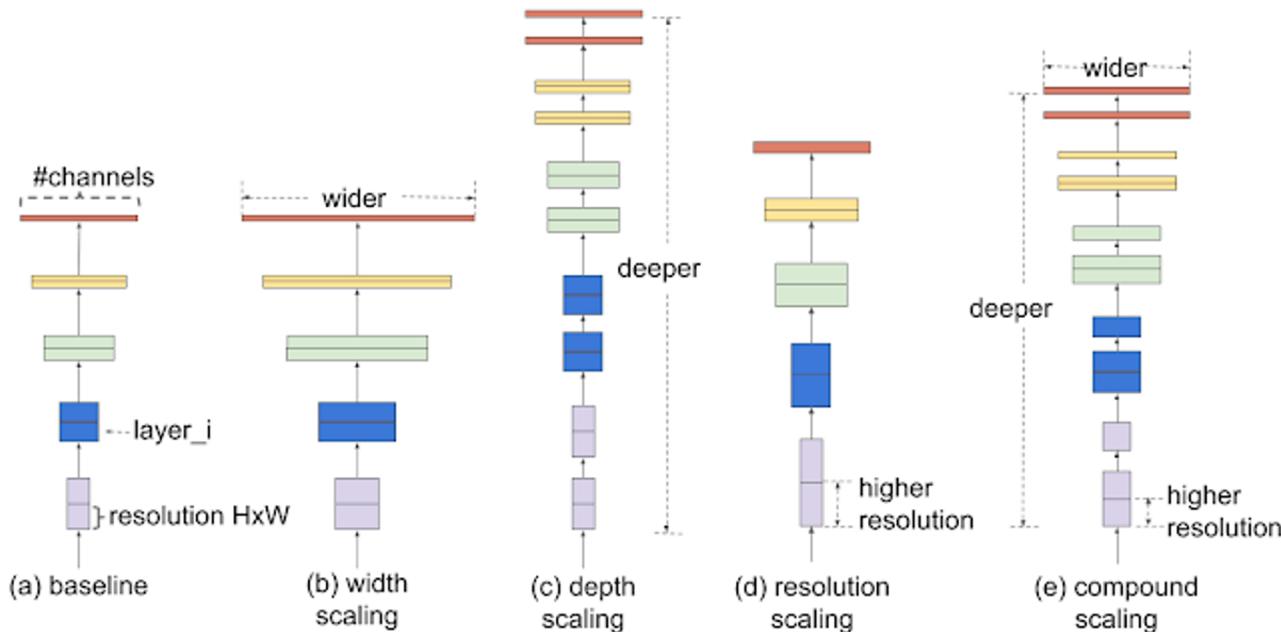
*FPN good when we have
small and big objects in
our images*

EfficientNet

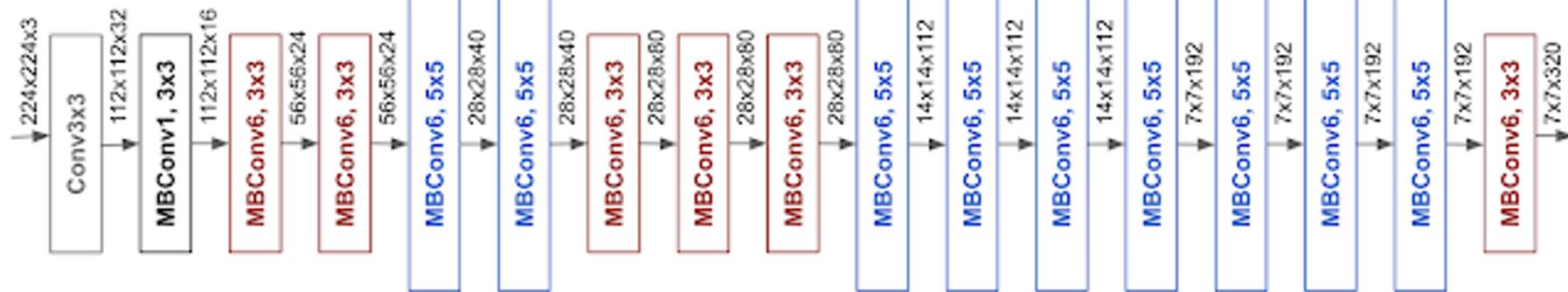
- Focus on improving scaling of CNNs
 - Depth, width, resolution
- Compound scaling method
 - Fix resource (FLOPs) and scaling coefficient
- Similar or better performance and significantly smaller than other CNN architectures



Compound Scaling

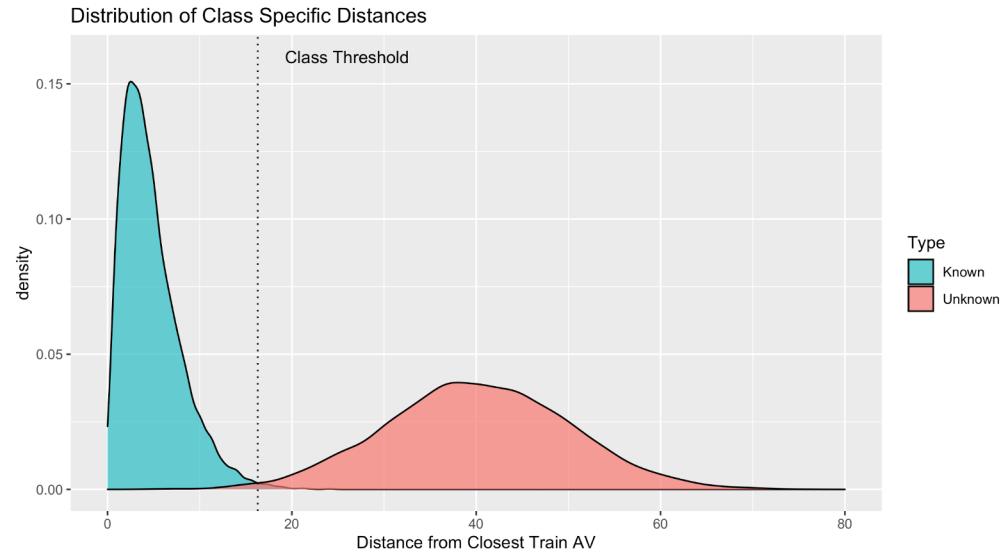


EfficientNet Baseline Architecture



Open Set K-Nearest Neighbors Classification

- Generate **Lookup Table of Activation Vectors**
- Generate **Per-Class Thresholds using Distances** to lookup table vectors



Adding Additional Classes

	Additional Incorrect Unknowns (False Negatives)		Additional Incorrect Knowns (False Positives)	
Additional Classes	Trained Classes	New Classes	Trained Classes	New Classes
None	64 / 706	-	13 / 180	-
0 → 5	65 / 706	2 / 13	15 / 180	2 / 180
5 → 10	65 / 706	5 / 26	14 / 180	7 / 180
10 → 15	65 / 706	11 / 42	13 / 180	7 / 180

Note: All thresholds adjusted, not just for new classes.

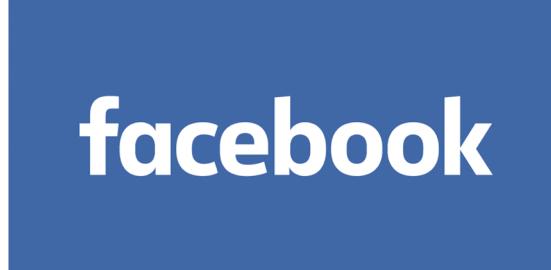
Duke

Sample Images for Classifier

Bing Downloader



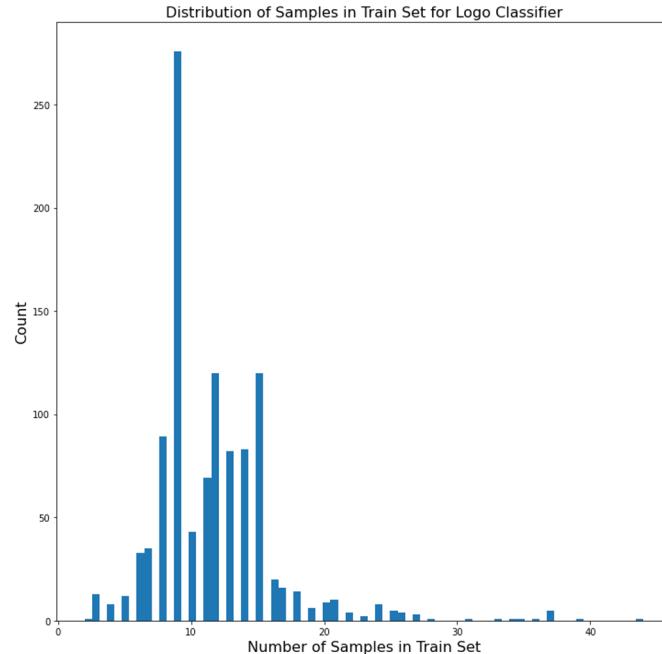
Annotation Extracted



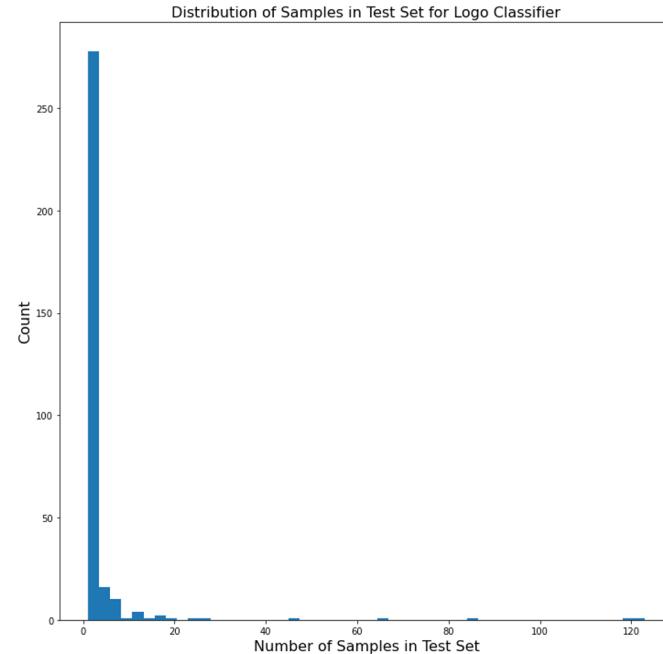
Duke

Classifier Data Distribution

Training Data



Test Data



Classifier Predictions

Correct Classifications



Incorrect Classifications



Previous Resizing



Duke

New Augmentation Examples



Duke

32 Class Performance

	Accuracy	Precision	Recall	F1-Score
Without Unknown	0.9518	0.9645	0.9518	0.9537
With Unknown	0.9210	0.9291	0.9210	0.9224



SPONSORED BY SQUARESPACE

Get a domain and create a website with Squarespace

START A FREE TRIAL

HIDE AD • AD VIA BUYSELLADS



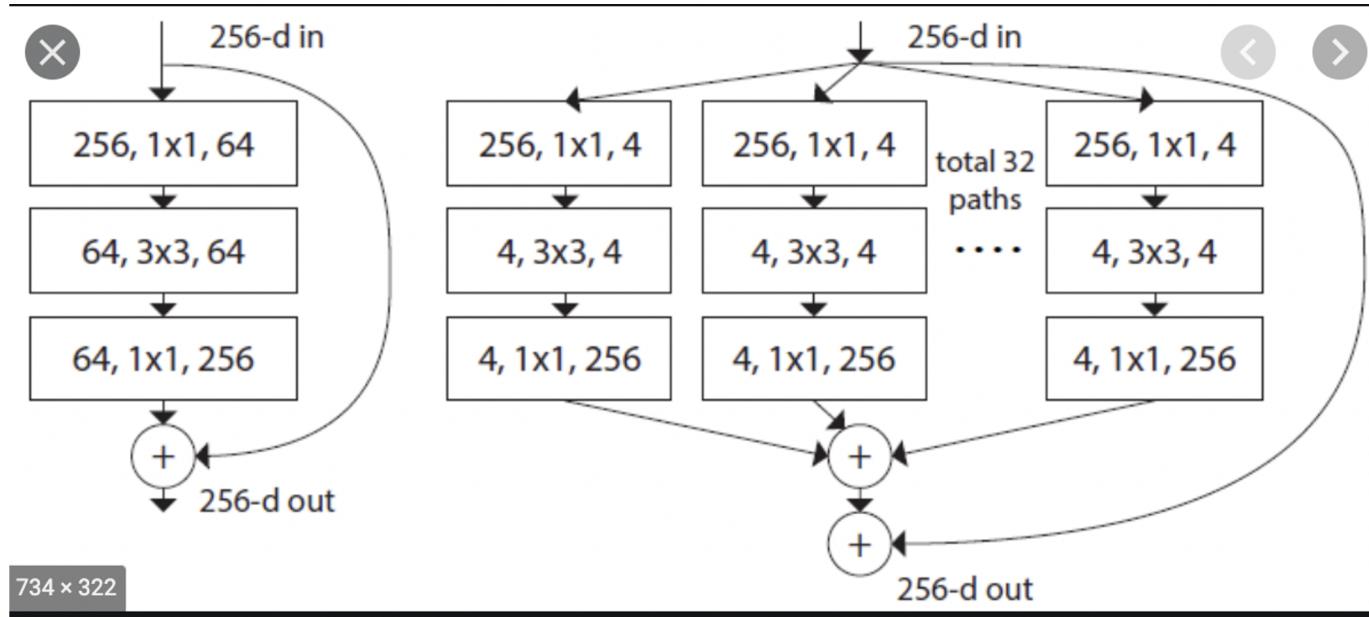
SEARCH

Fastenal Logo

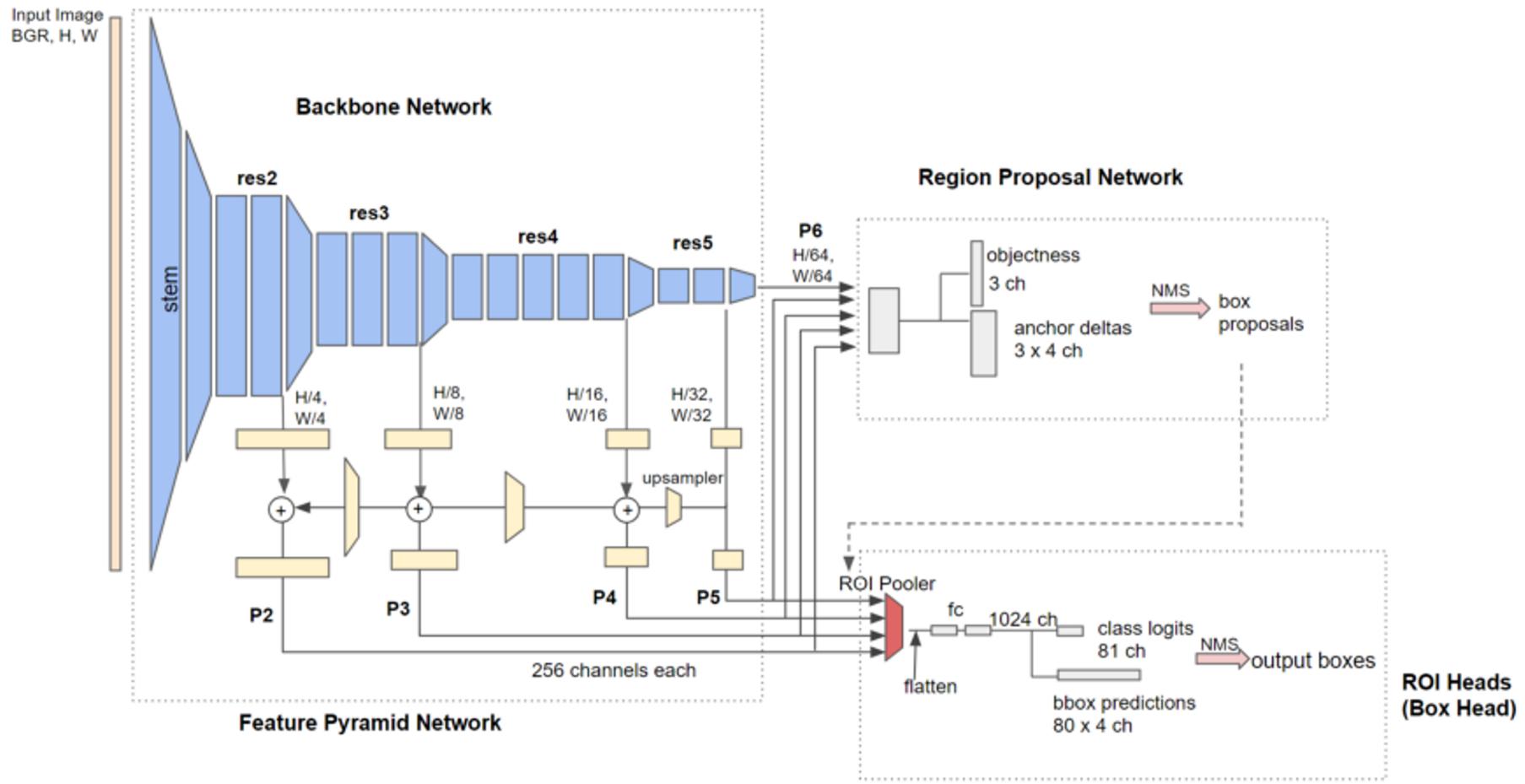
We have found 35 Fastenal logos. Do you have a better **Fastenal** logo file and want to share it? We are working on an upload feature to allow everyone to upload logos!



uke



Duke



Open Set K-Nearest Neighbors Classification

1. Create Lookup Table of Train AVs and Labels.
2. Calculate distances of all observations in the train set, a held out dataset of known logos, and a dataset of unknown logos to their $K = 2$ nearest neighbors in the Lookup Table.
3. Labels of the nearest neighbors become primary and secondary candidate labels.
4. Use the labels and distances to tune per class distance thresholds.
 - a. Choose best threshold based on within class accuracy.
 - b. Use nearest or second nearest neighbor depending on availability.
 - c. Set arbitrary threshold of $\text{Max Known Distance} + 2 * \text{SD}$ for classes with no unknown predictions.
5. Use Lookup Table and tuned thresholds for open-set prediction.