

# Introduction to ML

## Decision Trees

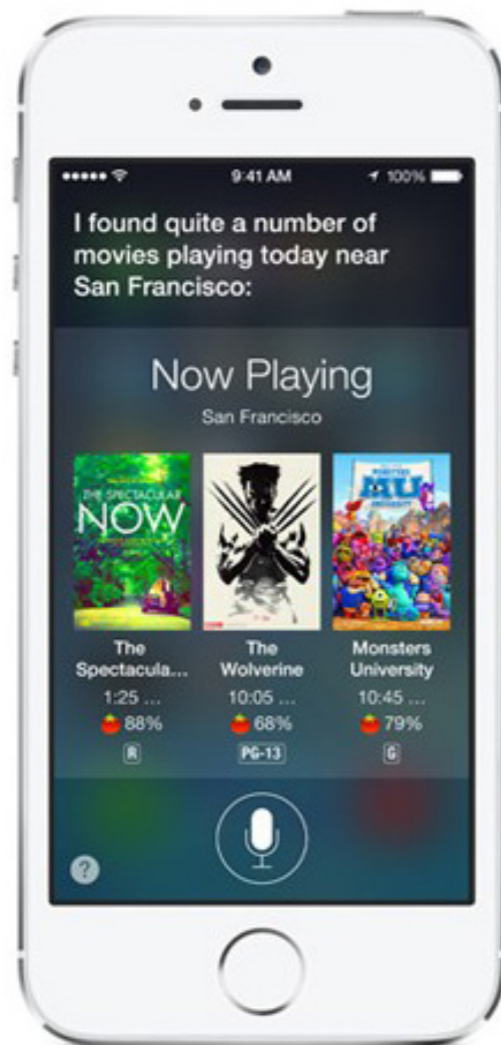
Nipun Batra

Jan 4, 2019

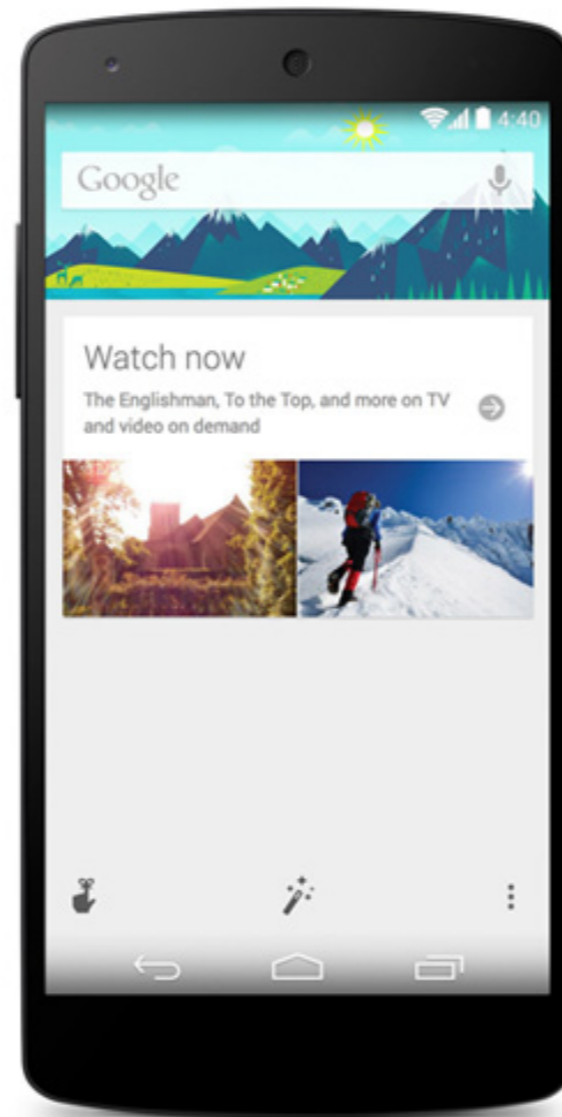
# Machine Learning Applications

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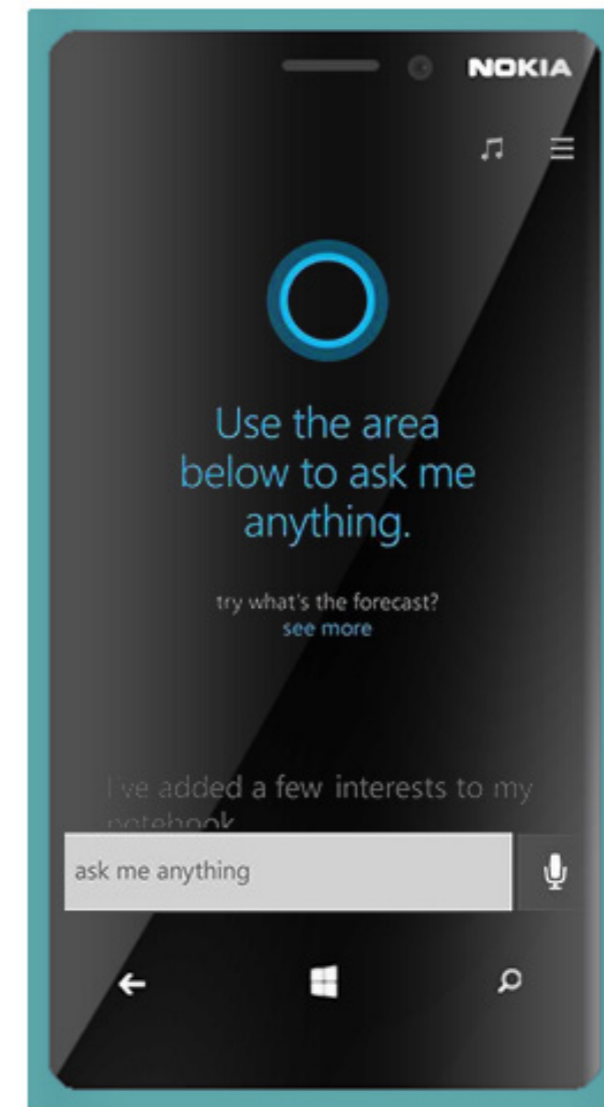
Apple Siri



Google Now

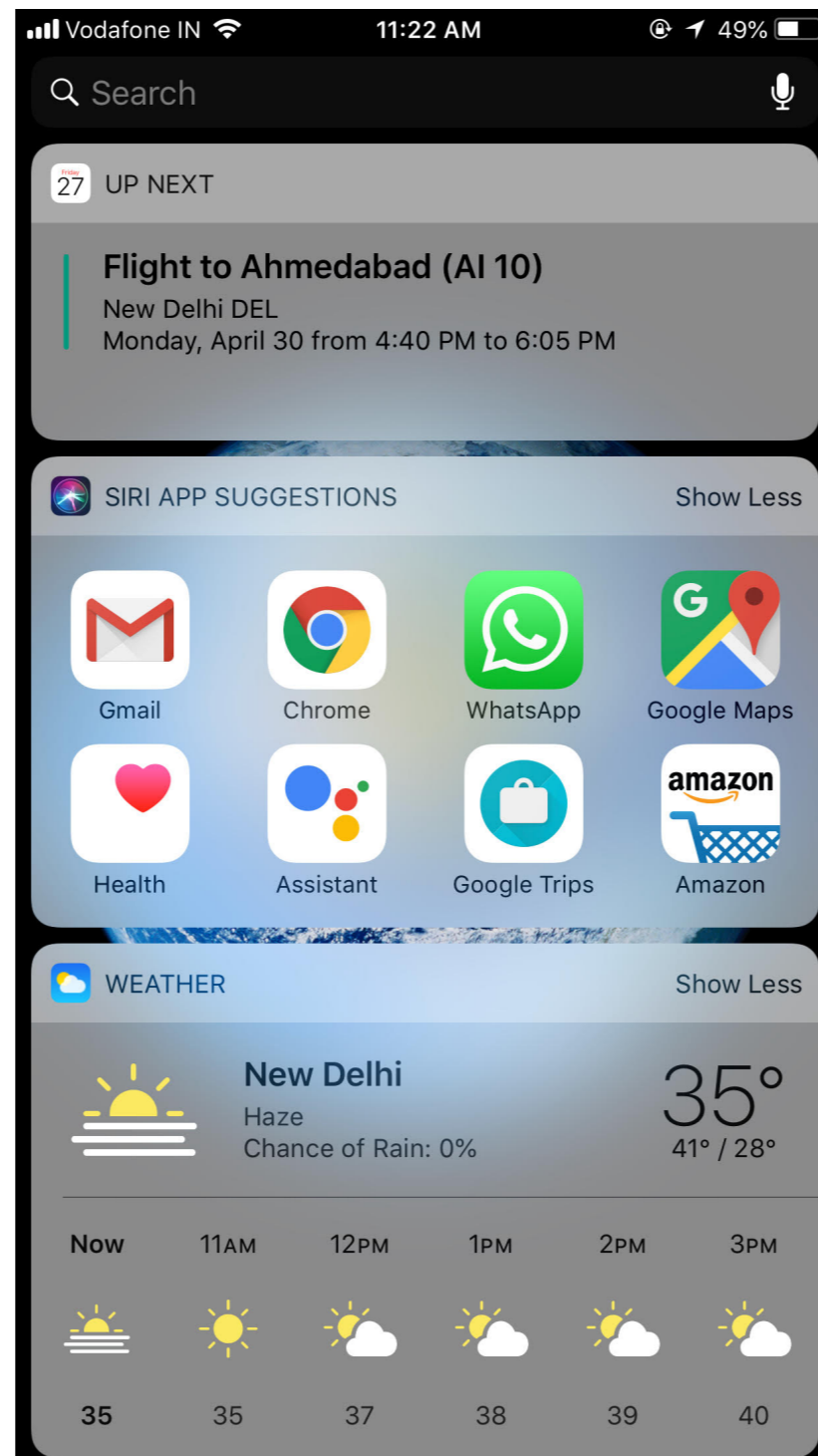


Windows Cortana



# Machine Learning Applications

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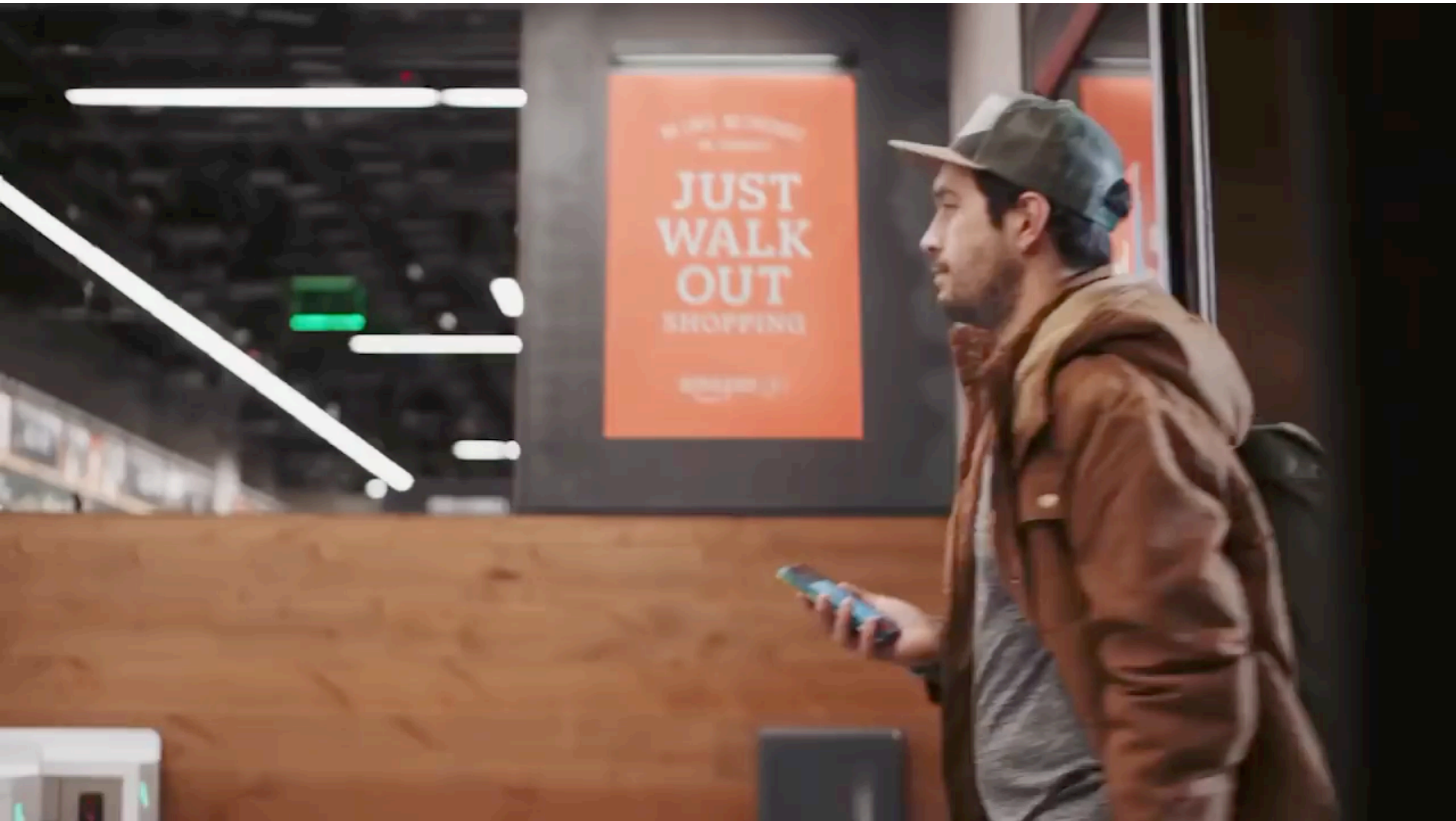
# The Long Wait ...

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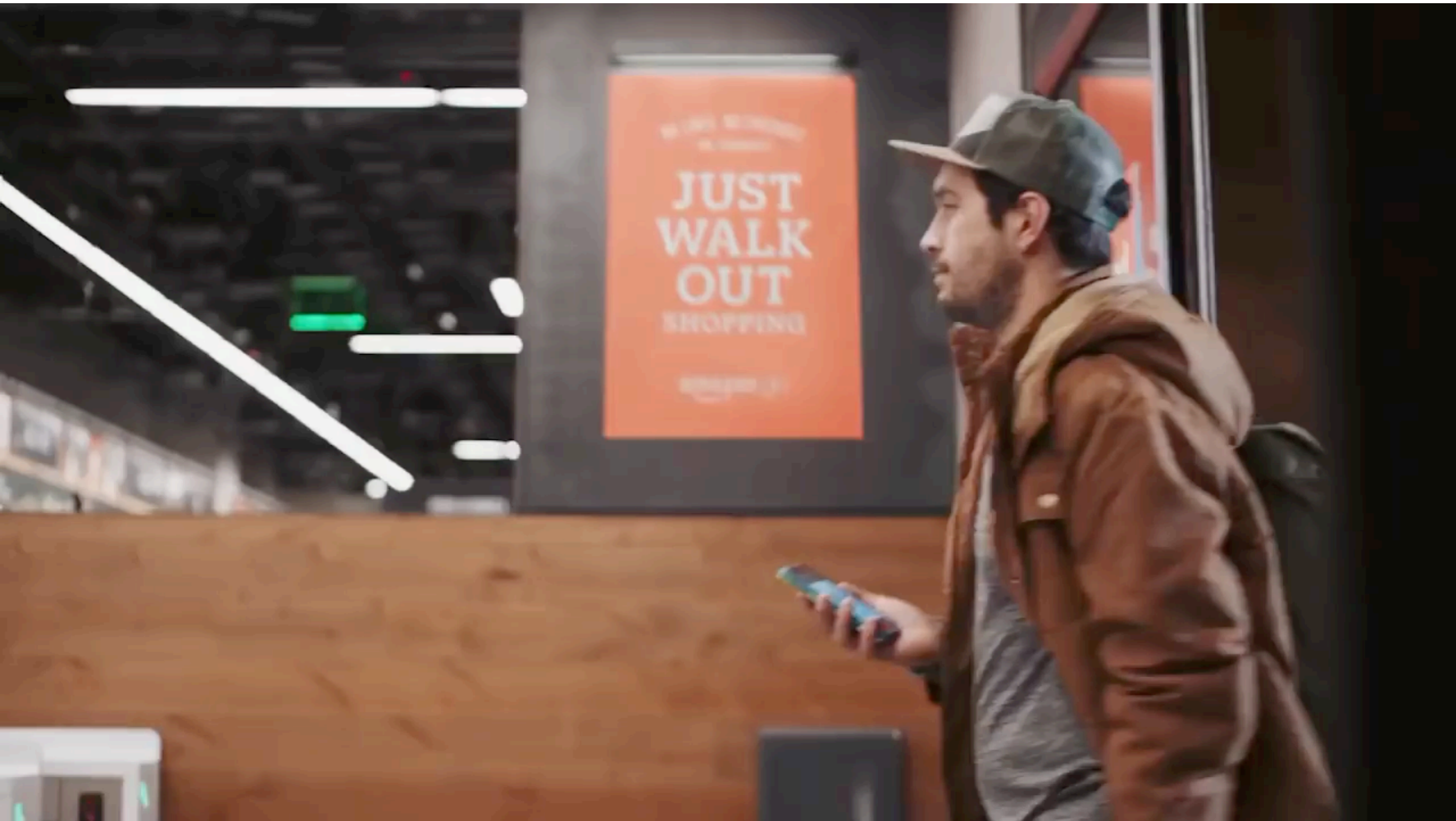
# Machine Learning Applications

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# Machine Learning Applications

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# Machine Learning Applications

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# Machine Learning Applications

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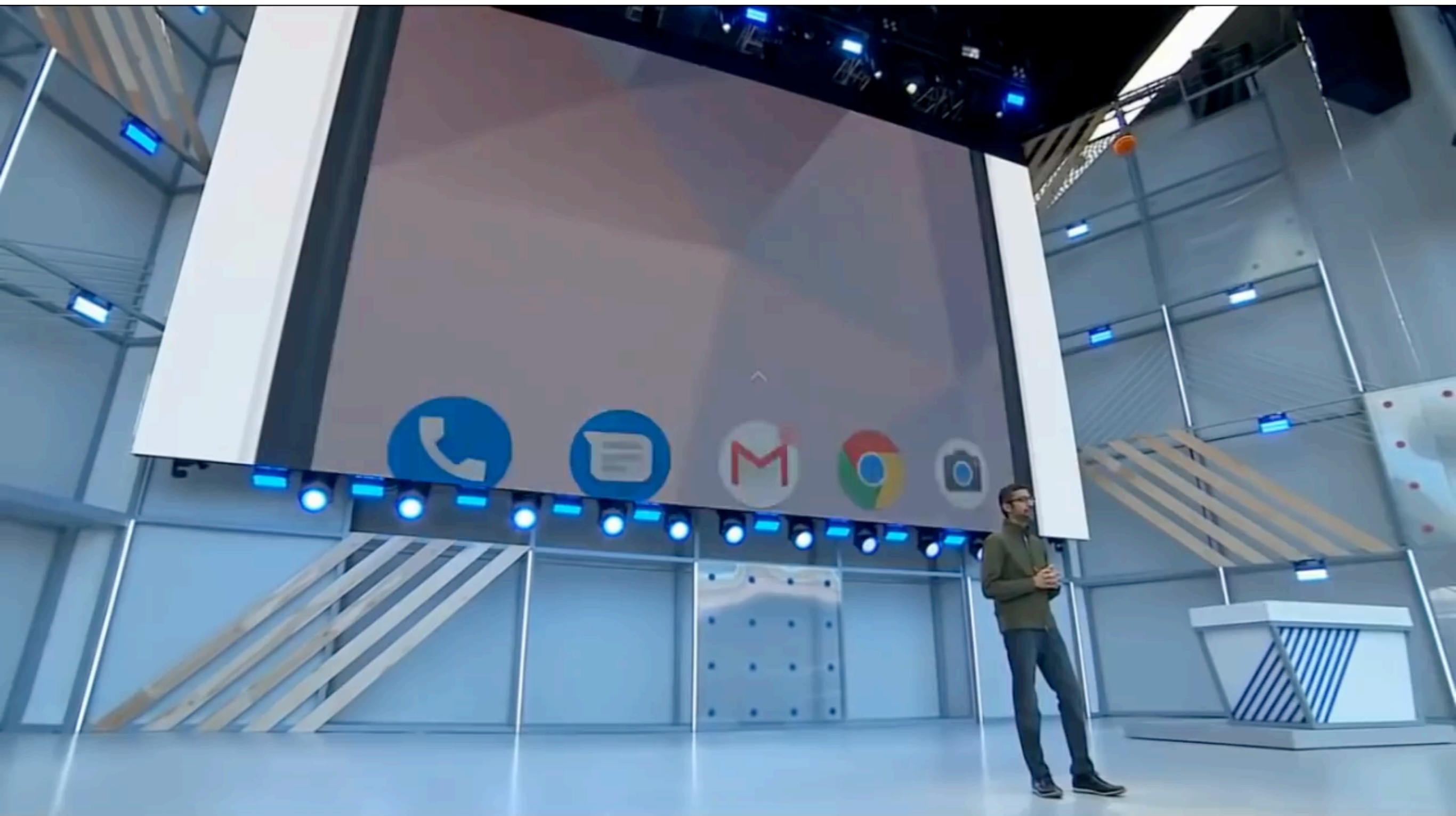
# Never Liked To Call People!

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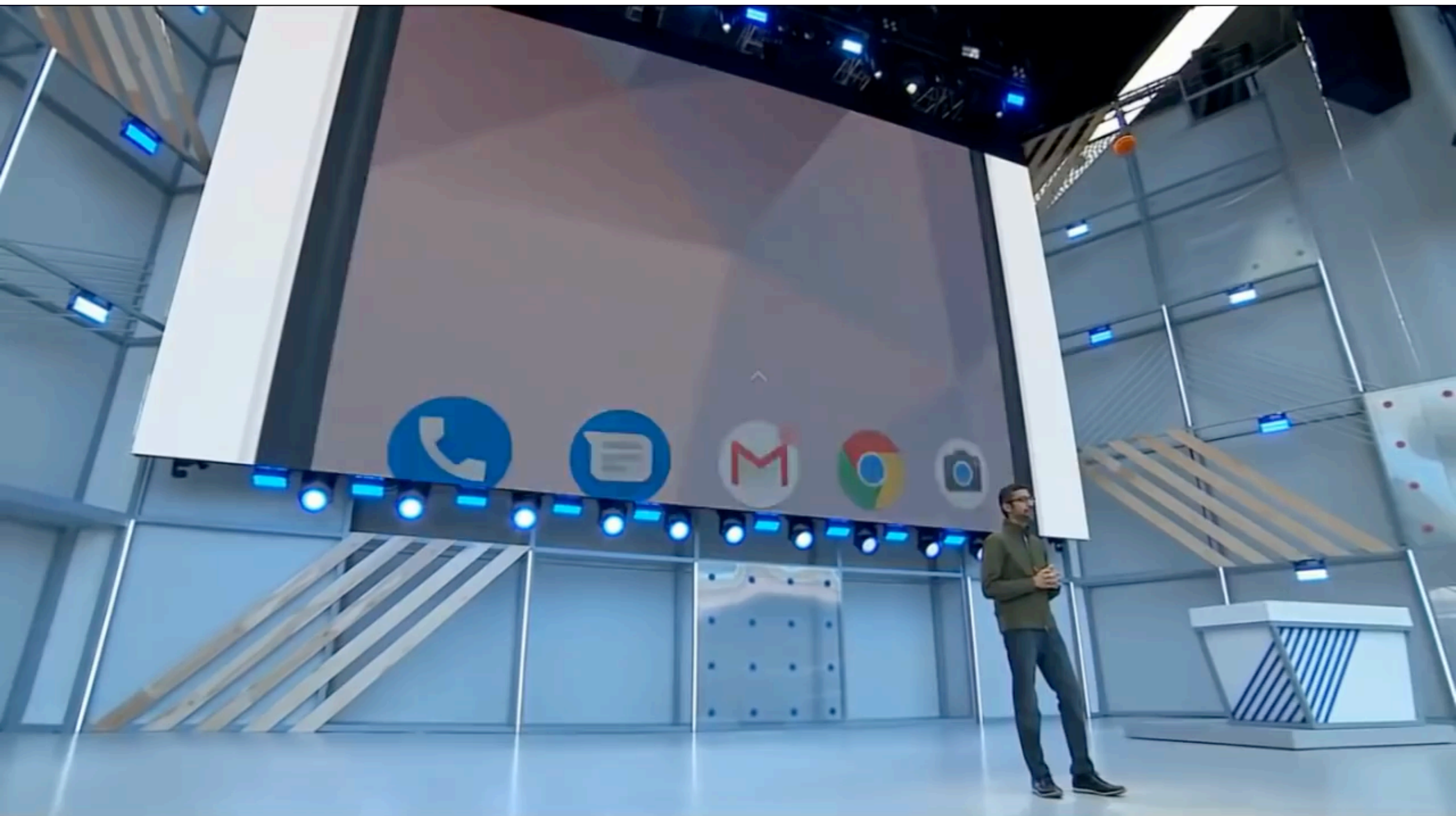
# Google Duplex!

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# Google Duplex!

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# Saving The Planet - One Watt A time

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# Saving The Planet - One Watt A time

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# Self Driving Car

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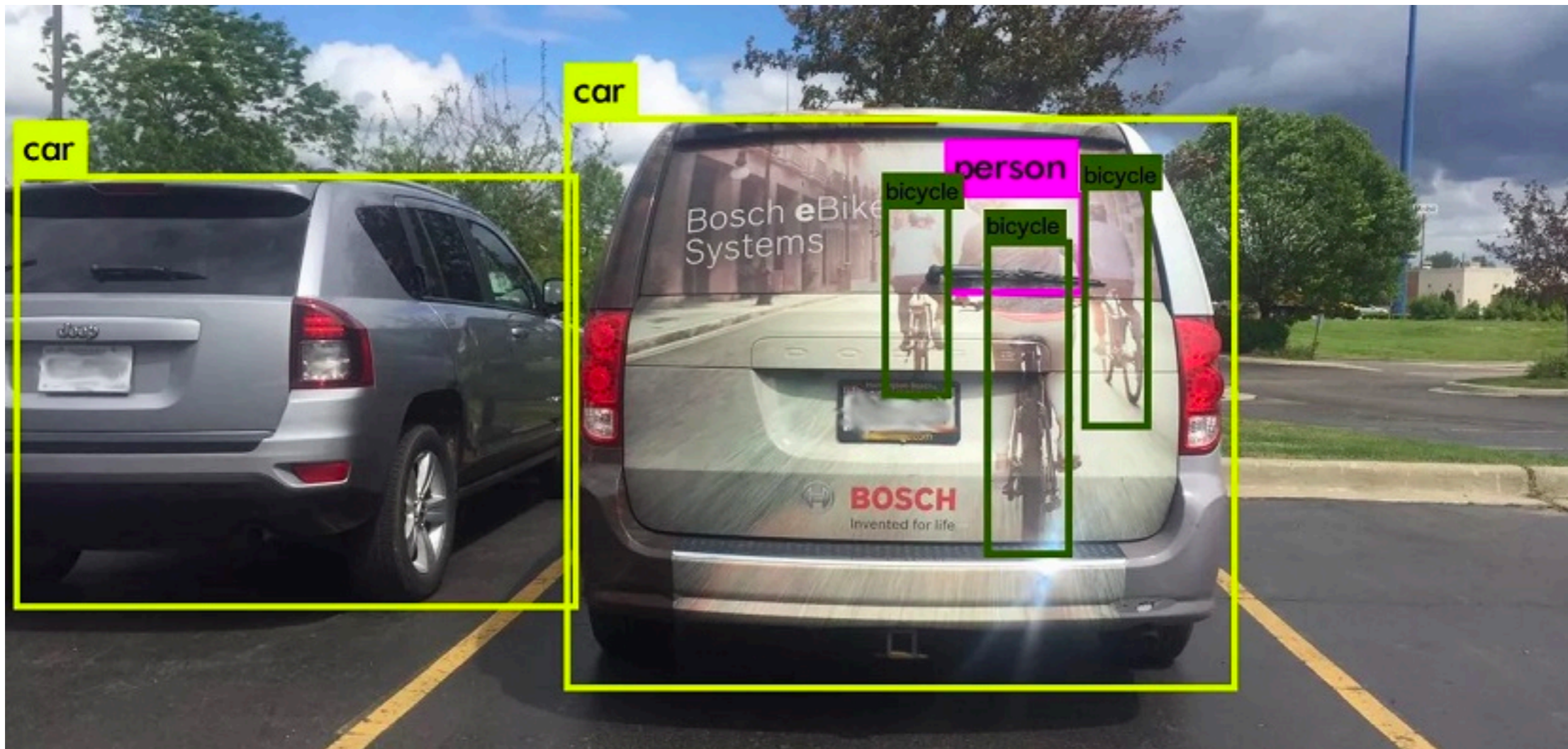
# Self Driving Car

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# Self Driving Car

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Courtesy: Cognata



# ML for Farm

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# ML for Farm

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# ML for Healthcare

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WORLD  
ECONOMIC  
FORUM

The logo of the World Economic Forum, featuring a blue arc that forms a partial circle around the text.

# ML for Healthcare

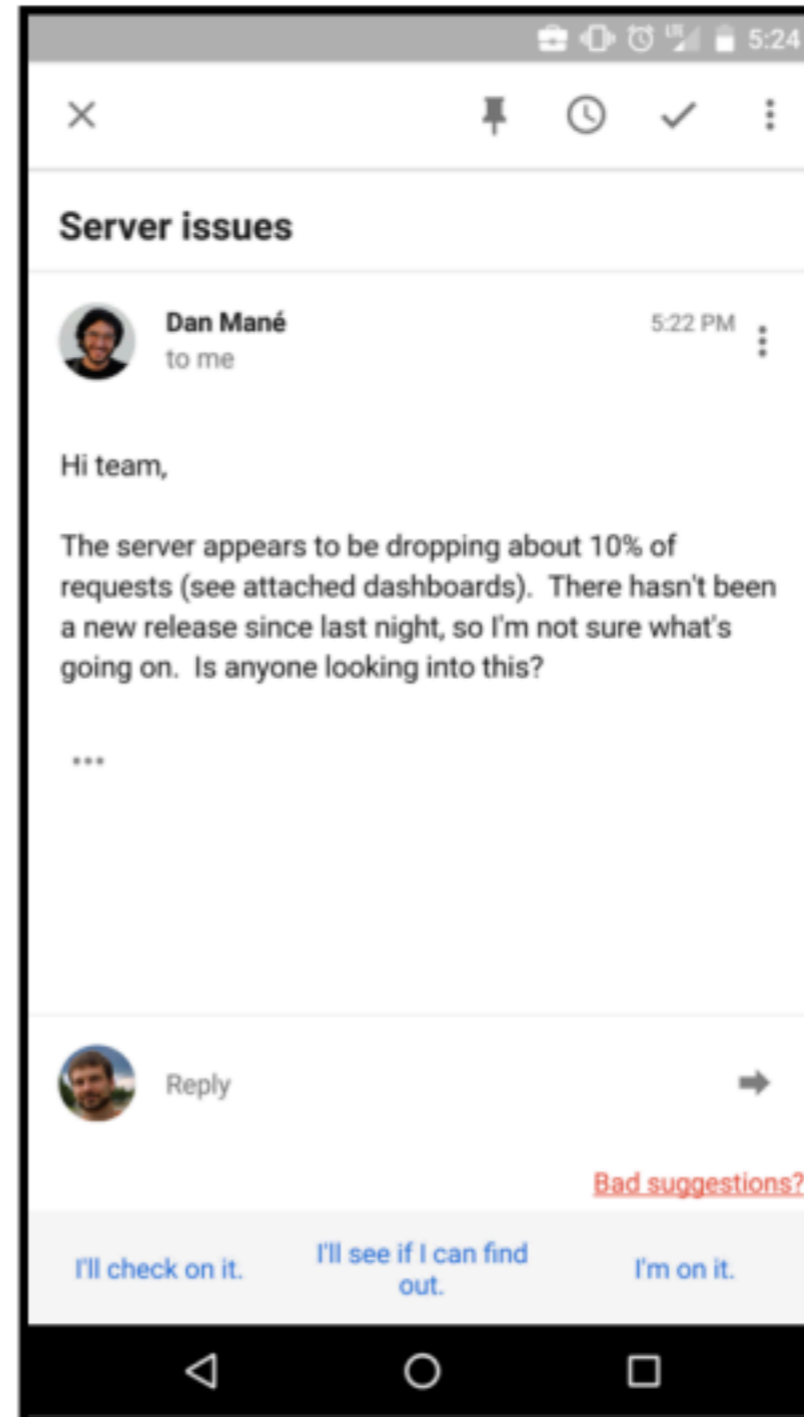
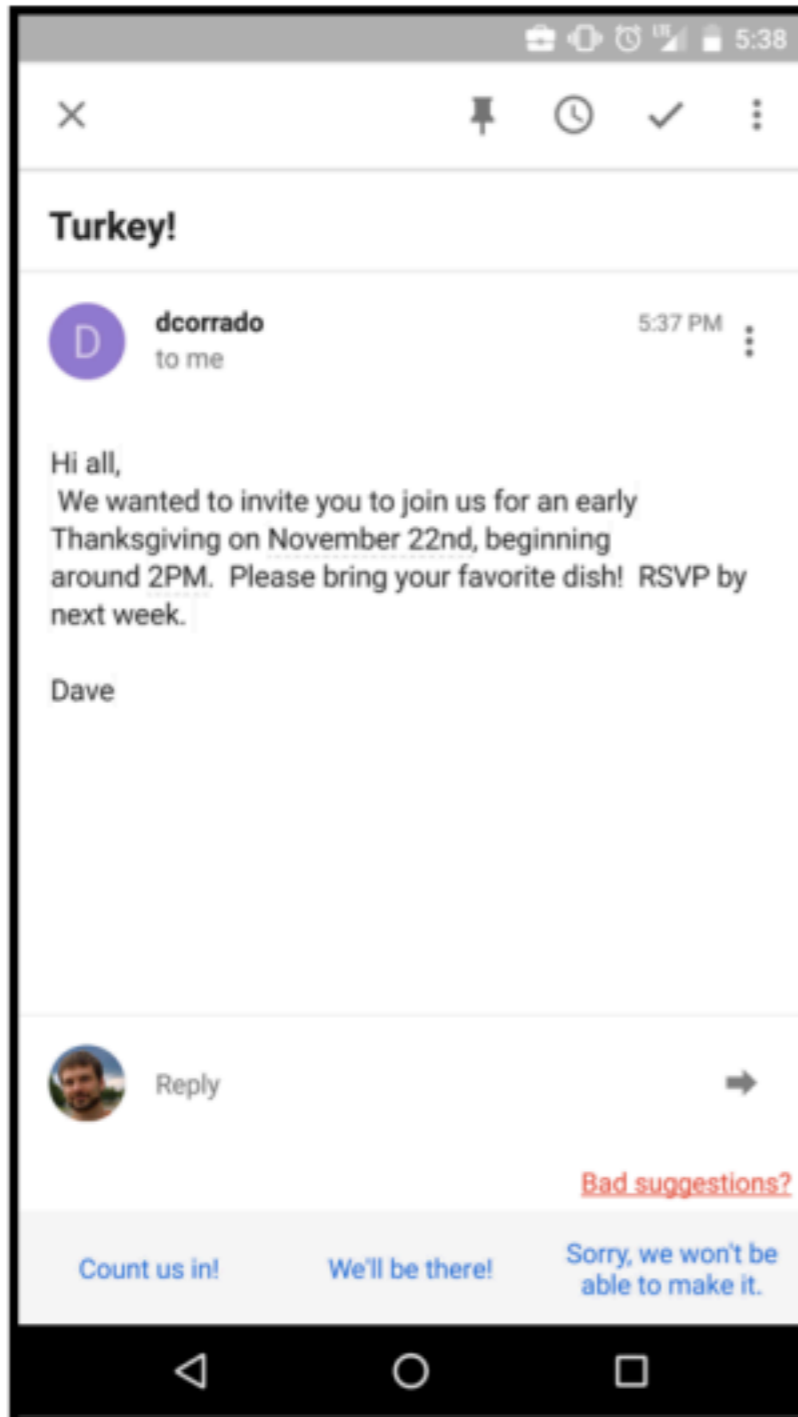
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WORLD  
ECONOMIC  
FORUM

The logo of the World Economic Forum, featuring a blue arc that forms a partial circle around the text.

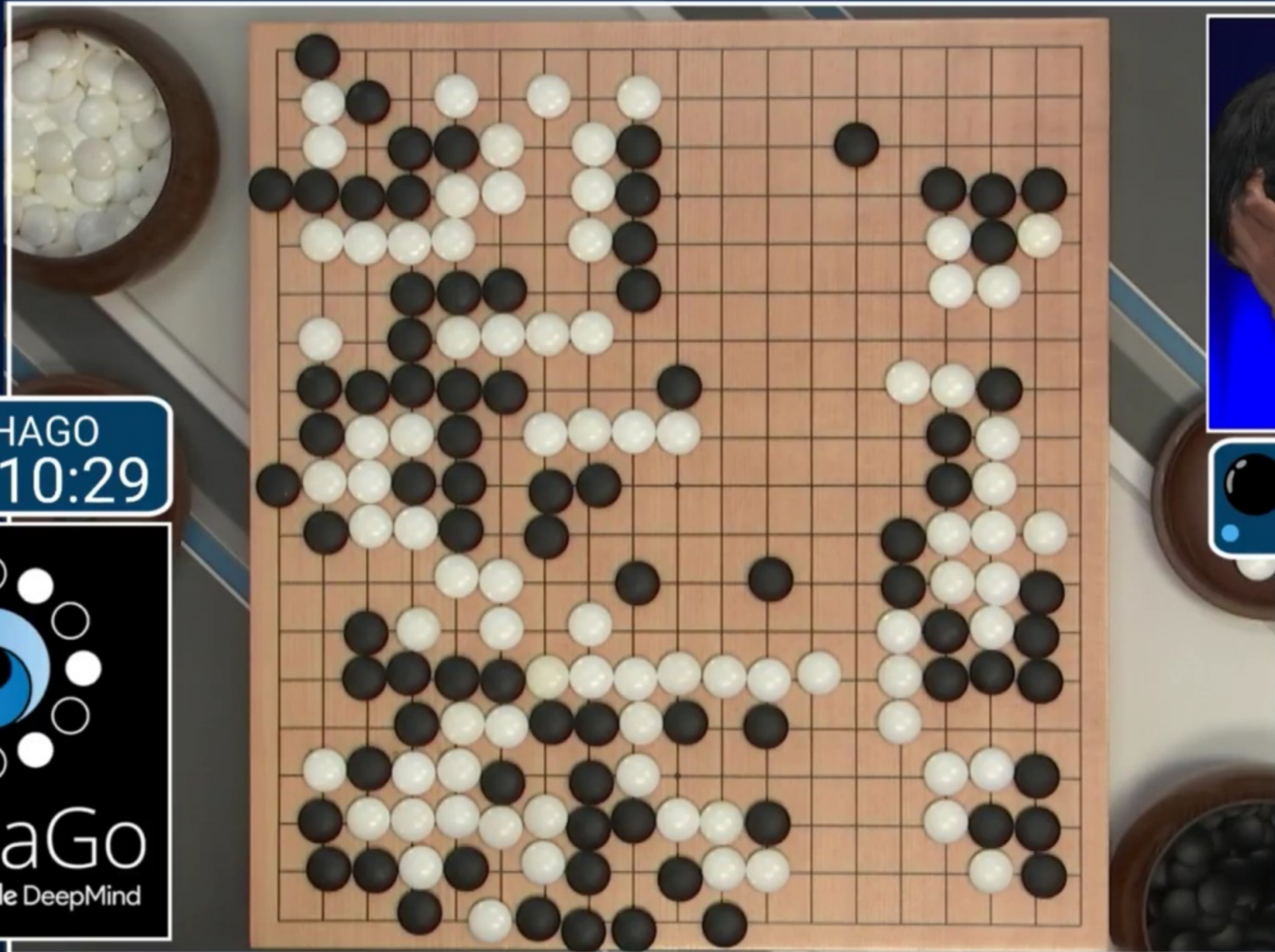
# Auto Reply

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# Machine Learning Applications

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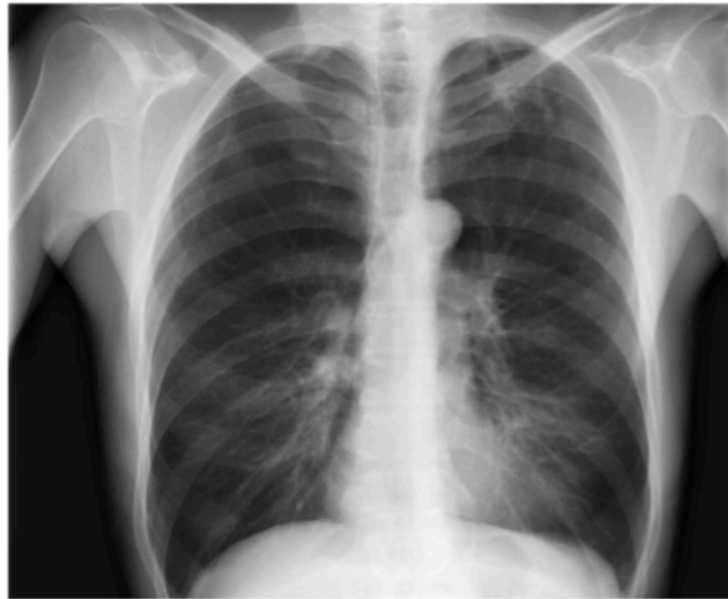
● ALPHAGO  
00:10:29



● LEE SEDOL  
00:01:00

# Machine Learning Applications

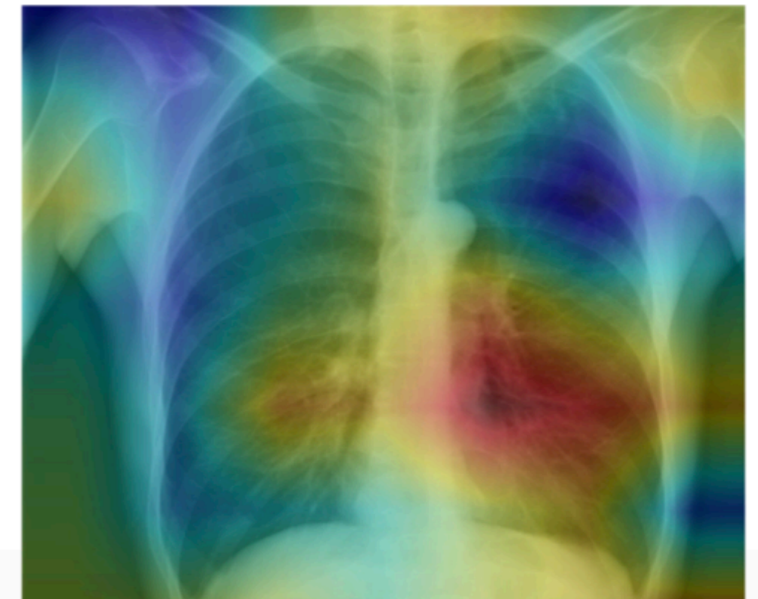
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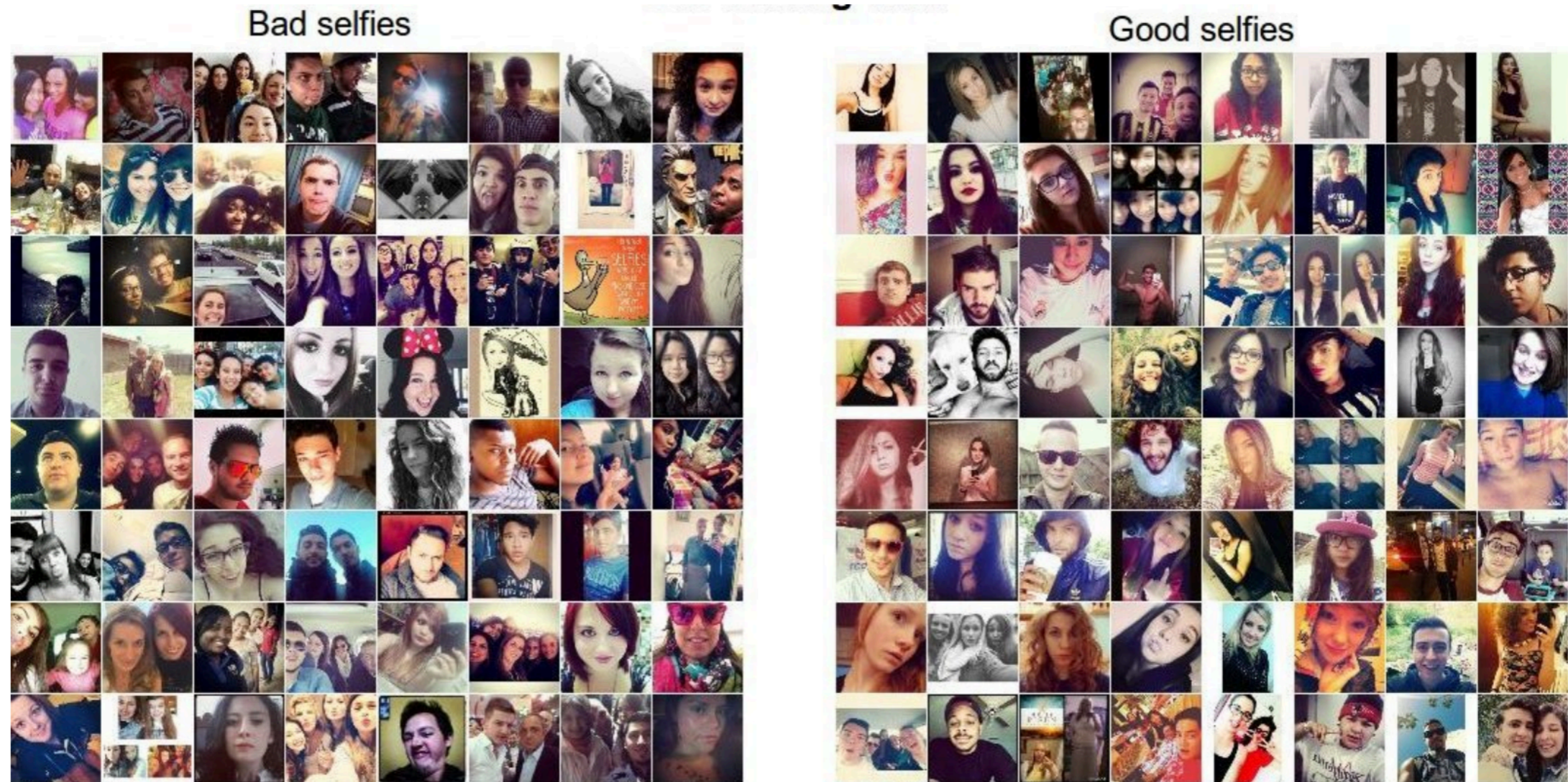
**Input**  
Chest X-Ray Image

**CheXNet**  
121-layer CNN

**Output**  
Pneumonia Positive (85%)



# Machine Learning Applications



Example images showing good and bad selfies in our training data. These will be given to the ConvNet as teaching material.

- Face should occupy about 1/3 of the image.
- Cut off your forehead

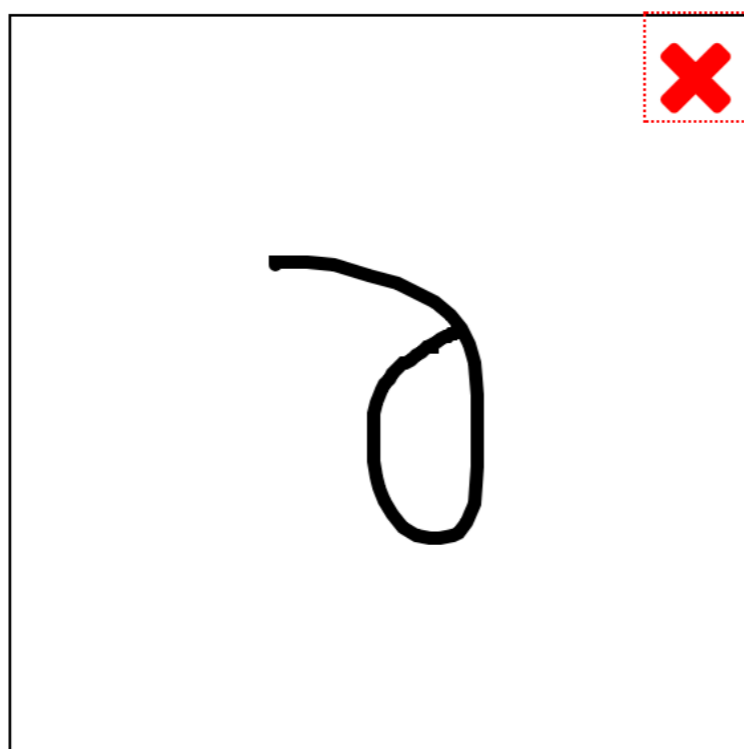


# Machine Learning Applications

**Detexify**

classify

symbols



$\partial$

Score: 0.12107724371908918

`\partial`  
mathmode

$\mathcal{D}$

Score: 0.1744210074369589

`\usepackage{ amssymb }`  
`\Game`  
mathmode

$\gamma$

Score: 0.18567692685446785

`\usepackage{ tipa }`  
`\textbabygamma`  
textmode

$\Upsilon$

Score: 0.19845446379011045

`\usepackage{ upgreek }`  
`\upgamma`  
mathmode

$\delta$

Score: 0.19849650347374576

`\usepackage[T1]{fontenc}`  
`\dh`  
textmode

## Want a Mac app?

Lucky you. The Mac app is finally stable enough. See how it works on [Vimeo](#). Download the latest version [here](#).

*Restriction:* In addition to the LaTeX command the unlicensed version will copy a reminder to purchase a license to the clipboard when you select a symbol.

You can purchase a license here:




Buy Detexify for Mac

The symbol is not in the list? [Show more](#)

Did this help?

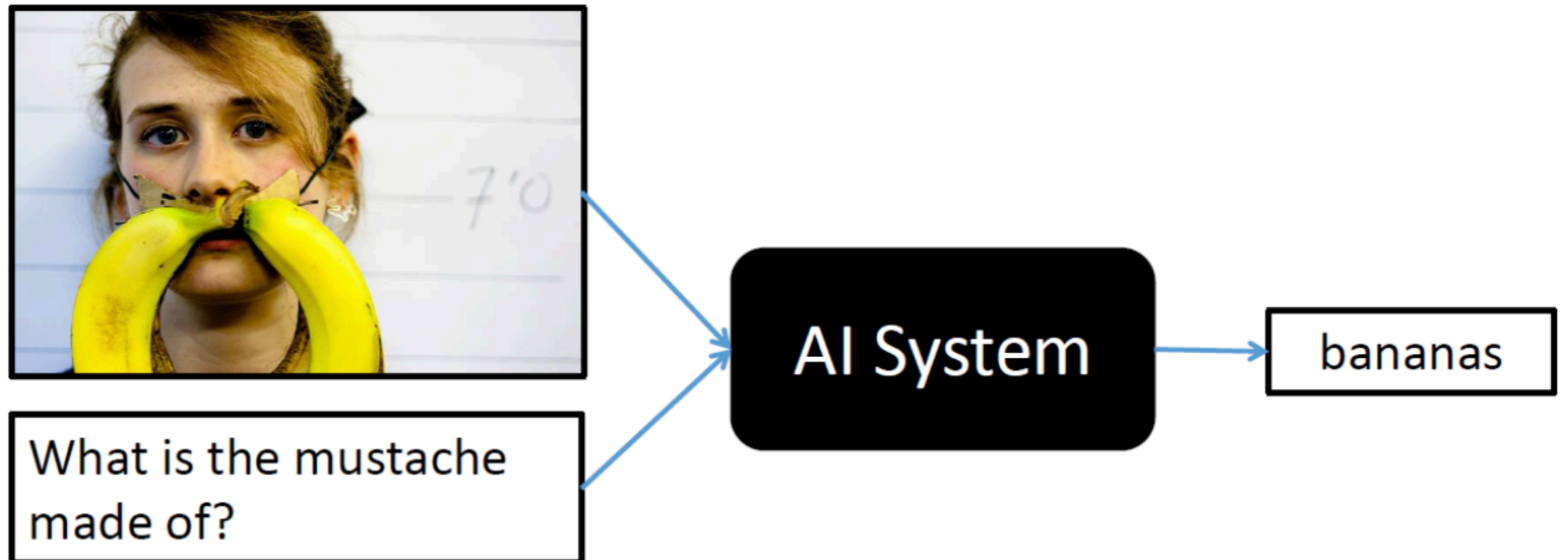
# Machine Learning Applications

Labels	Web	Properties	Safe Search	JSON																		
																						
image_20121216120914.jpg																						
<table><tbody><tr><td>Test Cricket</td><td>98%</td></tr><tr><td>Cricket</td><td>98%</td></tr><tr><td>Baseball Player</td><td>98%</td></tr><tr><td>Cricketer</td><td>97%</td></tr><tr><td>Bat And Ball Games</td><td>96%</td></tr><tr><td>Team Sport</td><td>91%</td></tr><tr><td>Ball Game</td><td>88%</td></tr><tr><td>Games</td><td>86%</td></tr><tr><td>Sports</td><td>85%</td></tr></tbody></table>					Test Cricket	98%	Cricket	98%	Baseball Player	98%	Cricketer	97%	Bat And Ball Games	96%	Team Sport	91%	Ball Game	88%	Games	86%	Sports	85%
Test Cricket	98%																					
Cricket	98%																					
Baseball Player	98%																					
Cricketer	97%																					
Bat And Ball Games	96%																					
Team Sport	91%																					
Ball Game	88%																					
Games	86%																					
Sports	85%																					

# Machine Learning Applications

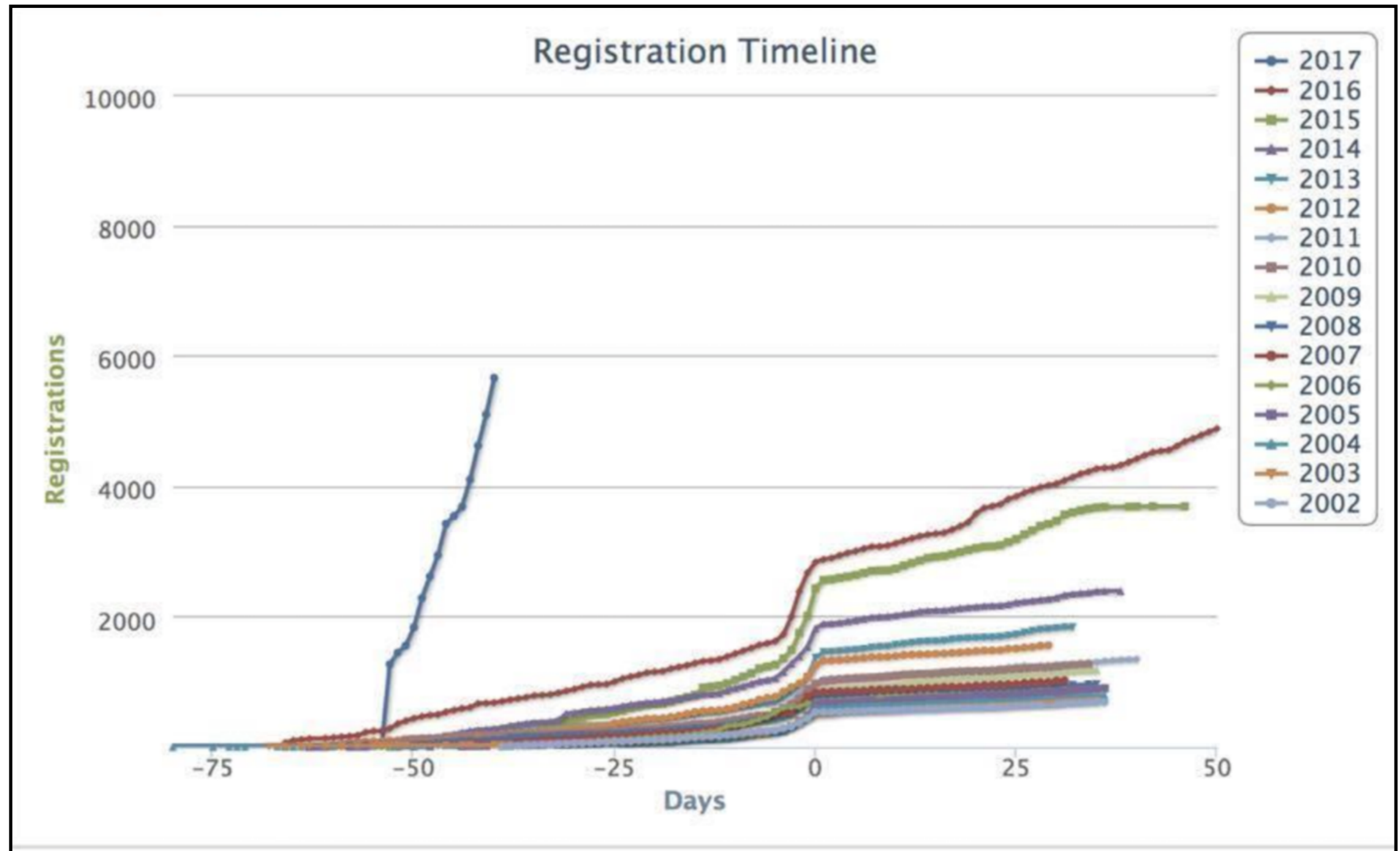
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## Visual Q and A



# NeurIPS registration

$x=0$  -> early registration deadline



# Machine Learning Gone Wrong

**THE VERGE**

TECH ▾

SCIENCE ▾

CULTURE ▾

CARS ▾

REVIEWS ▾

LONGFORM

VIDEO

MORE

🕒 STORYSTREAM

TRANSPORTATION

UBER

RIDE-SHARING



**Uber's fatal self-driving crash: all the news and updates**

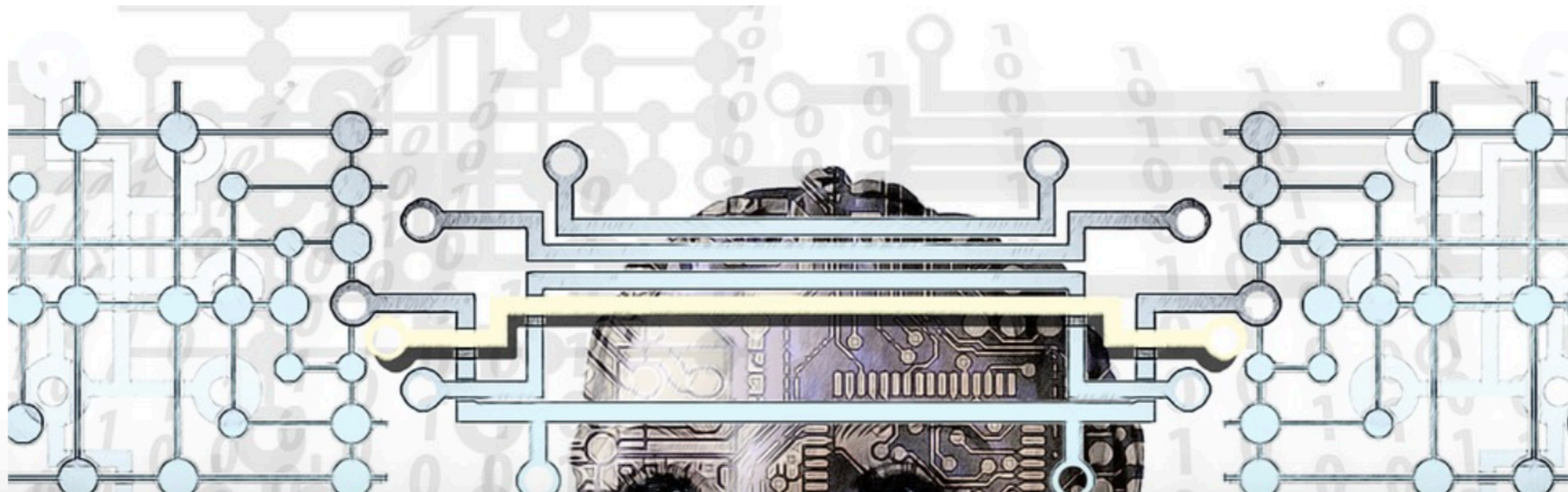
# Machine Learning Gone Wrong

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Home > Cool Science > After Uber, Tesla Incidents, Can Artificial Intelligence Be Trusted?

## After Uber, Tesla Incidents, Can Artificial Intelligence Be Trusted?

April 13, 2018



# “Bias” in Machine Learning

## Stereotypes in Google Translate

Translate

French English Turkish Detect language

English French Turkish Translate

He is a babysitter  
She is a doctor

O bir bebek bakıcısı  
O bir doktor

34/5000

Translate


French English Turkish Detect language

English French Turkish Translate


O bir bebek bakıcısı  
O bir doktor

She's a babysitter  
He is a doctor

33/5000

 ANITA B.ORG

PAGE 9 | GRACE HOPPER CELEBRATION FOR WOMEN IN COMPUTING 2017  
PRESENTED BY THE ANITA BORG INSTITUTE AND THE ASSOCIATION FOR COMPUTING MACHINERY

 #GHC17

# “Bias” addressed

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Text Documents

TURKISH - DETECTED ENGLISH SPANISH FRENCH TURKISH ARABIC ENGLISH

o bir doktor

Translations are gender-specific. [LEARN MORE](#)

she is a doctor *(feminine)*

he is a doctor *(masculine)*

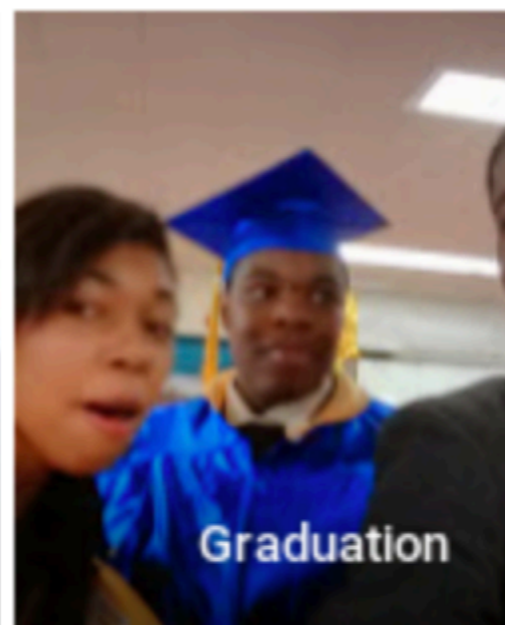
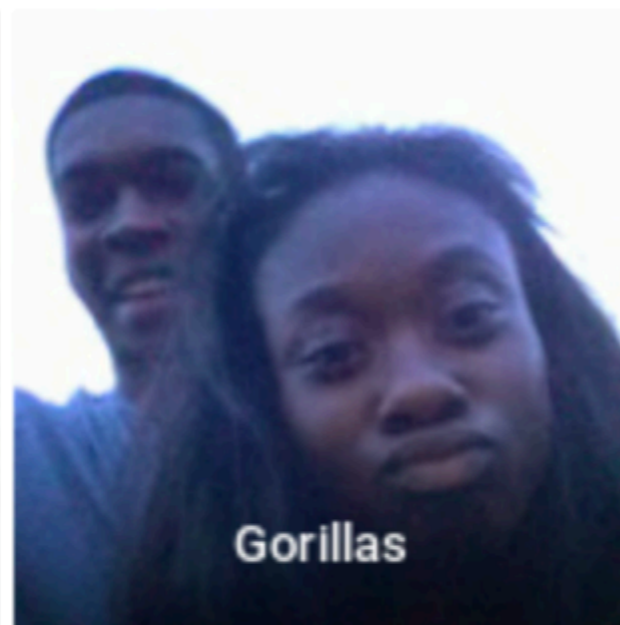
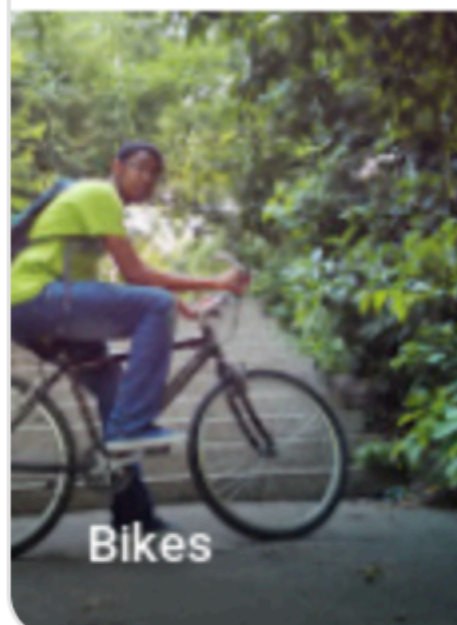
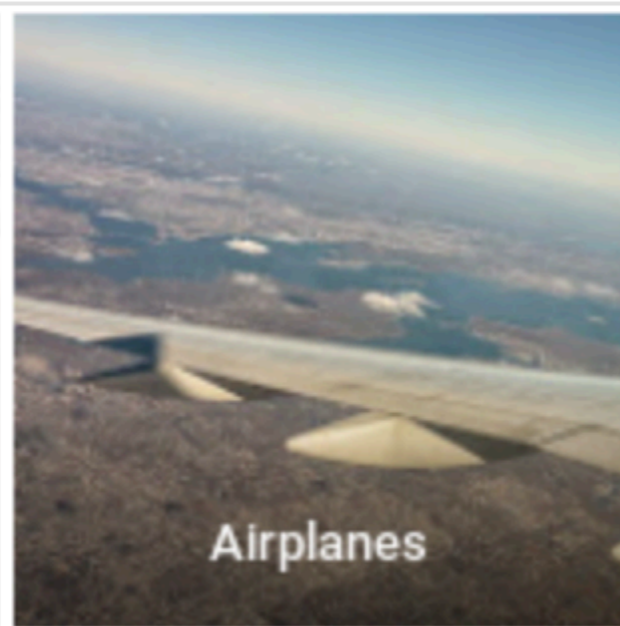
12/5000



# “Racist” Machine Learning?

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not a gorilla.



Where is the bride?

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“Bias” addressed

---

“Bias” addressed

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# A “reality” check

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ABC  
CLICK  
BBC  
NEWS

WH  
.GOV

# A “reality” check

---



ABC  
CLICK  
BBC  
NEWS

WH  
.GOV

# Adversaries!

---



$\mathbf{x}$

“panda”

57.7% confidence

+ .007 ×

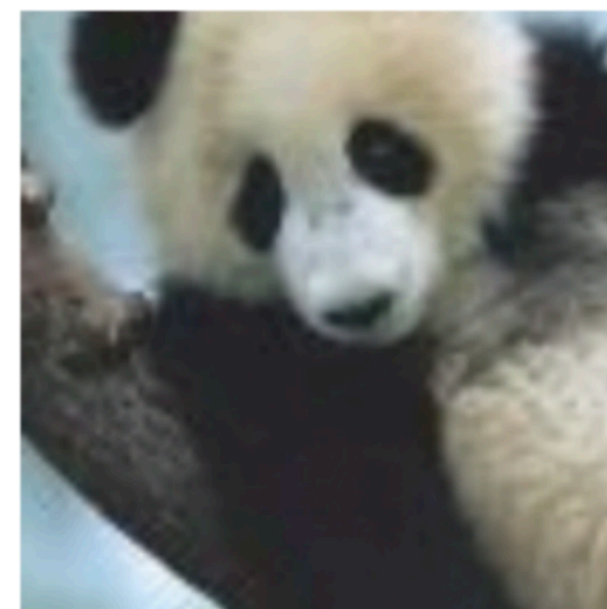


$\text{sign}(\nabla_{\mathbf{x}} J(\boldsymbol{\theta}, \mathbf{x}, y))$

“nematode”

8.2% confidence

=



$\mathbf{x} +$

$\epsilon \text{sign}(\nabla_{\mathbf{x}} J(\boldsymbol{\theta}, \mathbf{x}, y))$

“gibbon”

99.3 % confidence

# What is Machine Learning?

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# What is Machine Learning?

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- “Field of study that give computers the ability to learn without being explicitly programmed” - Arthur Samuel [1959]

# What is Machine Learning?

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- “Field of study that give computers the ability to learn without being explicitly programmed” - Arthur Samuel [1959]

# What is Machine Learning?

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- “Field of study that give computers the ability to learn without being explicitly programmed” - Arthur Samuel [1959]
- “A computer program is said to **learn** from **experience E** with respect to some class of **tasks T** and **performance measure P** if its performance at tasks in T, as measured by P, improves with experience E.” - Tom Mitchell

# What is Machine Learning?

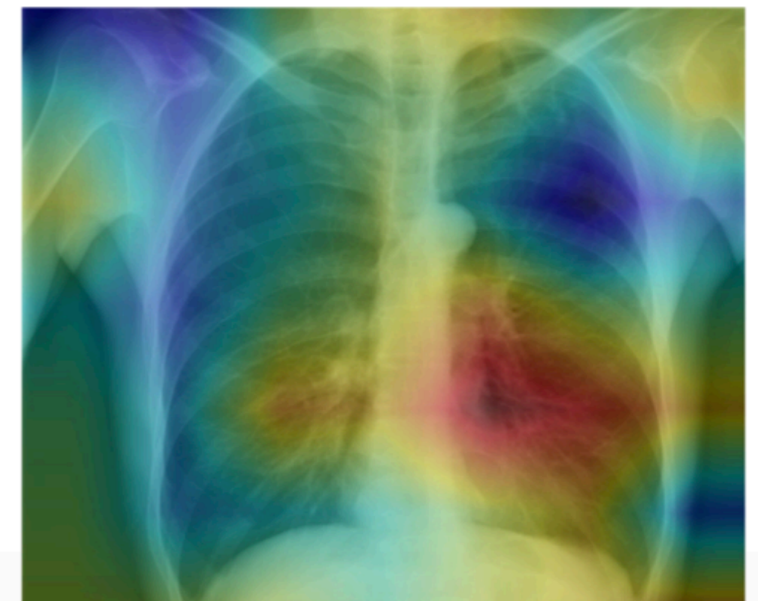
---



**Input**  
Chest X-Ray Image

**CheXNet**  
121-layer CNN

**Output**  
Pneumonia Positive (85%)



Q: Identify task, performance measure, and experience

# What is Machine Learning?

---

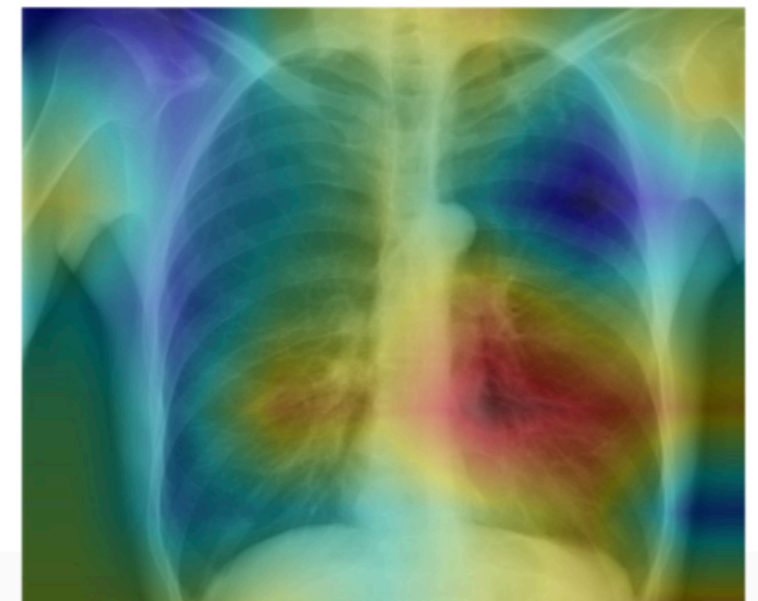


**Input**  
Chest X-Ray Image

Task

**CheXNet**  
121-layer CNN

**Output**  
Pneumonia Positive (85%)



Q: Identify task, performance measure, and experience

# What is Machine Learning?

---

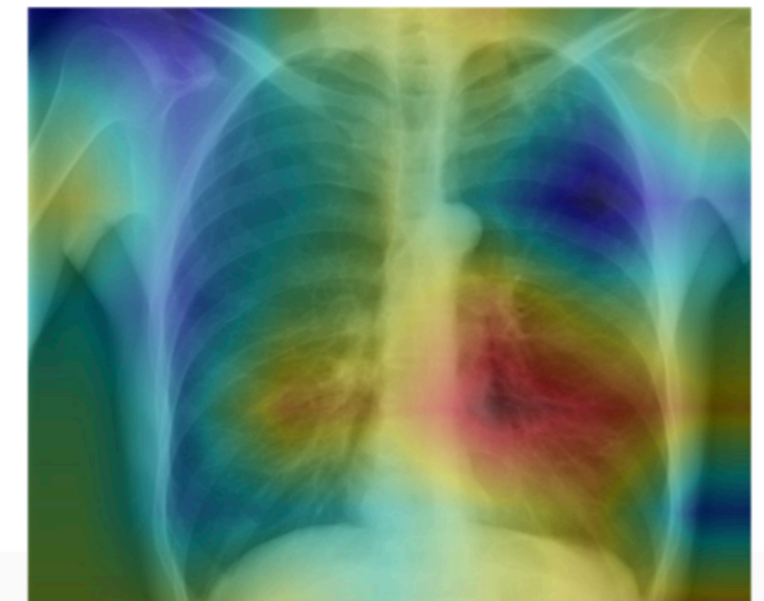
Performance  
measure

**Output**

Pneumonia Positive (85%)

Task

**CheXNet**  
121-layer CNN



**Input**

Chest X-Ray Image

Q: Identify task, performance measure, and experience

# What is Machine Learning?

---

Experience

1000s of <image, disease> pairs

Performance  
measure

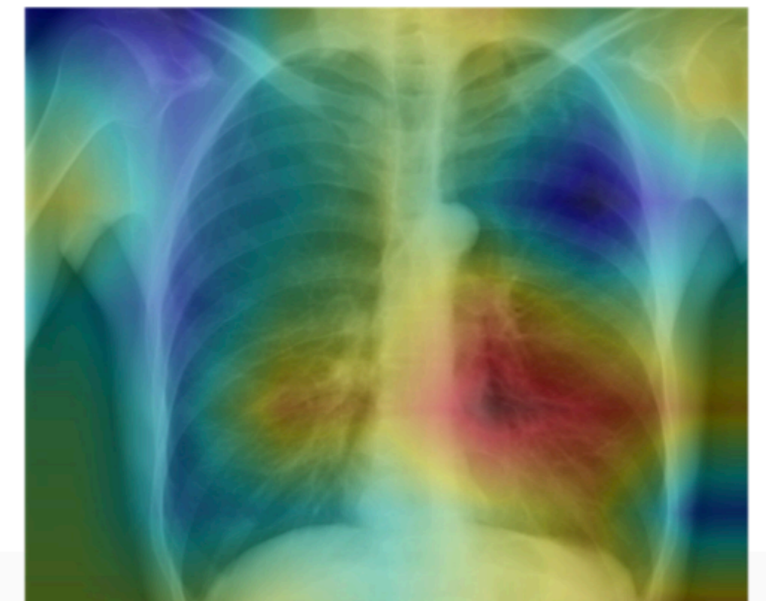
**Output**

Pneumonia Positive (85%)



Task

**CheXNet**  
121-layer CNN



**Input**

Chest X-Ray Image

Q: Identify task, performance measure, and experience

# What is Machine Learning?

---

Experience

1000s of <image, disease> pairs

Performance  
measure

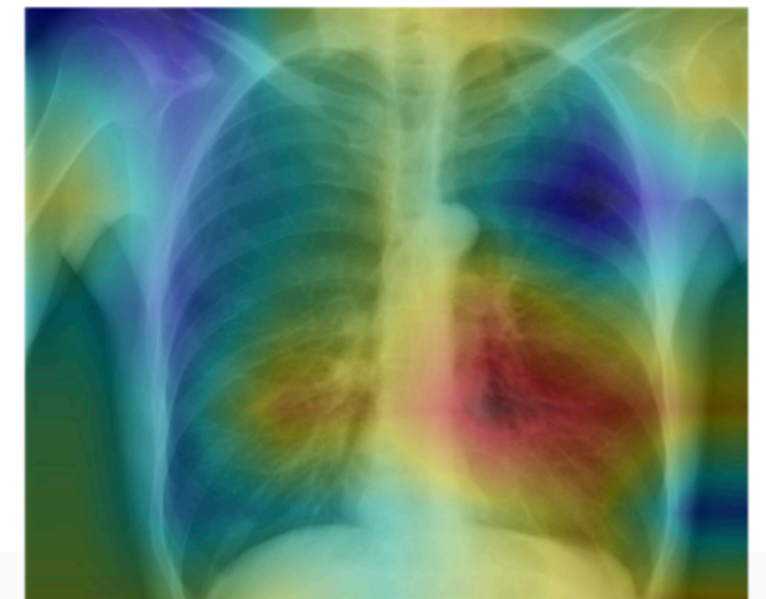
**Output**

Pneumonia Positive (85%)



Task

**CheXNet**  
121-layer CNN



**Input**

Chest X-Ray Image



# What is Machine Learning?

---

Experience

1000s of <image, disease> pairs



**Input**

Chest X-Ray Image

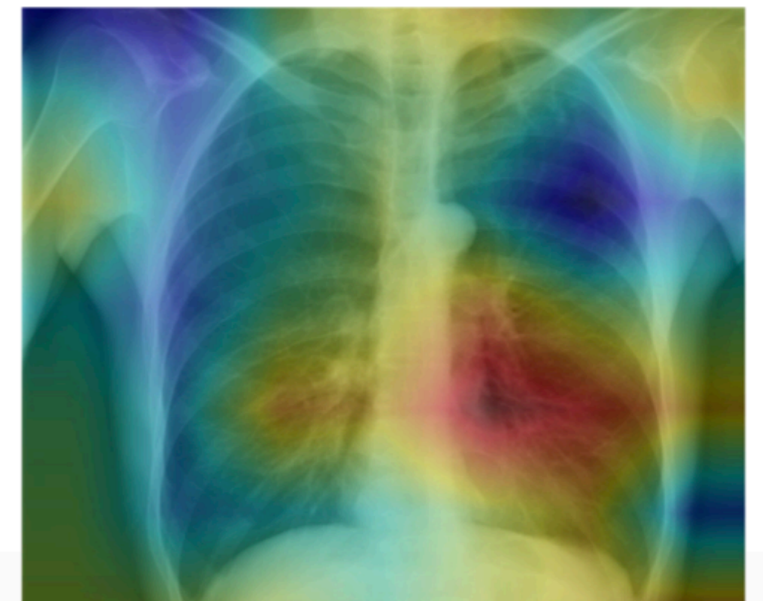
Task

**CheXNet**

121-layer CNN

**Output**

Pneumonia Positive (85%)



# What is Machine Learning?

---

Experience

1000s of <image, disease> pairs



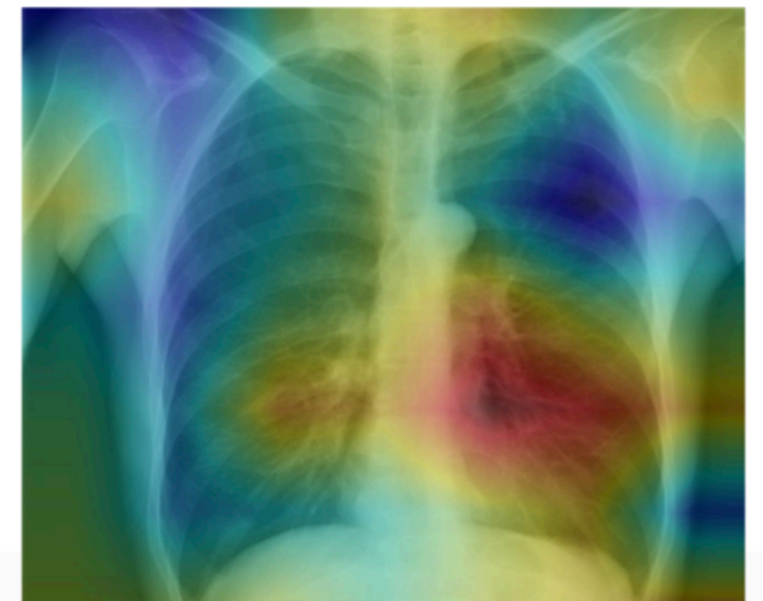
**Input**

Chest X-Ray Image

**CheXNet**  
121-layer CNN

**Output**

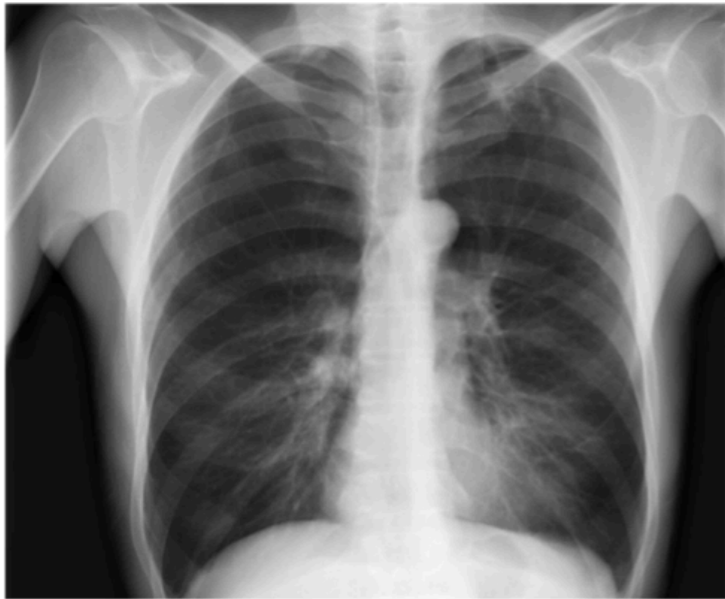
Pneumonia Positive (85%)



# What is Machine Learning?

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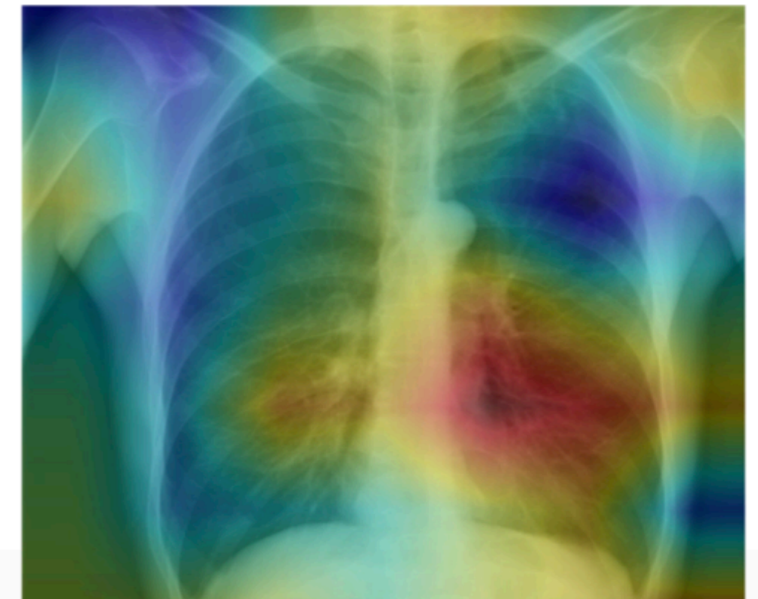
Experience  
1000s of <image, disease> pairs



**Input**  
Chest X-Ray Image

**CheXNet**  
121-layer CNN

**Output**  
Pneumonia Positive (85%)



# What is Machine Learning?

---

Experience  
1000s of <image, disease> pairs

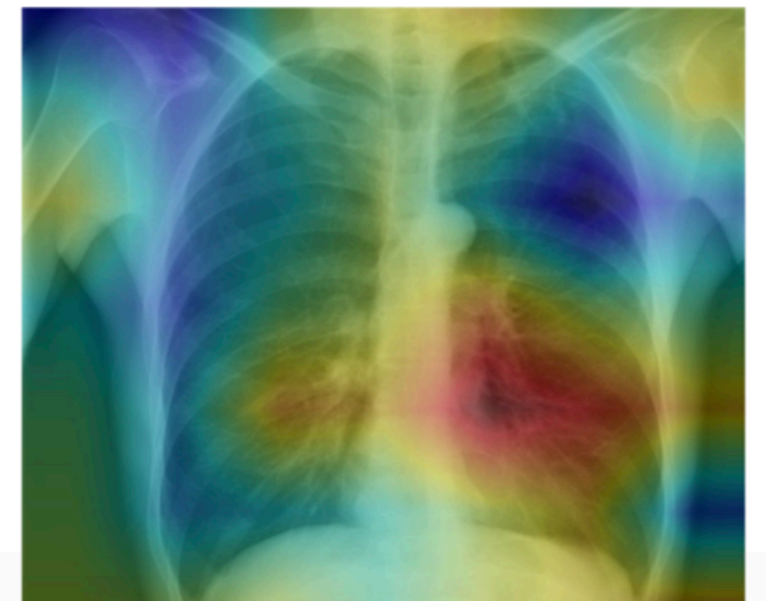
Supervised Learning

**Output**

Pneumonia Positive (85%)



**CheXNet**  
121-layer CNN



**Input**

Chest X-Ray Image

# Google Classroom and Website

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Google Classroom code: 2chpsz

Website: <https://nipunbatra.github.io/teaching/ml-spring-19/>