

# Classifier Evaluation & Decision Boundaries

---

# Announcements

# Classifiers (Review)

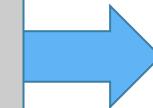
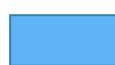
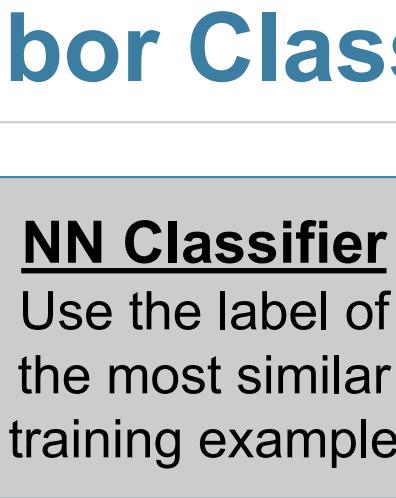
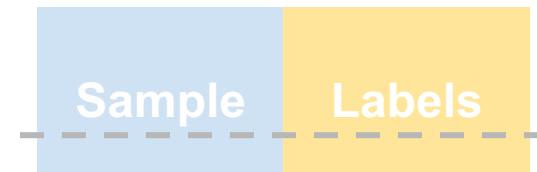
# Nearest Neighbor Classifier

Attributes of  
an example

## NN Classifier

Use the label of  
the most similar  
training example

Predicted label  
of the example



# The Classifier

---

To classify a point:

- Find its  $k$  nearest neighbors
- Take a majority vote of the  $k$  nearest neighbors to see which of the two classes appears more often
- Assign the point the class that wins the majority vote

(Demo)

---

# Evaluation

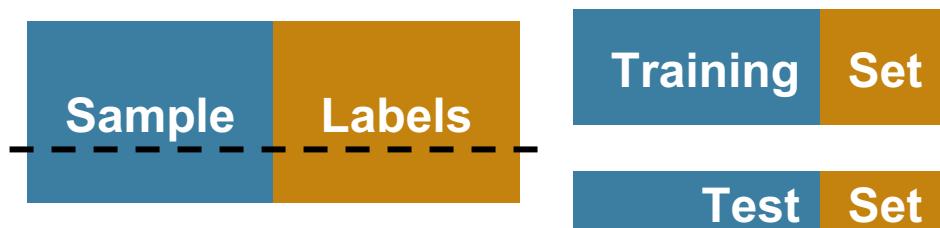
# Accuracy of a Classifier

---

The accuracy of a classifier on a labeled data set is the proportion of examples that are labeled correctly

Need to compare classifier predictions to true labels

If the labeled data set is sampled at random from a population, then we can infer accuracy on that population



---

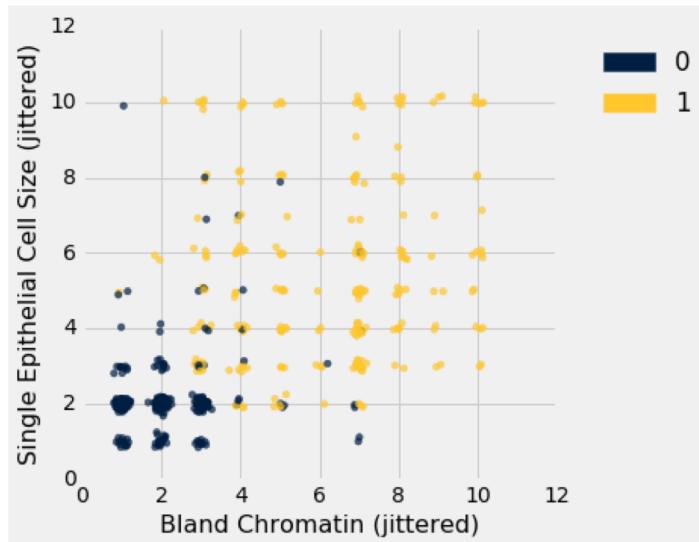
(Demo)

# Discussion Question

---

On the left is a plot of our training set.

What is the accuracy of a 1-NN classifier on the training set? (Yes, you can find the exact number.)



(Demo)

---

# Decision Boundaries

---

- A change in input attributes might change the prediction
- Inputs that are very close but result in different predicted labels are on either side of a ***decision boundary***
- To visualize, plot predictions of a regular set of inputs

(Demo)

---

# Recap

---

- The k-NN classifier takes a vote of the k closest points
- How do you choose k? Use your test set.
- The decision boundary...
  - Shows where the classifier changes its predictions
  - Changes based on k

# Hotels, Trafficking and Images

Human traffickers operate out of hotels

Traffickers advertise online with images taken inside hotel rooms

Identifying the specific hotels used can help:

- Find victims
- Document crime locations
- Understand criminal networks

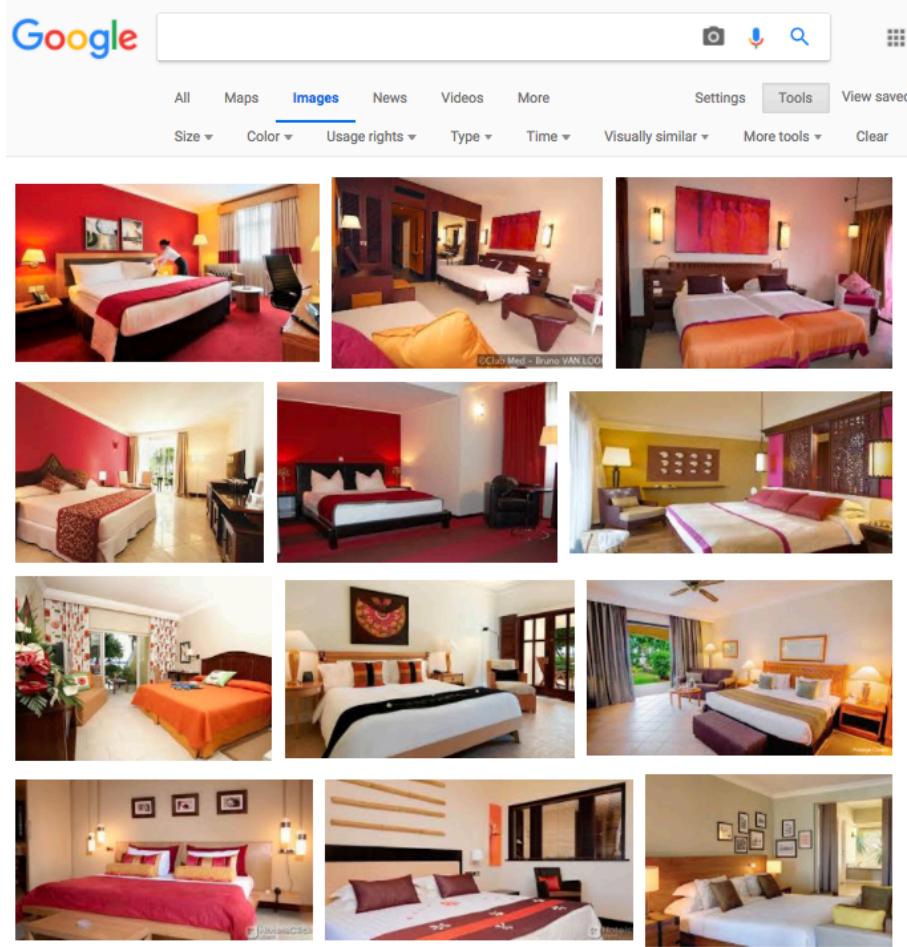


Follow

This is a hotel room. Do U know which one?  
This info can help police solve a child sexual abuse case. Tell us on  
[europol.europa.eu/stopchildabuse ...](http://europol.europa.eu/stopchildabuse ...)



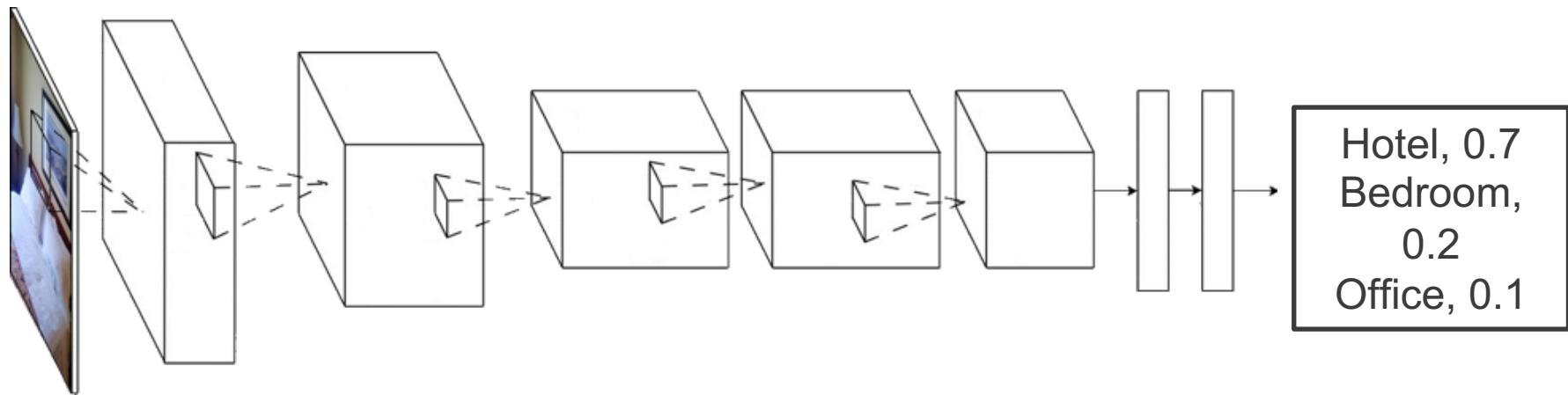
7:00 AM - 11 Aug 2017

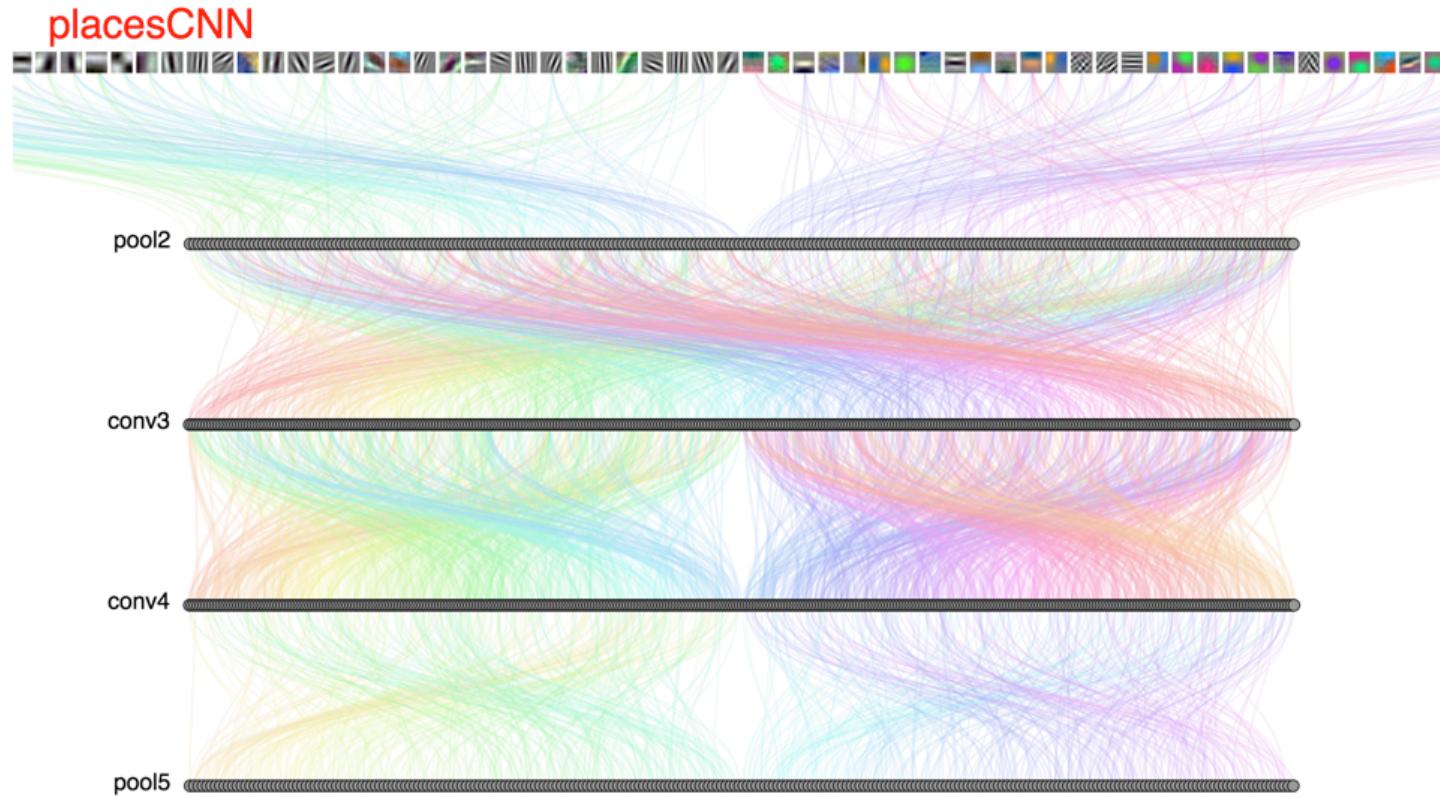


This is a hotel room. Do U know which one?  
This info can help police solve a child sexual  
abuse case. Tell us on  
[europol.europa.eu/stopchildabuse ...](http://europol.europa.eu/stopchildabuse ...)



7:00 AM - 11 Aug 2017

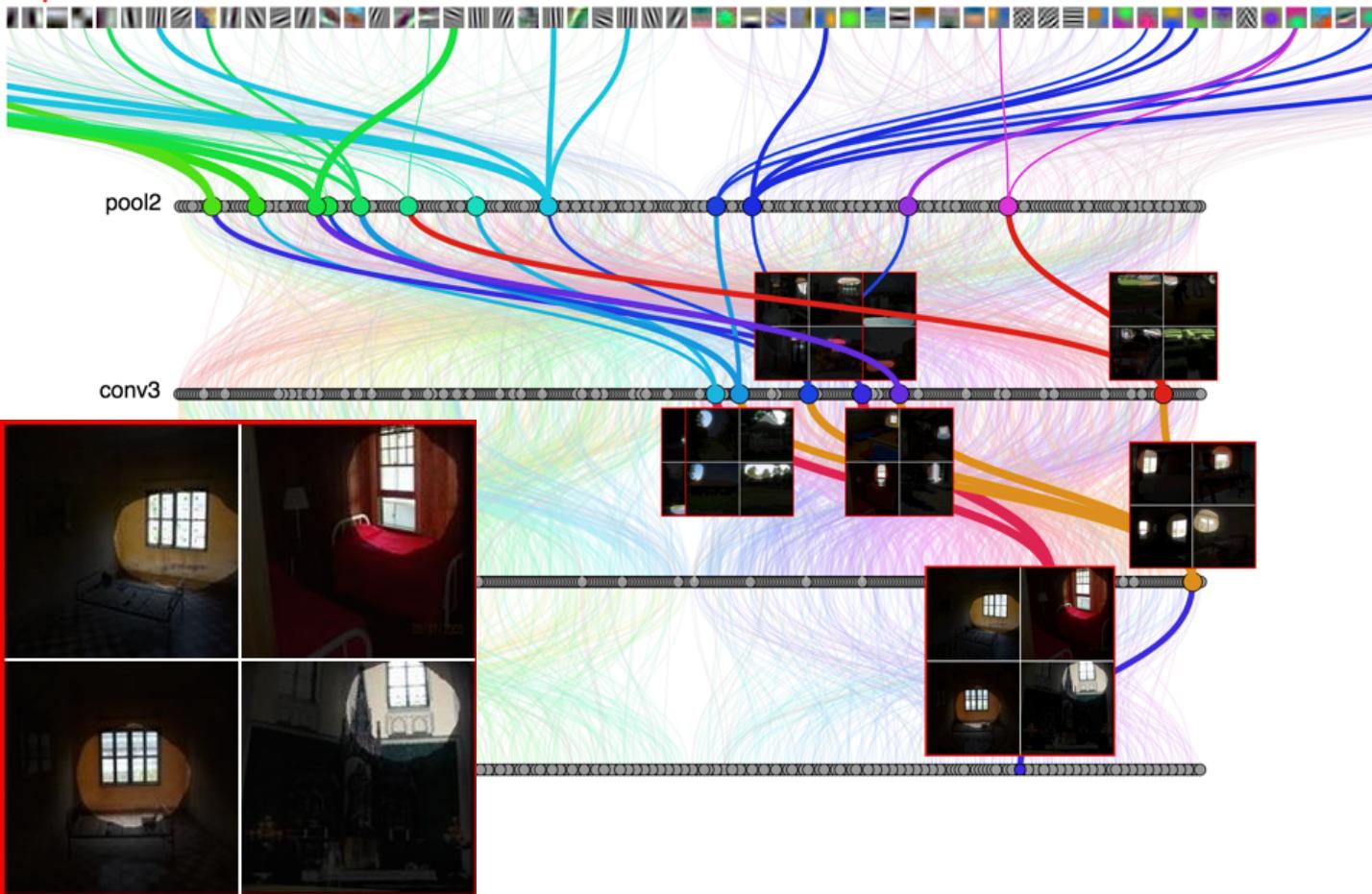


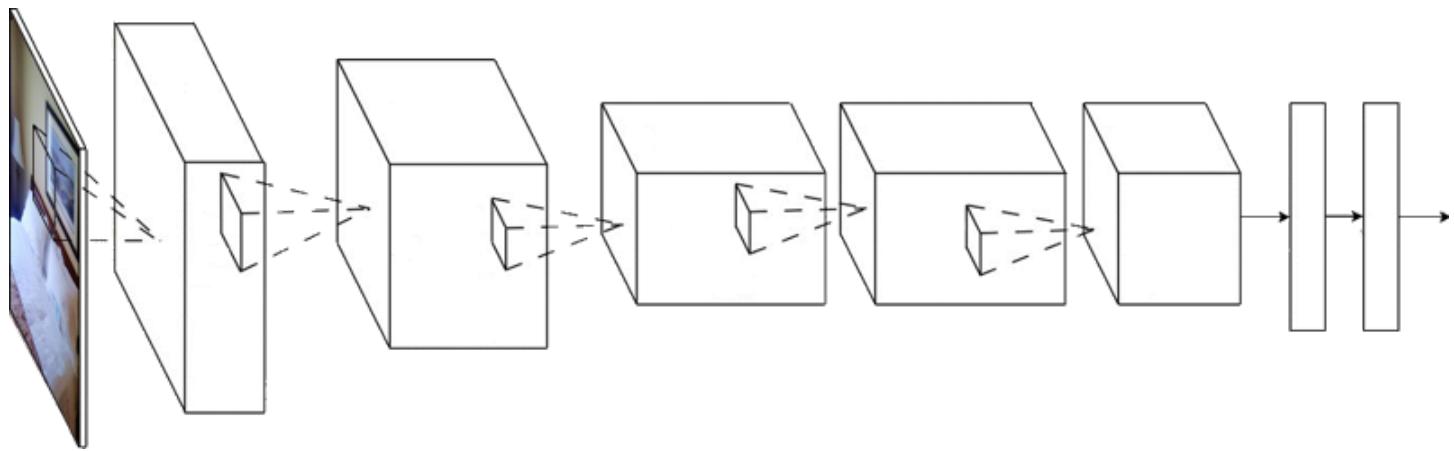


placesCNN

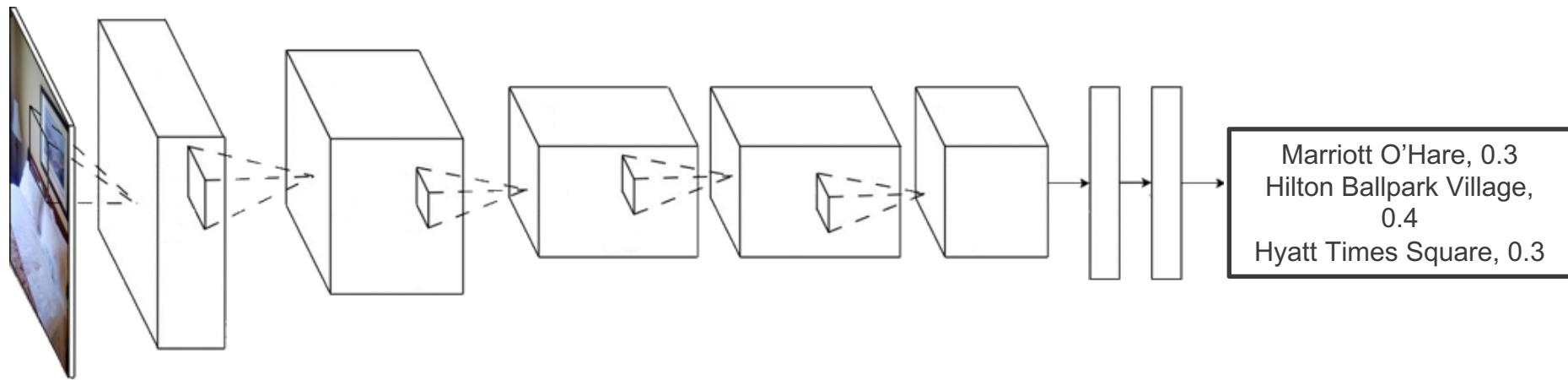


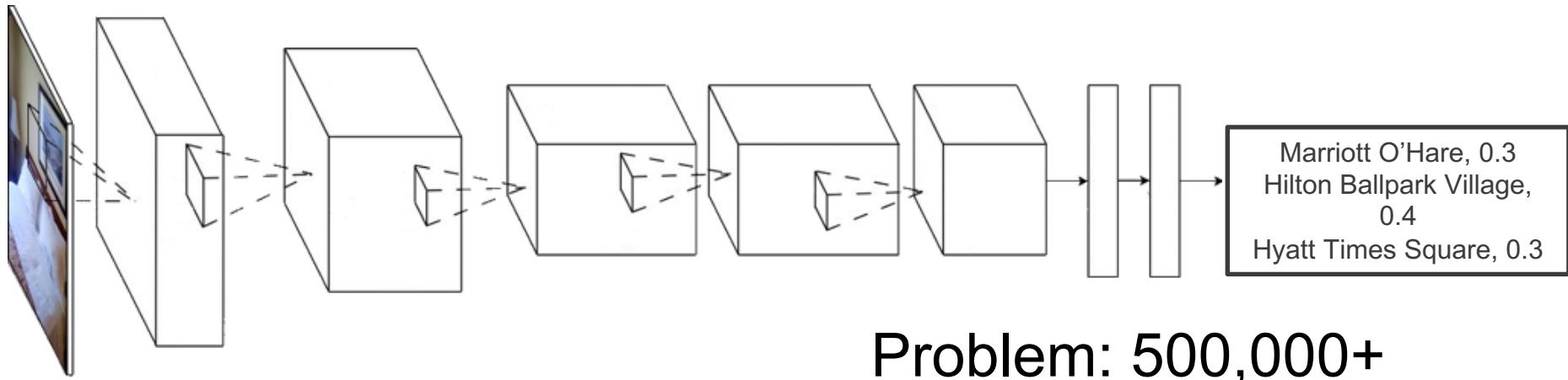
placesCNN





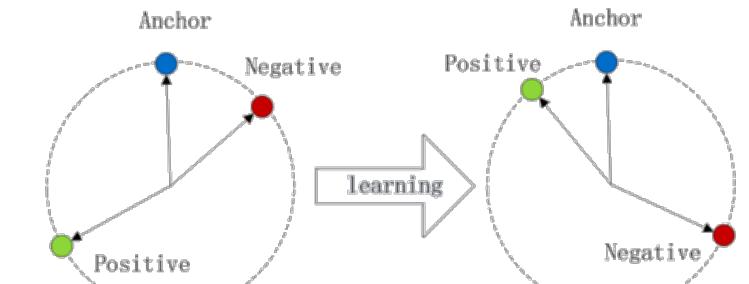
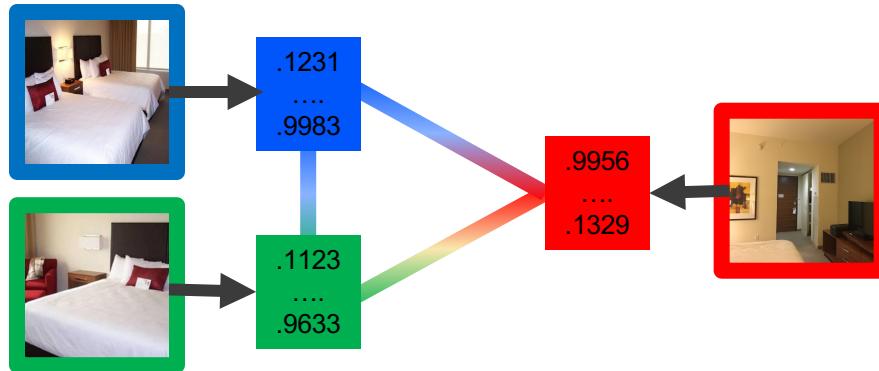
Hotel, 0.7  
Bedroom,  
0.2  
Office, 0.1



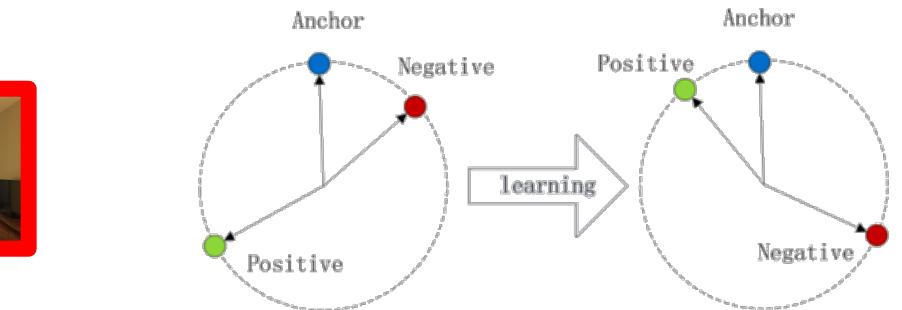
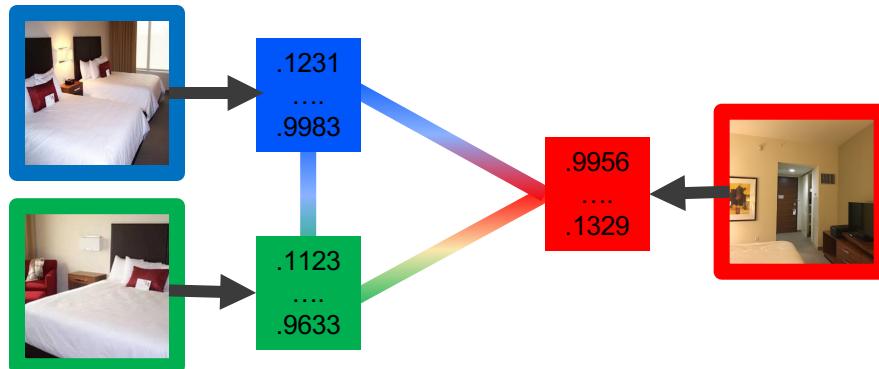


**Problem: 500,000+  
hotels around the  
world...**

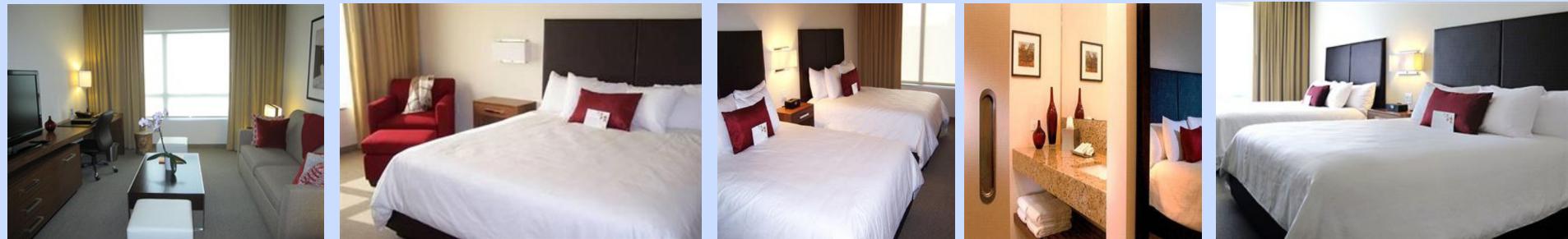
Instead of training network to predict a class, train it to output a code.



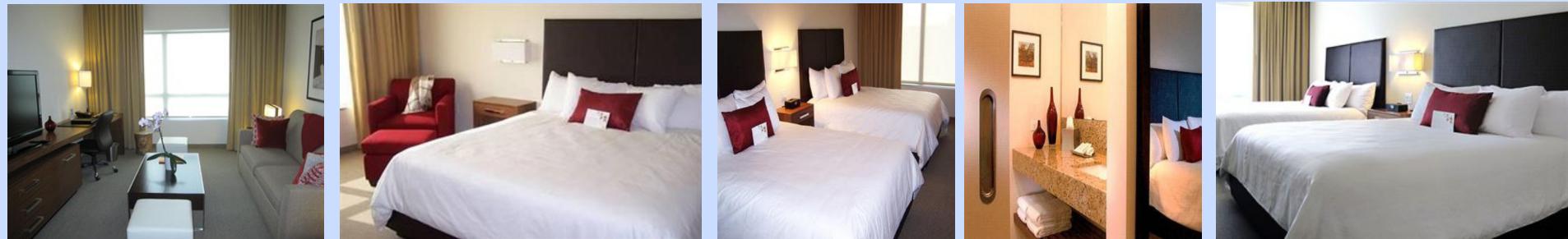
Instead of training network to predict a class, train it to output a code.



Problem: learning an embedding like this takes a LOT of data



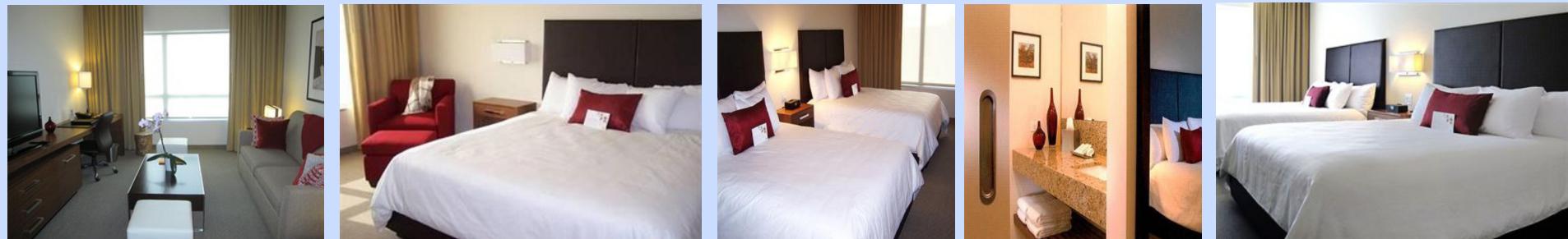
Travel Website Images from a hotel



Travel Website Images from a hotel



Investigative Images



Travel Website Images from a hotel



Investigative Images



TrafficCam Images from the same hotel

# TraffickCam

TraffickCam

- Available for iOS and Android
- Over 150,000 downloads
- 256,575 images from 32,018 hotels
- Average of 212 new images a day
- Combined with scraped data:
  - 2.92 million images
  - 256,939 hotels worldwide

Help fight trafficking by uploading photos of your hotel room. These photos will be used to determine where perpetrators of sex trafficking are committing their crimes.

Holiday Inn St. Louis - Forest Park/Hampton Av

123



You can submit up to four photos by tapping on the camera icons



TraffickCam



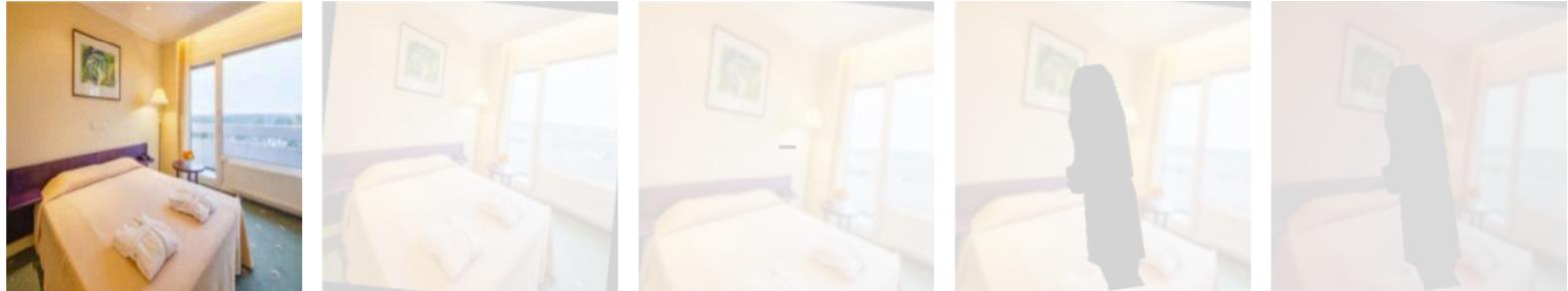
About



Contact

# Our Approach

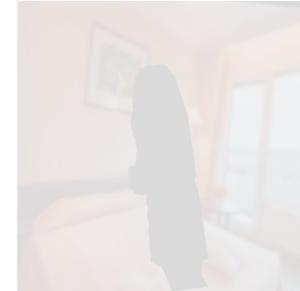
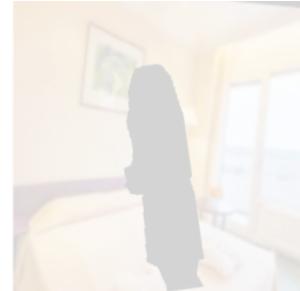
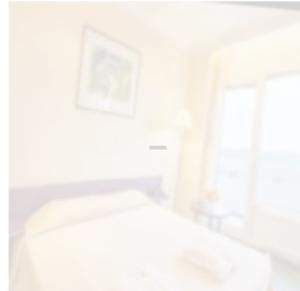
---



- Perform series of data augmentation steps
    - 
    - 
    - 
    -
-

# Our Approach

---



- Perform series of data augmentation steps
    - Rotate
    - 
    - 
    -
-

# Our Approach

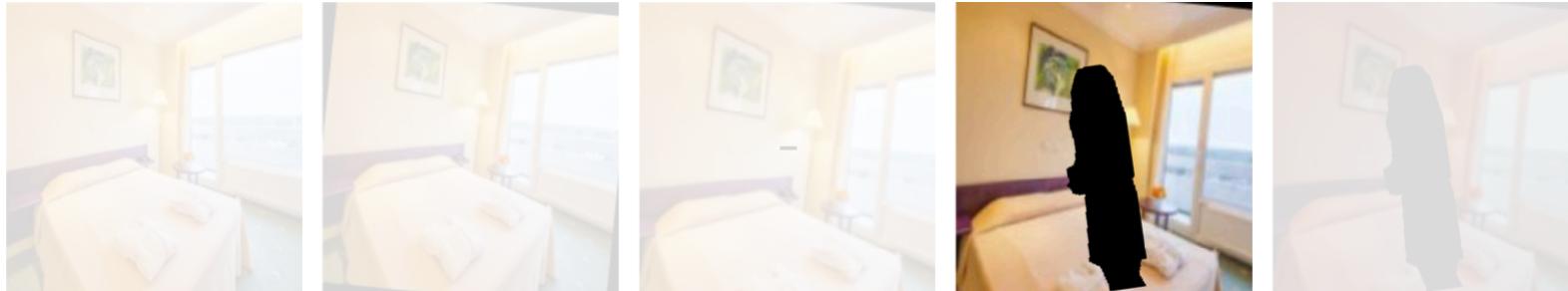
---



- Perform series of data augmentation steps
    - Rotate
    - Crop
    - 
    -
-

# Our Approach

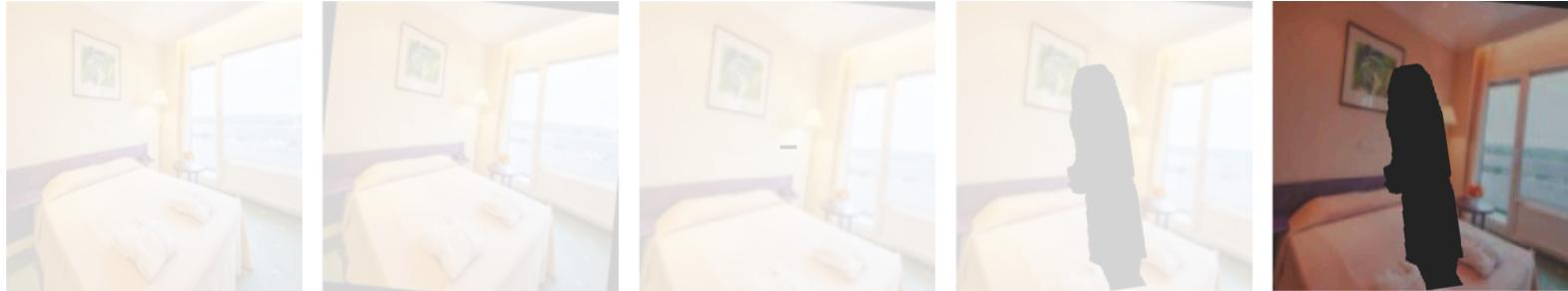
---



- Perform series of data augmentation steps
    - Rotate
    - Crop
    - Occlude
    -
-

# Our Approach

---



- Perform series of data augmentation steps
    - Rotate
    - Crop
    - Occlude
    - Filter
-

# Evaluation

---

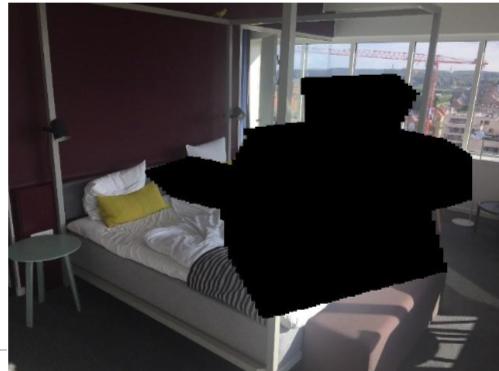
- Try to replicate trafficking investigations



# Evaluation

---

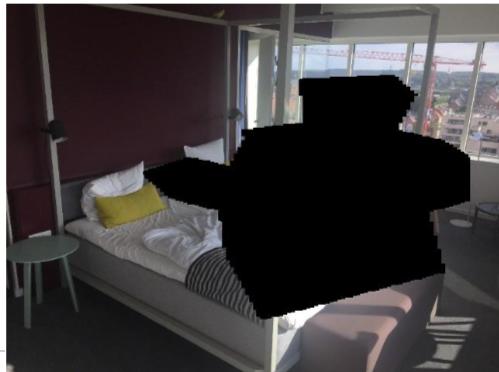
- Try to replicate trafficking investigations
- Always test with TraffickCam images
  - No user overlap between train/test
- 
- 



# Evaluation

---

- Try to replicate trafficking investigations
- Always test with TraffickCam images
  - No user overlap between train/test
- Varying levels of occlusions
- 



# Evaluation

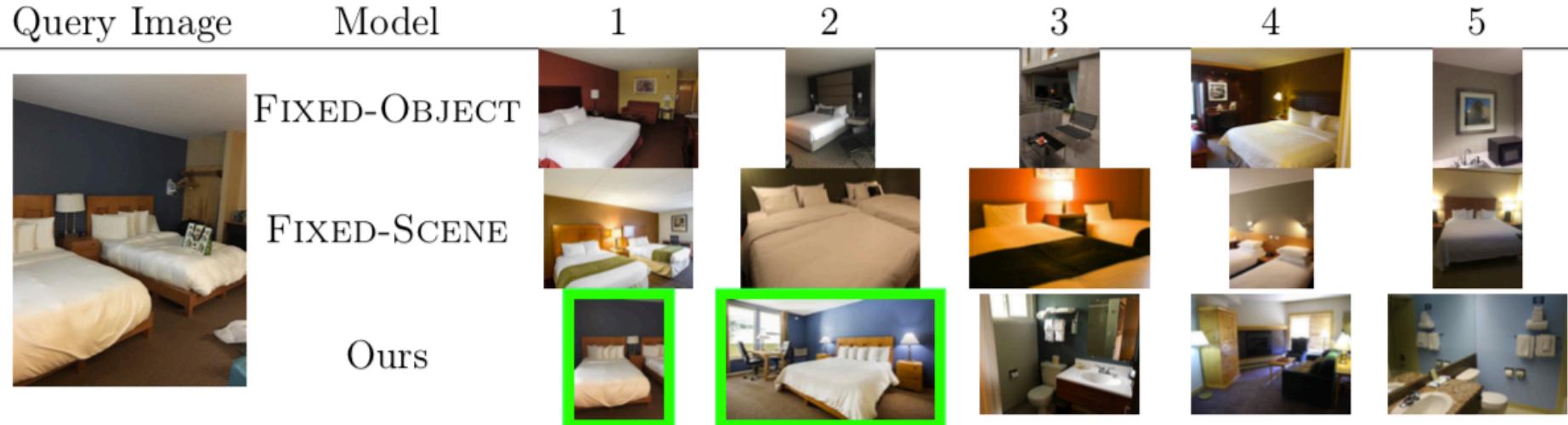
---

- Try to replicate trafficking investigations
- Always test with TraffickCam images
  - No user overlap between train/test
- Varying levels of occlusions
- Test hotel instance and hotel chain



# Evaluation

	Instance		
	K=1	10	100
FIXED-OBJECT	0.8	0.9	1.3
FIXED-SCENE	0.2	0.8	2.4
Ours	<b>8.1</b>	<b>17.6</b>	<b>34.8</b>



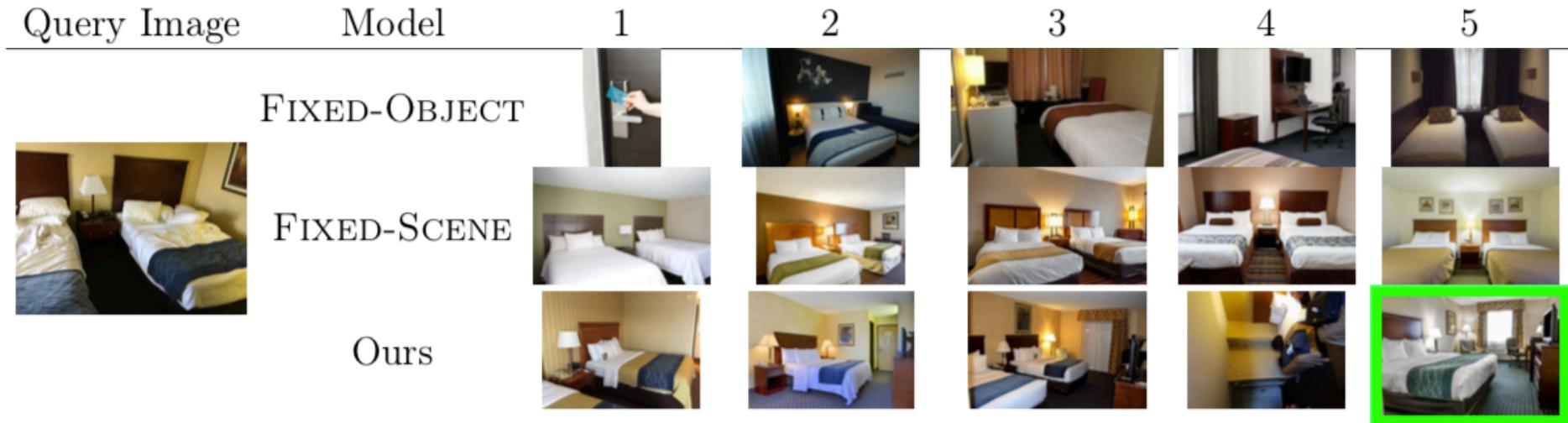
# Evaluation

	Instance		
	K=1	10	100
FIXED-OBJECT	0.8	0.9	1.3
FIXED-SCENE	0.2	0.8	2.4
Ours	<b>8.1</b>	<b>17.6</b>	<b>34.8</b>



# Evaluation

	Instance		
	K=1	10	100
FIXED-OBJECT	0.8	0.9	1.3
FIXED-SCENE	0.2	0.8	2.4
Ours	<b>8.1</b>	<b>17.6</b>	<b>34.8</b>



TraffickCam About Download Take Action Exchange Initiative Contact Dashboard Logout

## Search

 Edit

Mauritius

Include Keywords

Exclude Keywords  
Separate keywords by commas

Search with Image

Search without Image

Google Map data ©2018 Google Terms of Use

