Hotels Against Trafficking

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Motivation

In the United States alone:

- Approximately 75-80% of human trafficking and slavery is for sex
- 30,000 people die each year while being trafficked for sex from neglect, abuse, disease, or torture
- Nearly 20,000 victims are sold and trafficked each year. This number includes the victims who are as young as 5 and 6 years of age
- There have been approximately 100,000 to 150,000 sex slaves since 2001

Source: The Disturbing Reality of Human Trafficking and Children (Dec 18, 2016)

Objectives

Problem:

- Commercial sex within hotels and motels are most frequently advertised through online platforms (Backpage.com, Eros.com, etc.)

Goal:

- Automatically classifying different hotel chains using Deep Learning

Source: The National Human Trafficking Hotline

Images

3 hotel chains:

- Two-star hotel chain, Comfort Inn
- Three-star hotel chain, Best Western
- Four-star hotel chain, Hilton

Training set:

- 12,000 (128,128,3) images

Validation set:

- 3,000 (128,128,3) images

Test sets:

- Images are augmented with person-shaped masks of varying size splitted into 4 categories; each contains the same:
  - 388 (128,128,3) Comfort Inn images
  - 384 (128,128,3) Best Western images
  - 249 (128,128,3) Hilton images

Source: A Global Hotel Recognition Dataset

Test Sets

Unoccluded

Low Occlusions

Medium Occlusions

High Occlusions

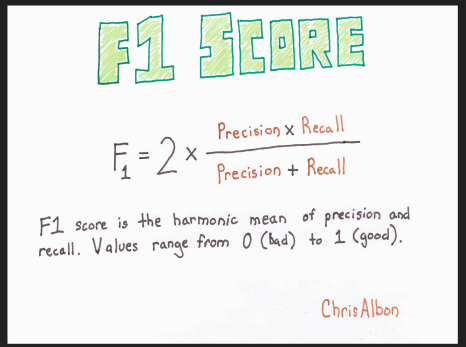
Best Model & Metrics

Best Model:

- VGG-16 Deep Convolutional Neural Network pre-trained on ImageNet database
- Last 5 layers unfrozen to allow for additional training on hotel chain database

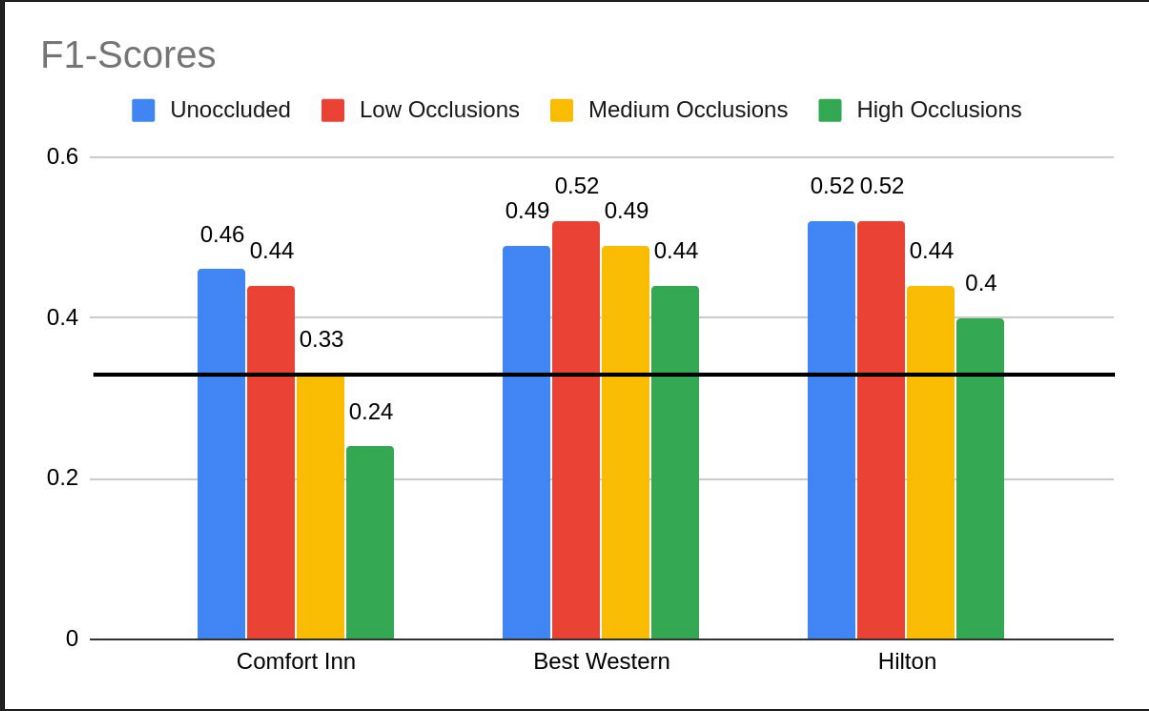
Metrics:

- Precision:
  - What proportion of positive identifications was actually correct?
- Recall:
  - What proportion of actual positives was identified correctly?
- F1-Score:
  - The harmonic mean of Precision and Recall



Source: [Classification: Precision and Recall]

Results


F1-Scores
Unoccluded
Low Occlusions
Medium Occlusions
High Occlusions
0.6
0.4
0.2
0
0.46
0.44
0.33
0.24
0.49
0.52
0.49
0.44
0.52
0.52
0.44
0.4
Comfort Inn
Best Western
Hilton

Difficulties

Comfort Inn

Best Western

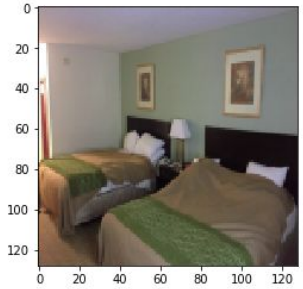
Hilton

Demo - Comfort Inn

```
1 demo.demo("Comfort_Inn_1.jpg", model)
```

Original Image:

Processed Image:

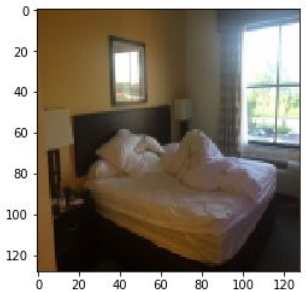


Prediction: Comfort Inn

```
1 demo.demo("Comfort_Inn_2.jpg", model)
```

Original Image:

Processed Image:

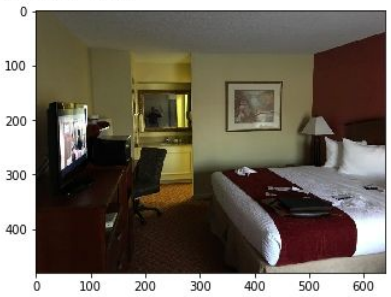


Prediction: Comfort Inn

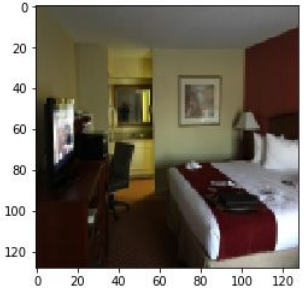
Demo - Best Western

```
1 demo.demo("Best_Western_1.jpg", model)
```

Original Image:



Processed Image:

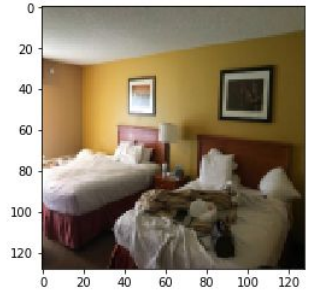


Prediction: Hilton

```
1 demo.demo("Best_Western_2.jpg", model)
```

Original Image:

Processed Image:

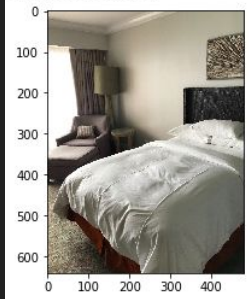


Prediction: Best Western

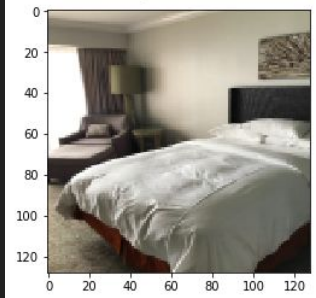
Demo - Hilton

```
1 demo.demo("Hilton_1.jpg", model)
```

Original Image:



Processed Image:

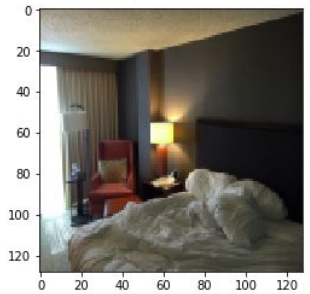


Prediction: Hilton

```
1 demo.demo("Hilton_2.jpg", model)
```

Original Image:

Processed Image:



Prediction: Hilton

Next Steps for Future Improvements

- Further fine-tuning the best model
- Further fine-tuning other Deep Convolutional Neural Network models

Future Plans

- Automatically classifying different hotels and motels using Deep Learning

Questions?

THANK YOU!

Sources

- https://keras.io/models/sequential/
- https://keras.io/applications/
- https://keras.io/callbacks/
- https://keras.io/layers/core/
- https://keras.io/layers/normalization/
- https://keras.io/utils/
- https://scikit-learn.org/stable/modules/generated/sklearn.model_selection.train_test_split.html
- https://scikit-learn.org/stable/modules/model_evaluation.html#classification-metrics
- https://pypi.org/project/opencv-python/

Contact Information

GitHub: https://github.com/nt-ds/hotels-against-trafficking

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