Combating Human Trafficking from **Image Classification** of the **Hotel-ID dataset**

Computer Vision Project 2021/2022

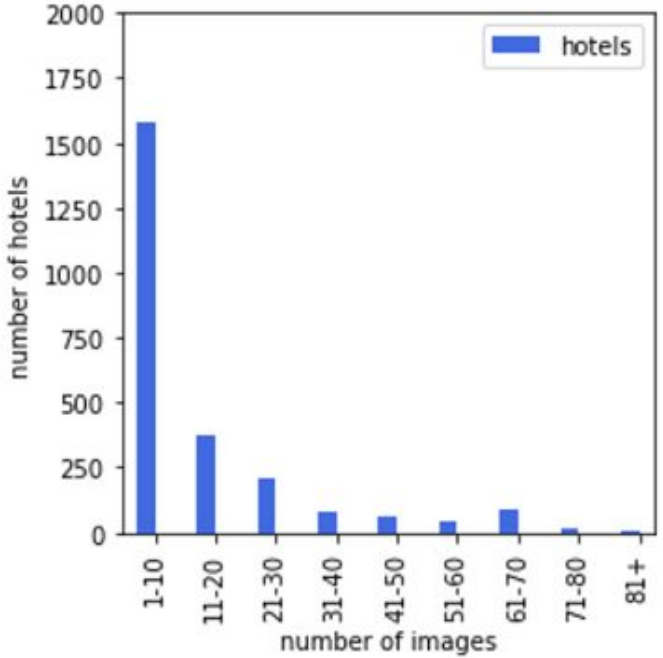
Paper

Problem

Hotel ID: **32248**

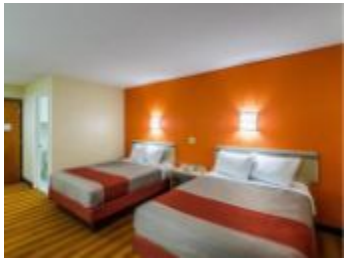
Dataset

- 97 527 images (~25GB)
- 7770 different classes (hotel ids)



Problem characteristics

High Intra-class Variation



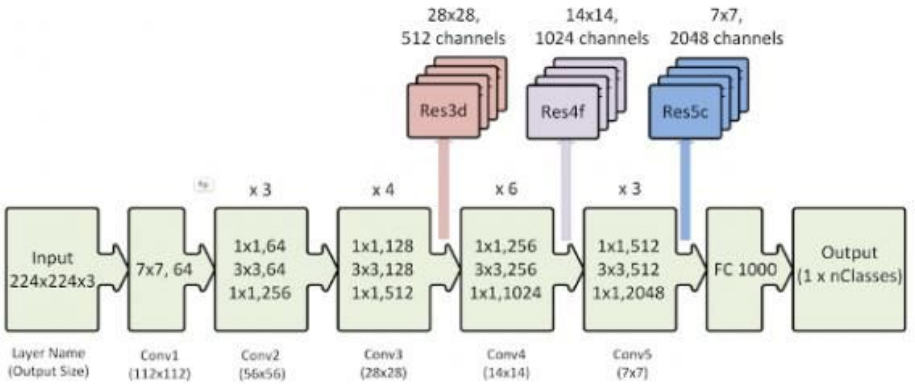
Low Inter-class Variation

Paper’s Approach - Image Processing

- Resize to 256x256
- Randomly Flip Horizontally
- Random Rotation (+/- 30º)
- Color Jittering

Paper’s Approach - Model

ResNet50 pre-trained on ImageNet dataset



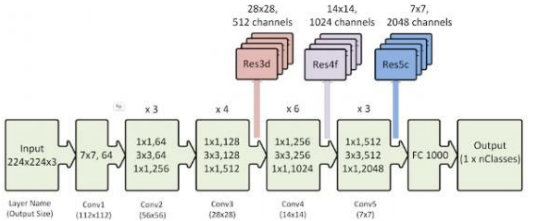
- Dropout of 50%
- Fully Connected Layer
- Label Smoothing
- SGD Optimizer

Paper’s Approach – Classification & Results

Recall@1	Recall@10	Recall@100	Mean Average Precision@5
49.3%	68.8%	84.8%	55.1%

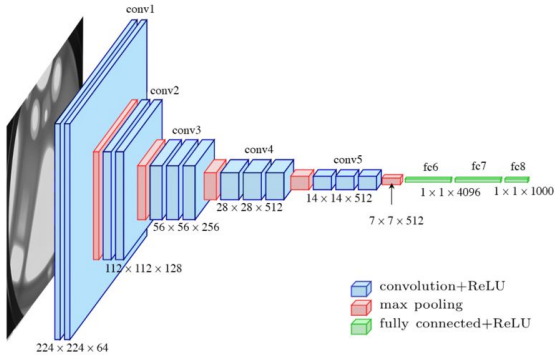
Ideal Scenario

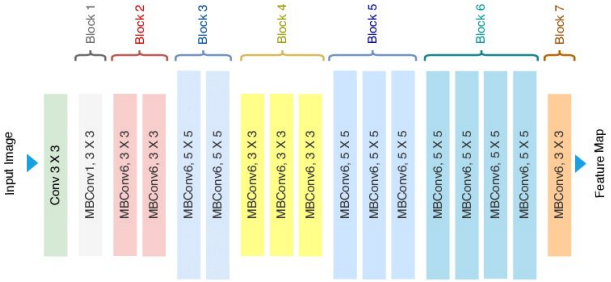
Various Models



ResNet Models

VGG Models





EfficientNet Models

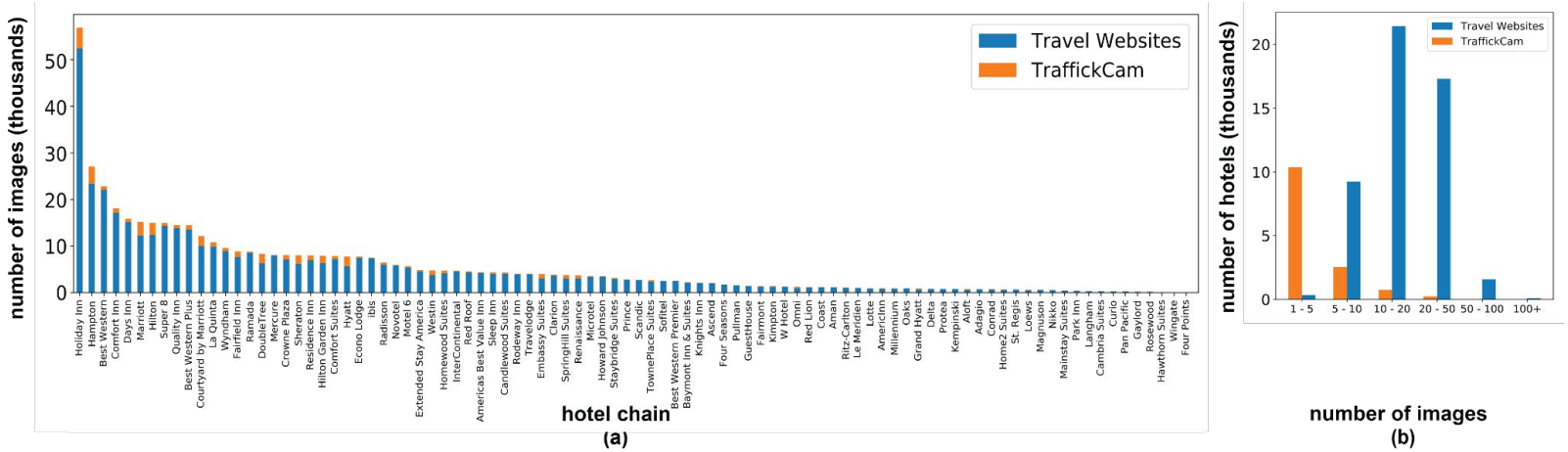
Realistic Data

Human Posture Silhouettes

https://www.kaggle.com/deepshah16/silhouettes-of-human-posture

More Data

Hotels-50k Dataset



https://paperswithcode.com/dataset/hotels-50k

Reality

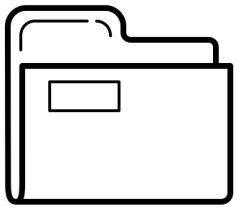
Constraints

- Large Dataset (> 25GB)
- GPU intensive

kaggle

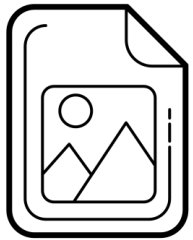
Paperspace

Dataset Optimization



>25 GB

resize to 128x128



convert to HDF5 file

4.14 GB

Attempts

Optimizer Functions

- Adam optimizer
- Stochastic Gradient Descent

Model Backbone

- ResNet-50 V1
- ResNet-152 V1
- ResNet-50 V2
- ResNet-152 V2
- MobileNet V1
- MobileNet V2
- EfficientNet B1
- EfficientNet V2
- Inception V3

Additional Dense Layer

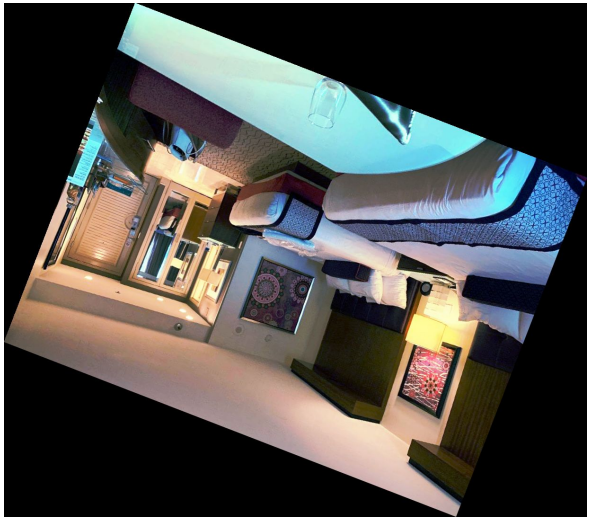
- None
- 64 nodes
- 128 nodes
- 256 nodes
- 512 nodes
- 1024 nodes

Intermediate Layers

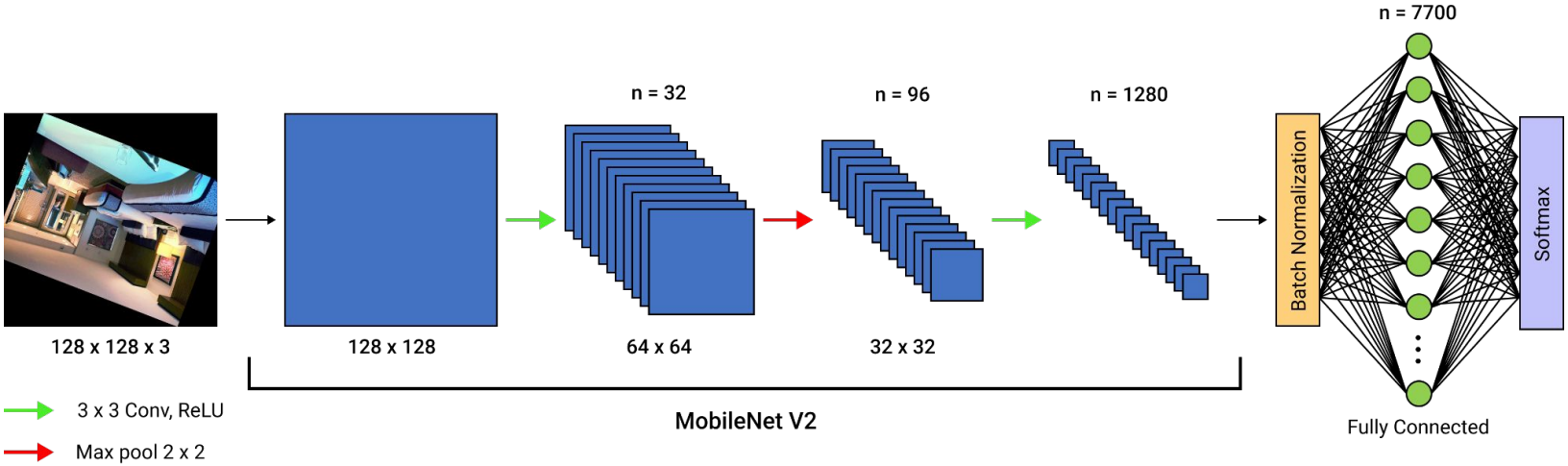
- Dropouts
- Regulizers
- Pooling Layers
- Flatten Layer
- BatchNormalization Layer

Final Model – Image Augmentation

- Random **Horizontal Flip**
- Random **Vertical Flip**
- Random **Rotation** between +/- 40º
- Random **Contrast**



Final Model – Model



- **Drop Out** of 0.5
- **L2 regularization** with value of 0.0001

Final Model – Results

	Accuracy	Top 5 Accuracy	Top 10 Accuracy
Project Model[1]	**14.89%**	**24.42%**	**29.15%**
Hotel-50k Model[2]	8.1%	17.6%	34.8%
Control (random)	0.013%	0.64%	0.129%

[1] Trained for 40 Epochs (~6h)

[2] Stylianou, Abby, Hong Xuan, Maya Shende, Jonathan Brandt, Richard Souvenir, and Robert Pless. "Hotels-50k: A global hotel recognition dataset." In *Proceedings of the AAAI Conference on Artificial Intelligence*, vol. 33, no. 01, pp. 726-733. 2019.

Q&A