Working with Large Sets of Images in MATLAB Just Got Easier

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Why Are We Talking About Large Sets of Images?

- 100 hours of video uploaded to YouTube per minute\(^1\)
- Explosive increase in number of imaging devices
  - Webcams
  - Smartphone Cameras
  - IP Cameras
  - Industrial Cameras

Challenges Posed by Large Sets of Images

1. How do I import several thousand images into MATLAB?
2. Can I find patterns or models to represent my image data?
3. How do I test and visualize my algorithm on many images?
4. What if my desktop or laptop doesn’t have enough computing power?
5. Can I acquire large sets of images using MATLAB?

**Goal:** Show you **new functionality** in MATLAB to **augment existing workflows** to solve these challenges
Problem: Image Category Classification

Given a large set of images of cars, planes and motorbikes

How to model the data to recognize which category an image belongs to?

Data from Caltech 101: L. Fei-Fei, R. Fergus and P. Perona. Learning generative visual models from few training examples: an incremental Bayesian approach tested on 101 object categories. IEEE, CVPR 2004, Workshop on Generative-Model Based Vision. 2004
http://www.vision.caltech.edu/Image_Datasets/Caltech101/
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Machine Learning

A machine learning algorithm takes examples of inputs and outputs associated with a task and produces a program that can perform the task.

If brightness > 0.5
then ‘hat’
If edge_density < 4 and major_axis > 5
then “boat”
...

model = fitcsvm (image_features, label)
Machine Learning Workflow Using Images

- **Training Data**
- **Feature Extraction**
- **Learning or Modelling**

**Input Image** → **Feature Extraction** → **Classification**

Classifier / Model → ‘hat’
Machine Learning Workflow Using Images

Training Data

imageSet

Feature Extraction

bagOfFeatures

Learning or Modelling

trainImageCategoryClassifier

Classifier / Model

‘hat’

Input Image

imageSet

Feature Extraction

Classification

evaluate
Everyday Applications of Machine Learning
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Additional Algorithms Available*

- Cascade Object Detector
  - Pre-trained models for faces, facial features etc.
  - Framework for training

- People Detector

- Optical Character Recognition

* Requires Computer Vision System Toolbox
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Parallel Computing with MATLAB

MATLAB Distributed Computing Server

MATLAB
Parallel Computing Toolbox
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Thank You !