Working with Large Sets of Images in MATLAB Just Got Easier

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Product Marketing Manager: Computer Vision

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

1- KPCB 2013 Internet Trends http://www.kpcb.com/blog/2013-internet-trends

Challenges Posed by Large Sets of Images

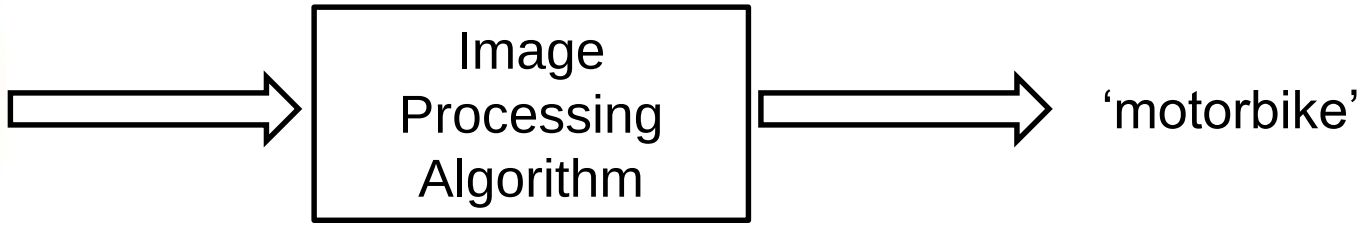
1. How do I import several thousand images into MATLAB?
2. Can I find patterns or models to represent my image data?
3. How do I test and visualize my algorithm on many images?
4. What if my desktop or laptop doesn't have enough computing power?
5. Can I acquire large sets of images using MATLAB ?

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 ?



‘motorbike’

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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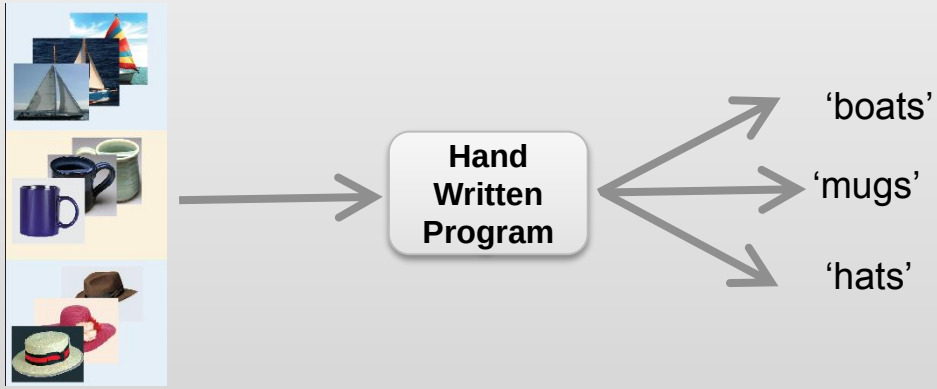
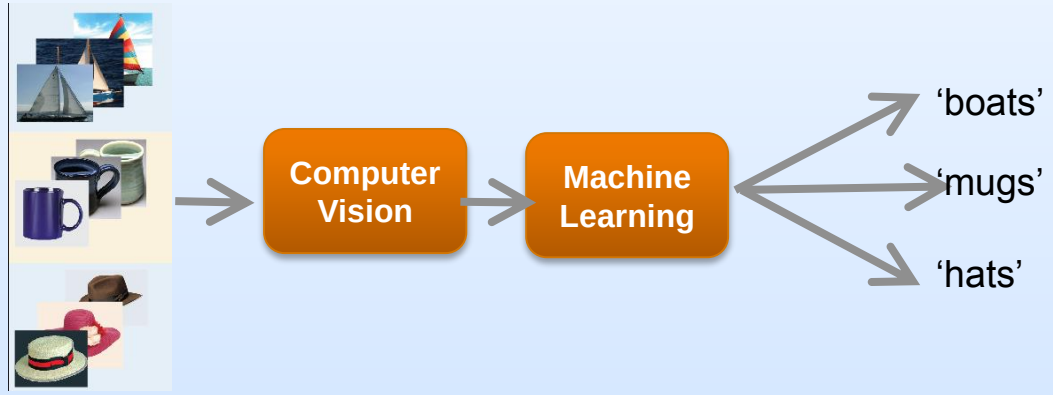
Machine Learning

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"
…

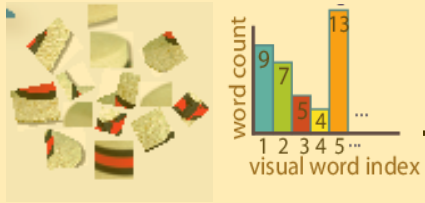


$$model = fitcsvm(image\_features, label)$$

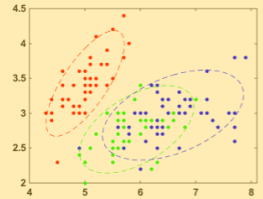
Machine Learning Workflow Using Images

Training Data

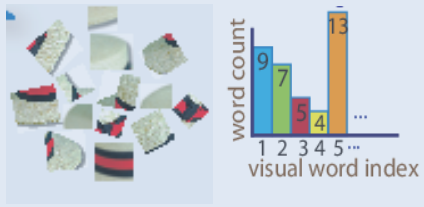
Feature Extraction



Learning or Modelling



Training



Classifier / Model → ‘hat’

Input Image → Feature Extraction → Classification

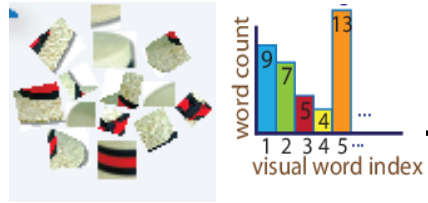
Classification

Machine Learning Workflow Using Images

Training Data

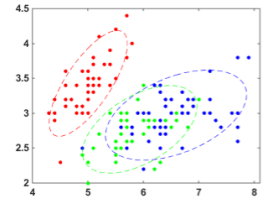
`imageSet`

Feature Extraction



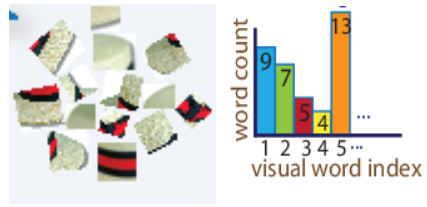
`bagOfFeatures`

Learning or Modelling



`trainImageCategoryClassifier`

`bagOfFeatures`



Classifier / Model

‘hat’

`evaluate`

Input Image

`imageSet`

Feature Extraction

Classification

Everyday Applications of Machine Learning

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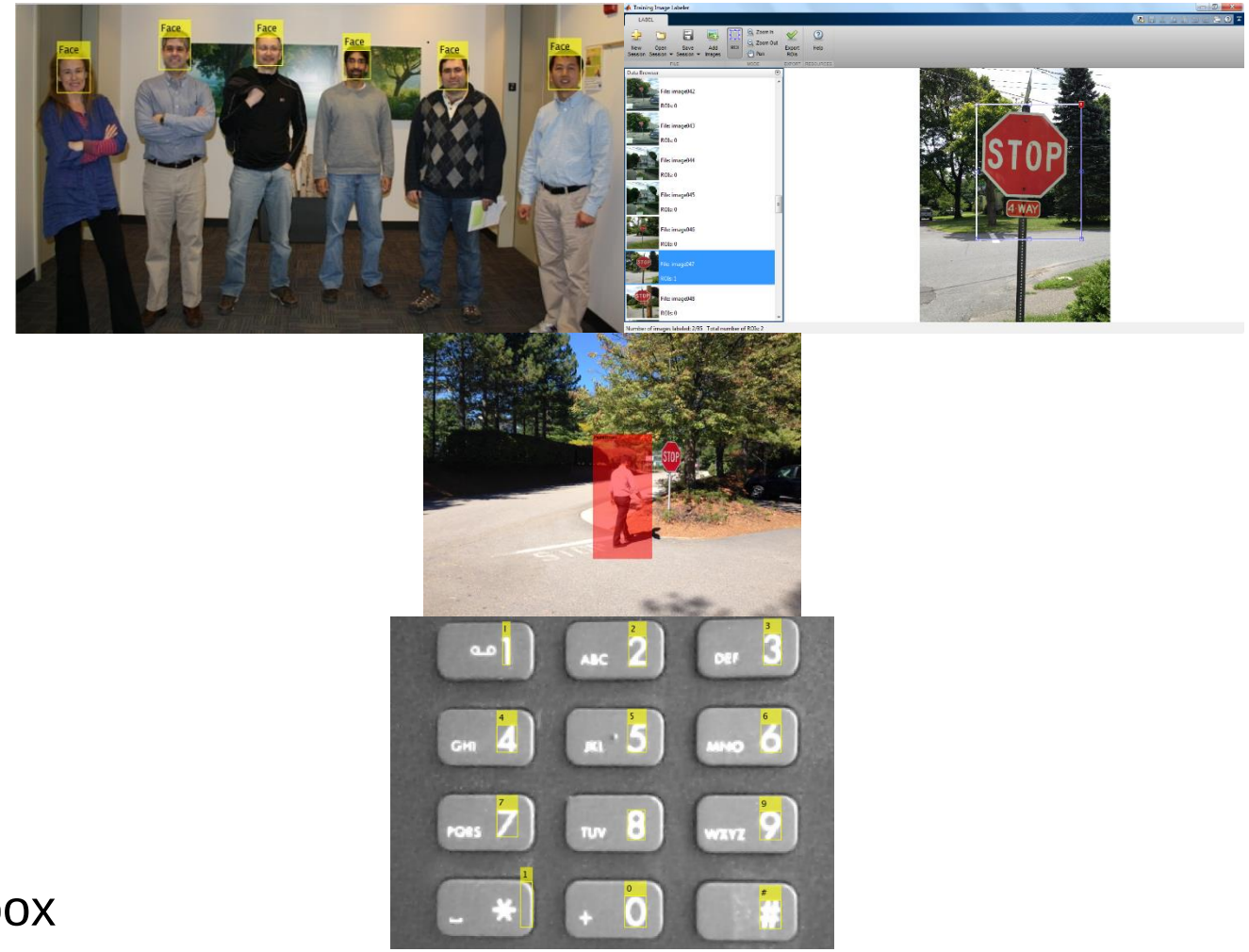
Additional Algorithms Available*

- 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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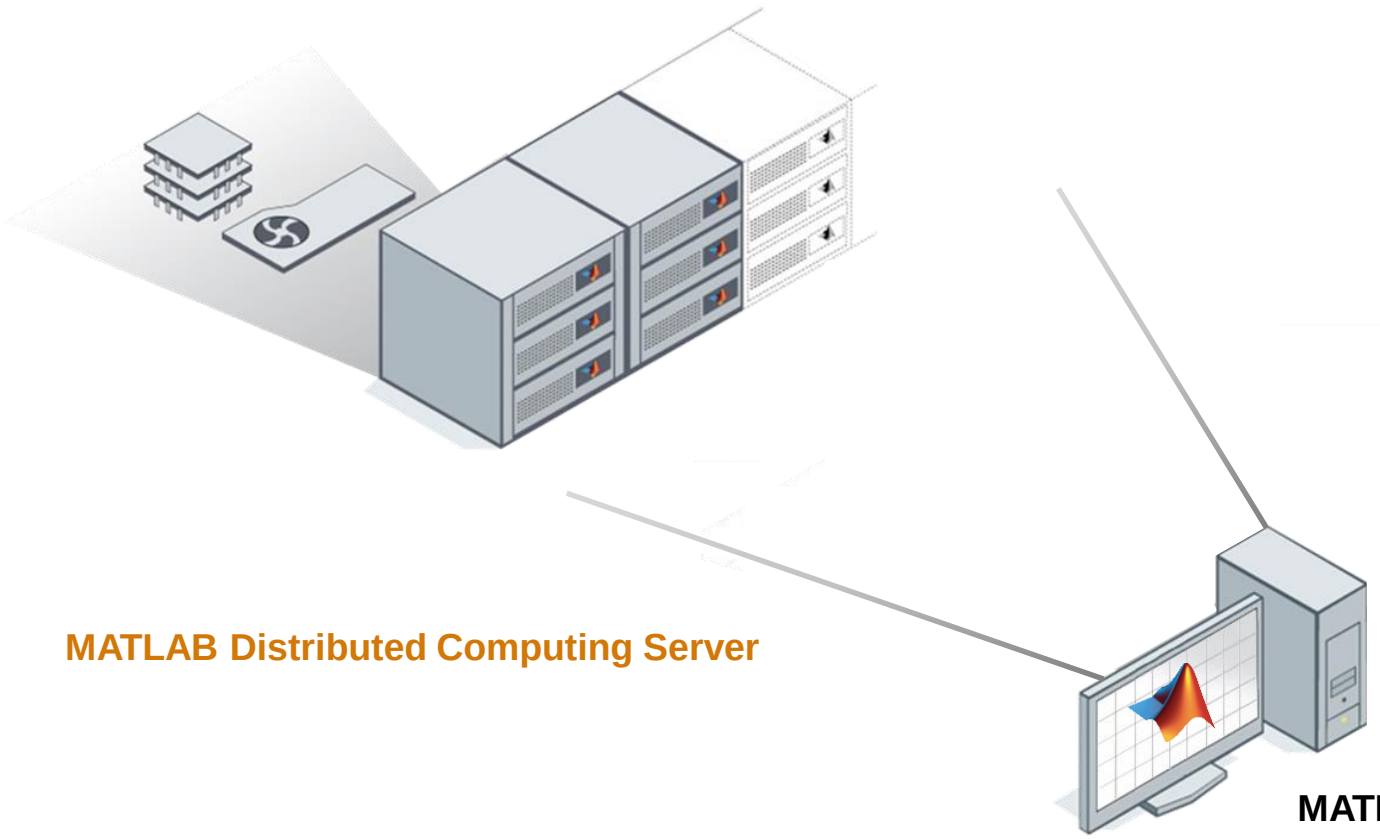
Parallel Computing with MATLAB



MATLAB Distributed Computing Server

MATLAB

Parallel Computing Toolbox

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Thank You !