Homework 4

Computer Vision, 2018 Spring

May 3, 2018

Instructions

- Deadline: 2018/5/18 11:59:59 pm
- Hand in: through E3
- Tasks:

    1. Tiny images representation + nearest neighbor classifier
       (accuracy of about 18-25%)
    2. Bag of SIFT representation + nearest neighbor classifier
       (accuracy of about 50-60%)
    3. Bag of SIFT representation + linear SVM classifier
       (accuracy of about 60-70%)

    Extra bonus: try to use deep learning! (you can choose any type of neural network model)

- You need to evaluate the accuracy of your model.
- You can use
  http://www.vlfeat.org/download.html
  http://www.vlfeat.org/matlab/matlab.html

Goal: builds a classifier to categorize images into one of 15 scene types!

Example scenes from each category in the 15 scene dataset. Figure from **Lazebnik et al. 2006**.

Tiny images representation

- Simply resizes each image to a small, fixed resolution (16*16).

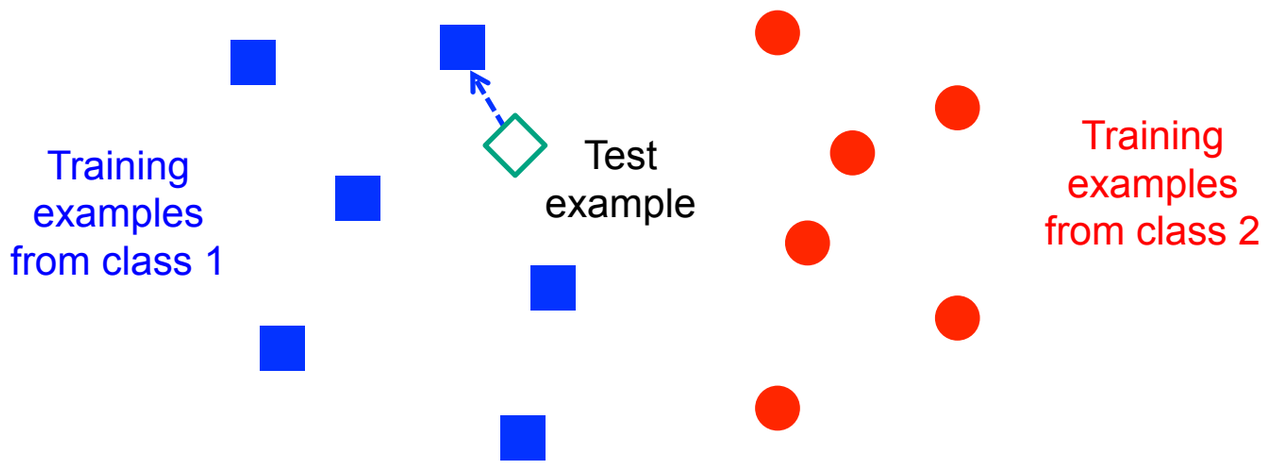
- You can either resize the images to square while ignoring their aspect ratio or you can crop the center square portion out of each image.

- The entire image is just a vector of 16*16 = 256 dimensions.

- You can use functions (MATLAB): imread, imresize

Nearest neighbor classifier

- Instead of 1 nearest neighbor, you can vote based on k nearest neighbors which will increase performance (although you need to pick a reasonable value for k).

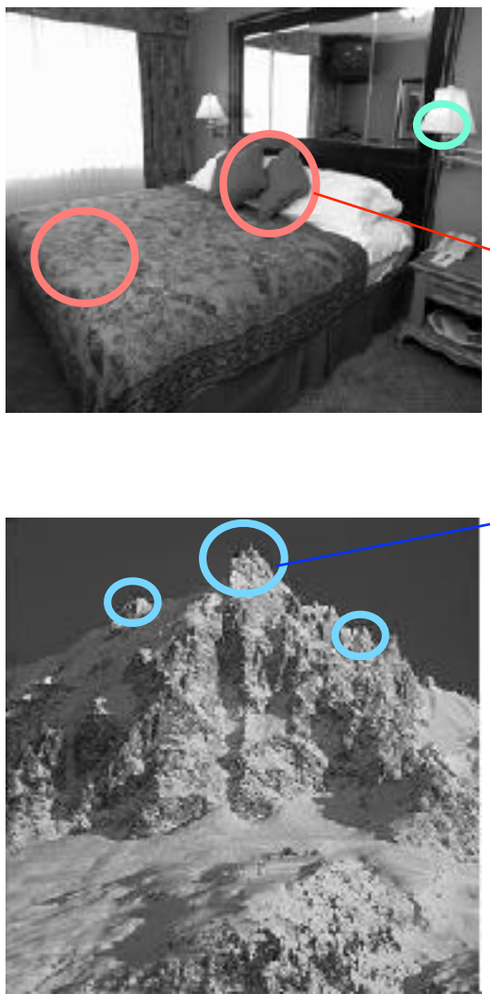


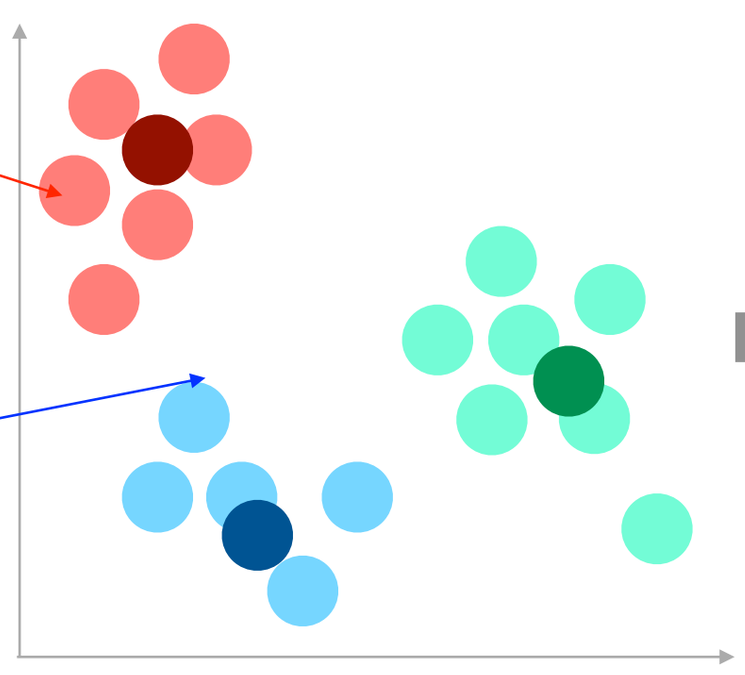
f(**x**) = label of the training example nearest to **x**

- All we need is a distance function for our inputs
- No training required!

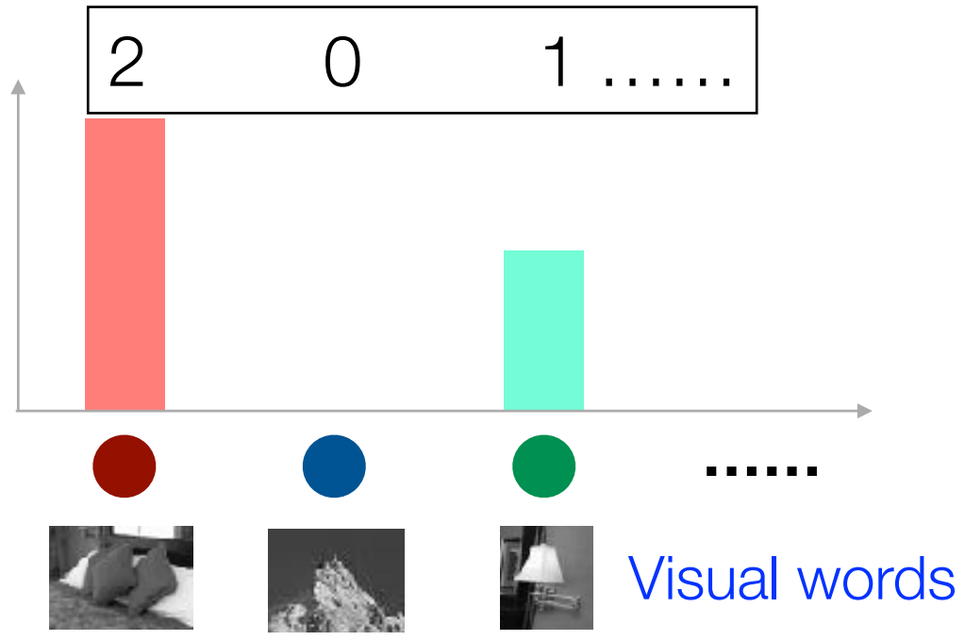
Bag of SIFT representation

Resized images → SIFT → Vector Quantization
Bag-of-words model



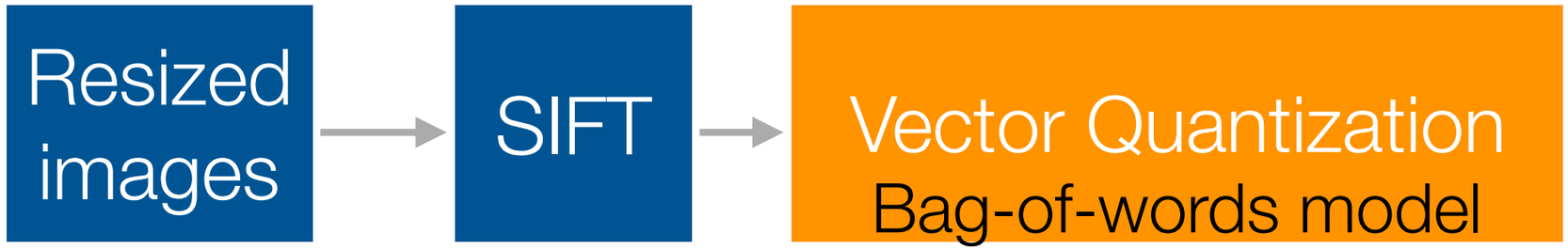


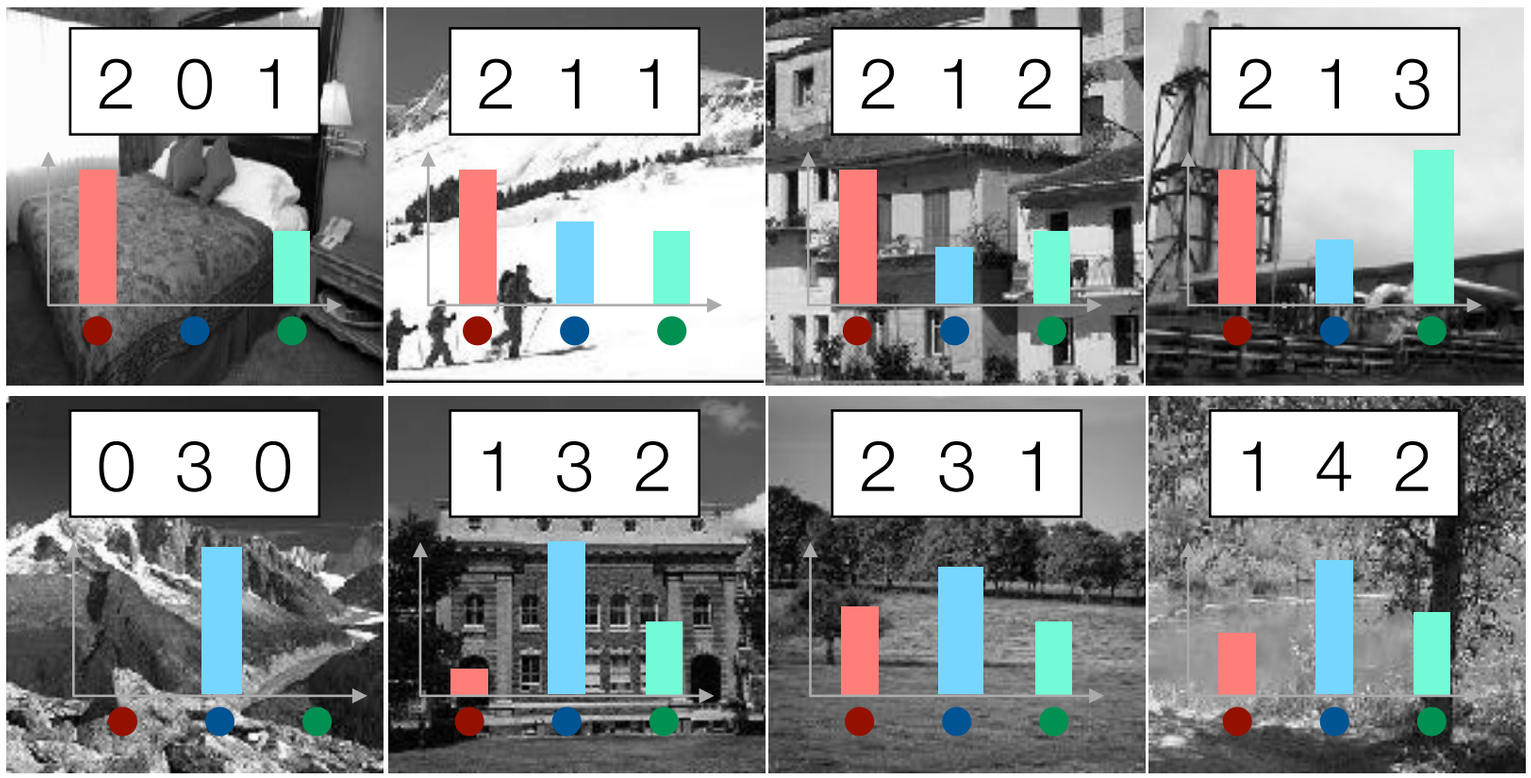
K-means cluster



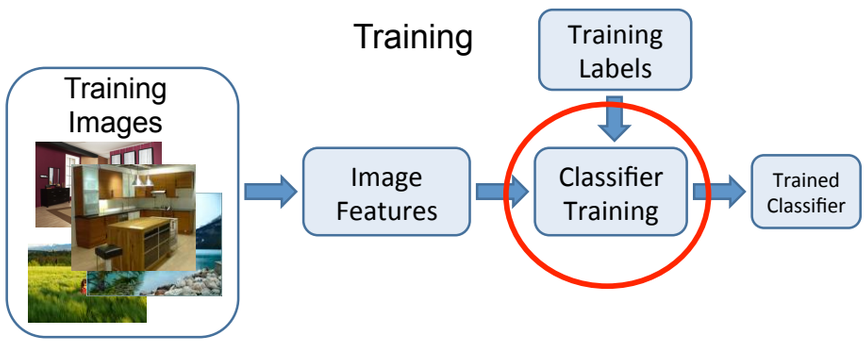
Histogram

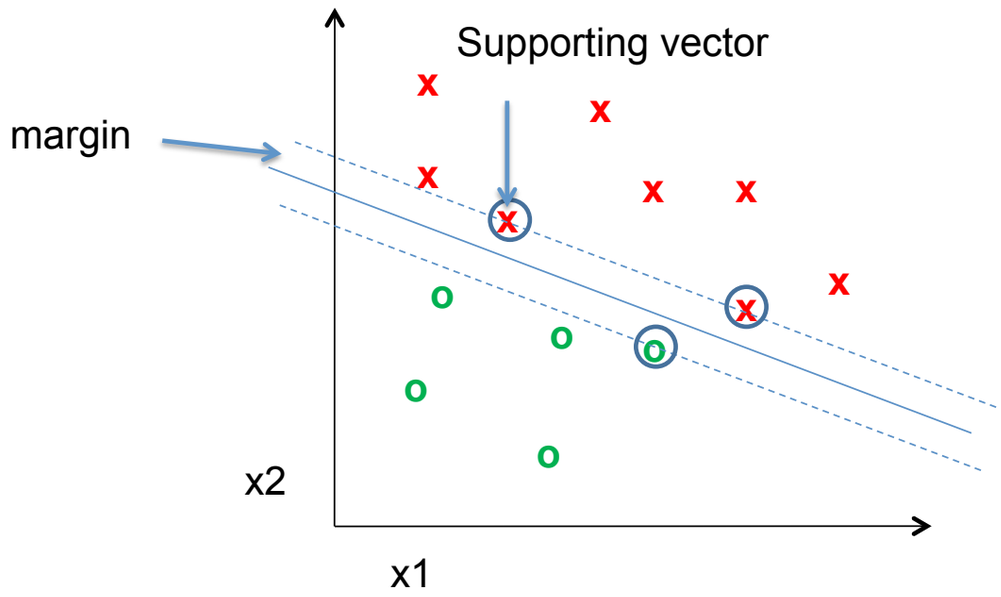
Bag of SIFT representation





SVM





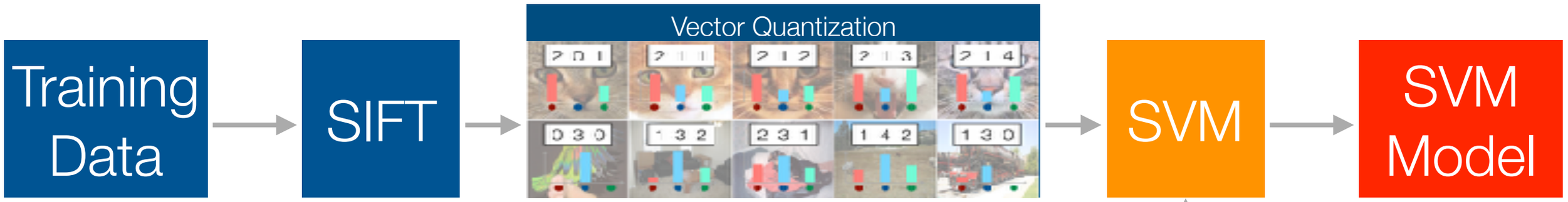
- Find a *linear function* to separate the classes:

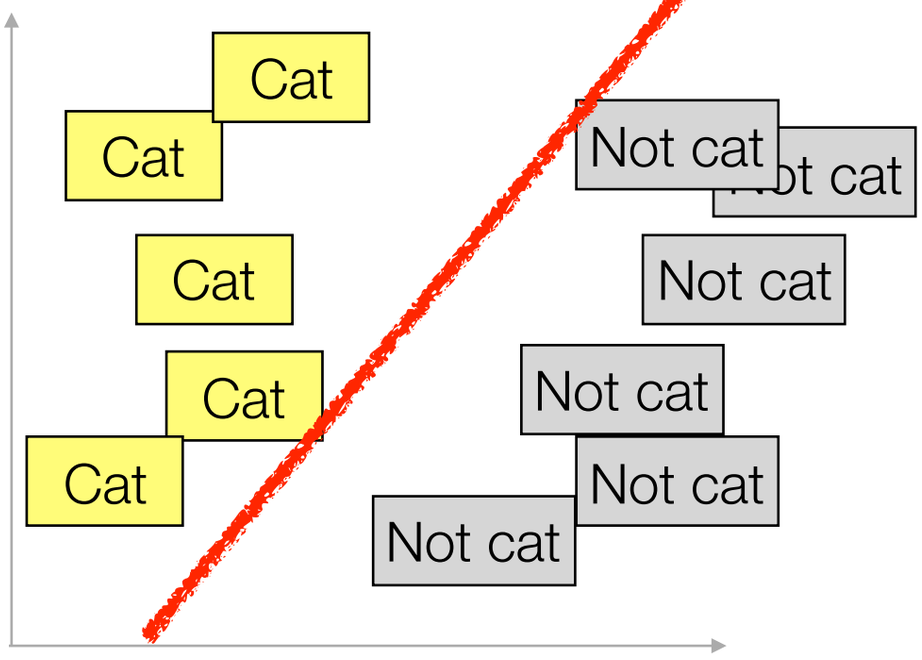
$$f(\mathbf{x}) = \mathrm{sgn}(\mathbf{w} \cdot \mathbf{x} + b)$$

- You can use functions (MATLAB): fitcsvm, predict

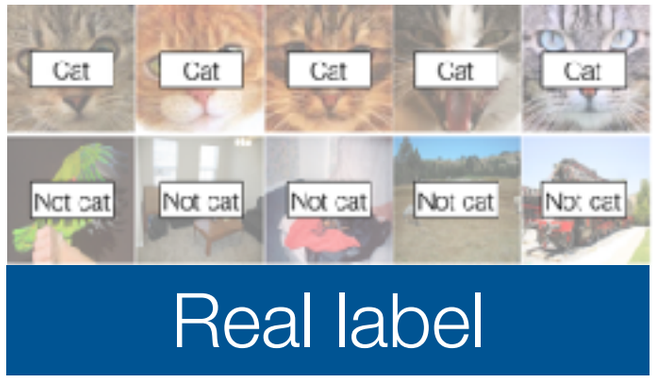
Example: cat facial recognition

Training Phase

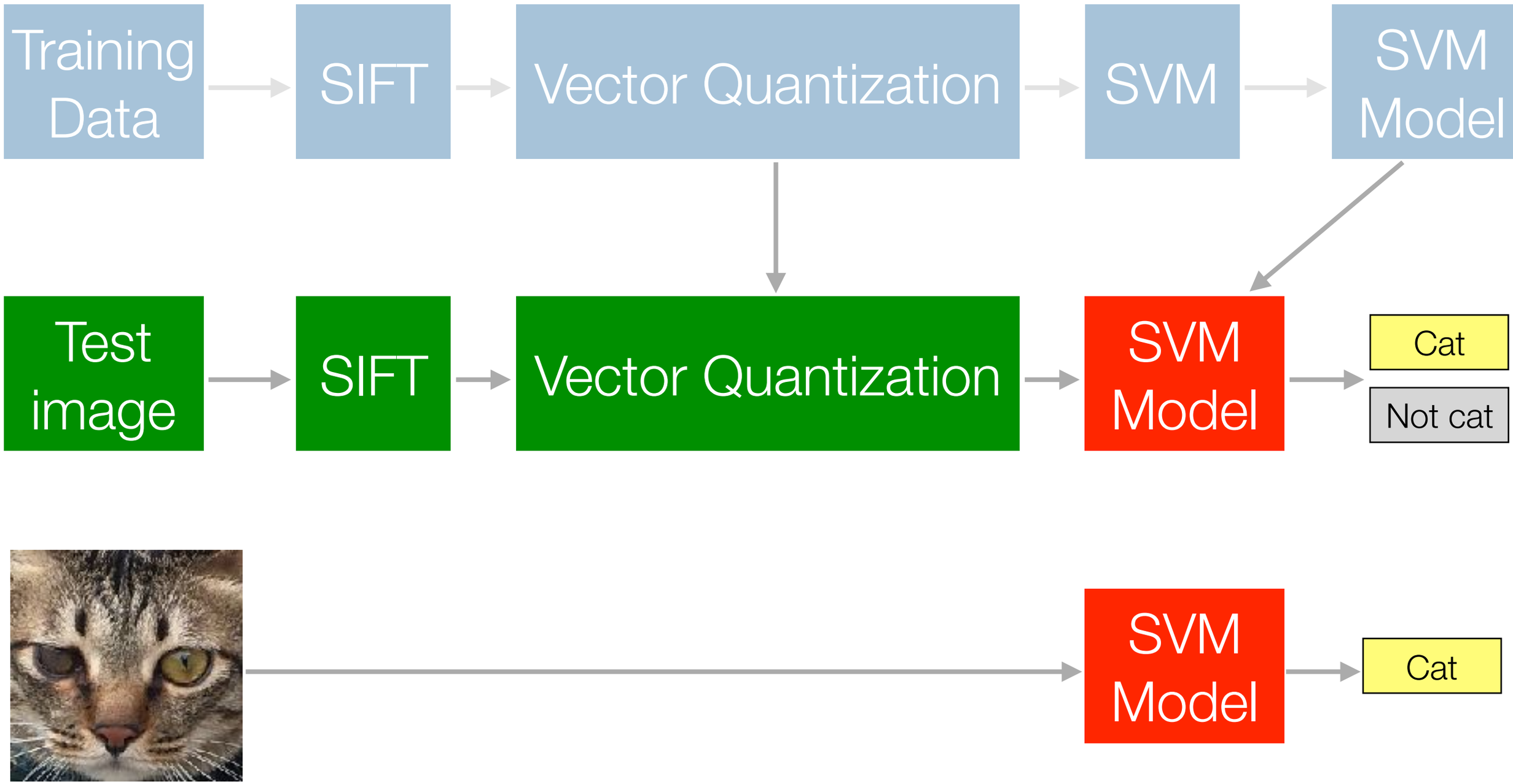




SVM model



Example: cat facial recognition **Detection Phase**



Example: Convolutional Neural Network (CNN)