

Homework 5

Computer Vision, 2021 Spring

Instructions

- Deadline: **2021/06/04 23:55**
 - Hand in: through New 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!



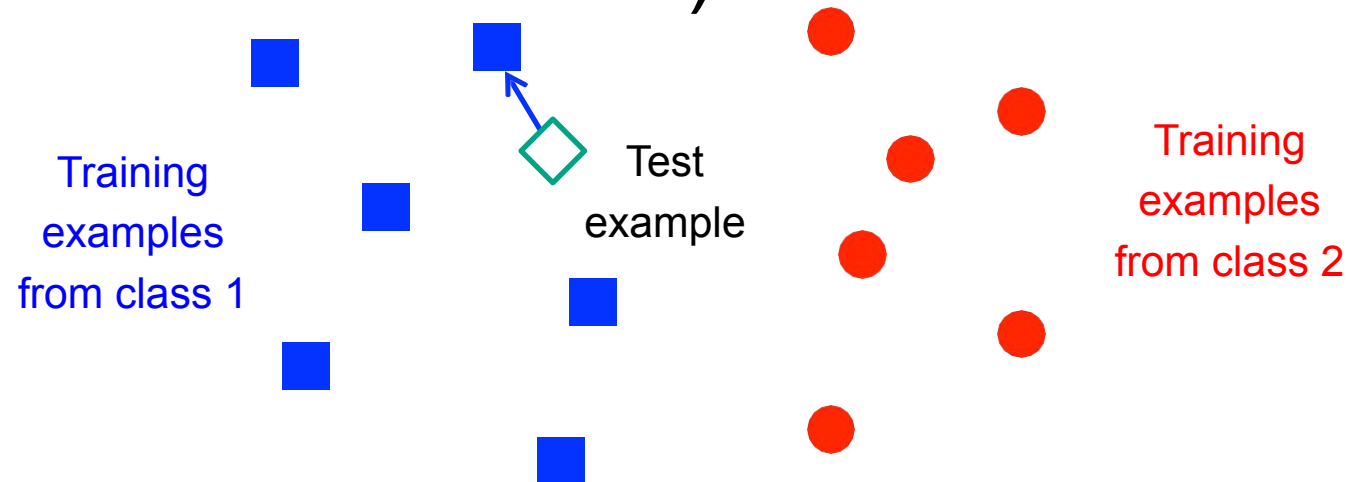
Example scenes from each category in the 15 scene dataset. Figure from **Lazebnik et al. 2006**.

Tinyimagesrepresentation

- 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 $16 \times 16 = 256$ dimensions.
- You can use functions: `imread`, `imresize`

Nearest neighbor classifier

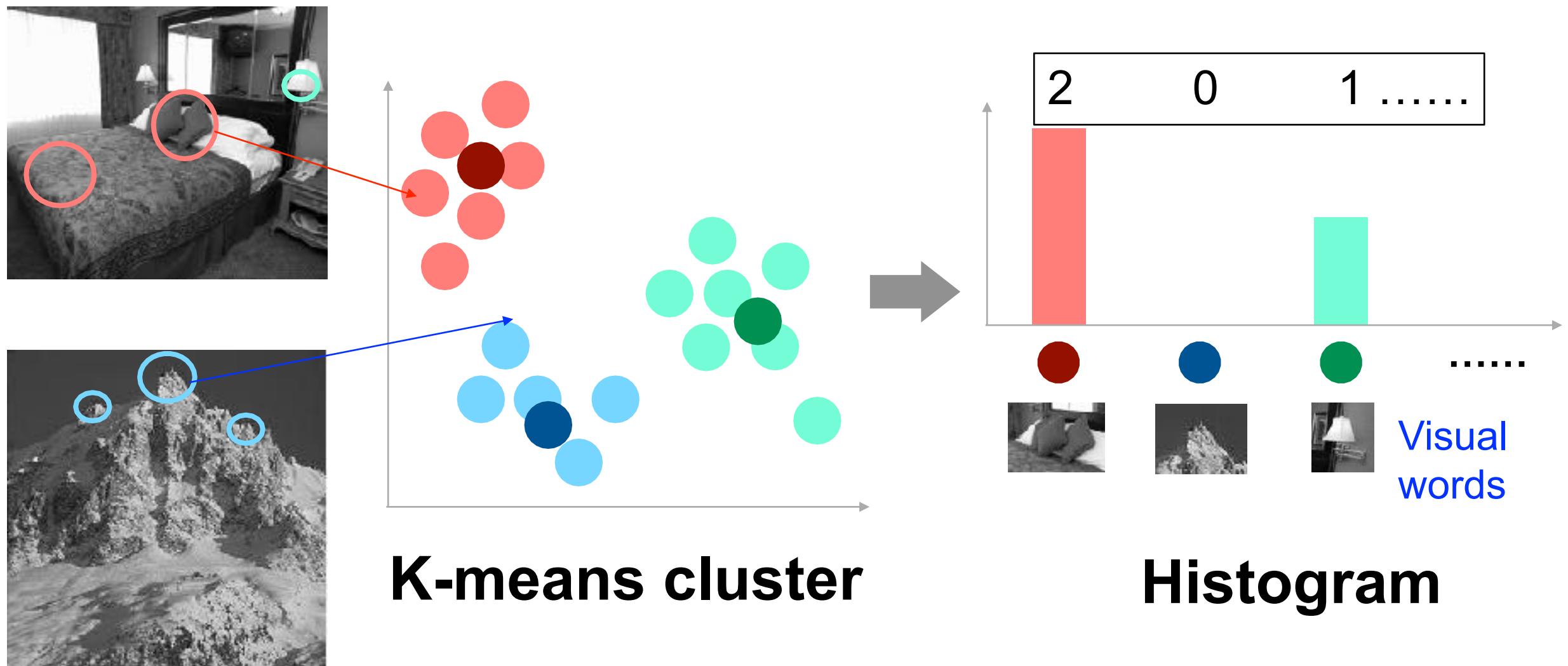
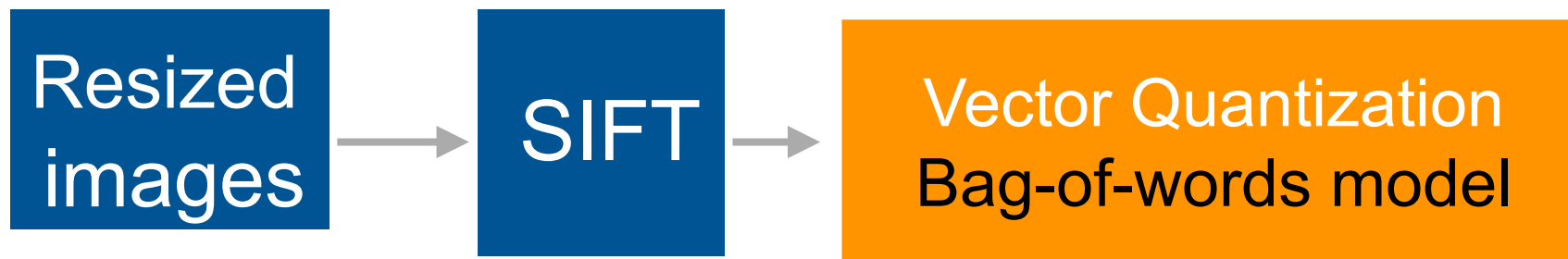
- Instead of 1 nearest neighbor, you can vote based on k nearest neighbors which will increase performance (although you need to pick a reasonable value for k).



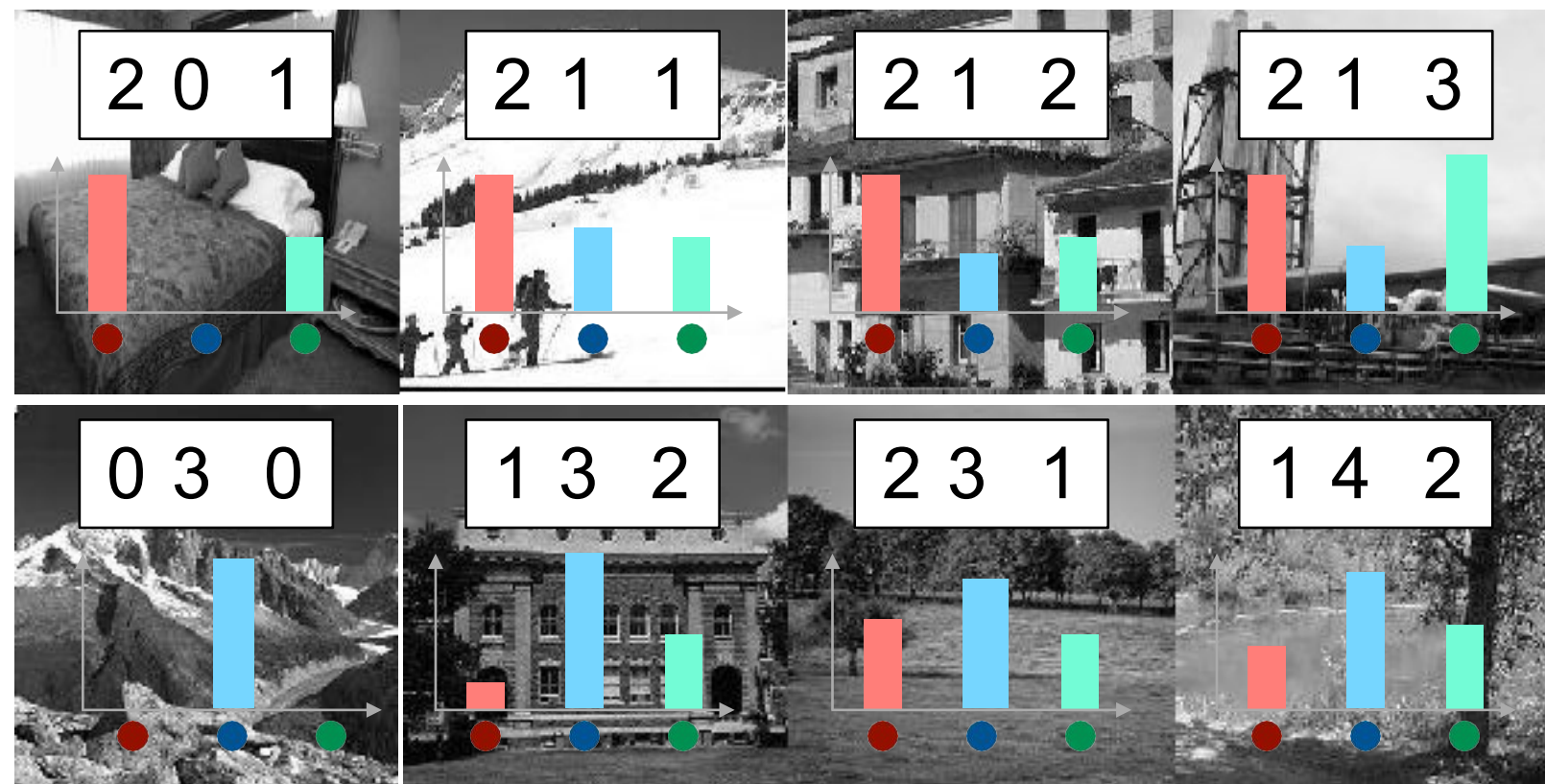
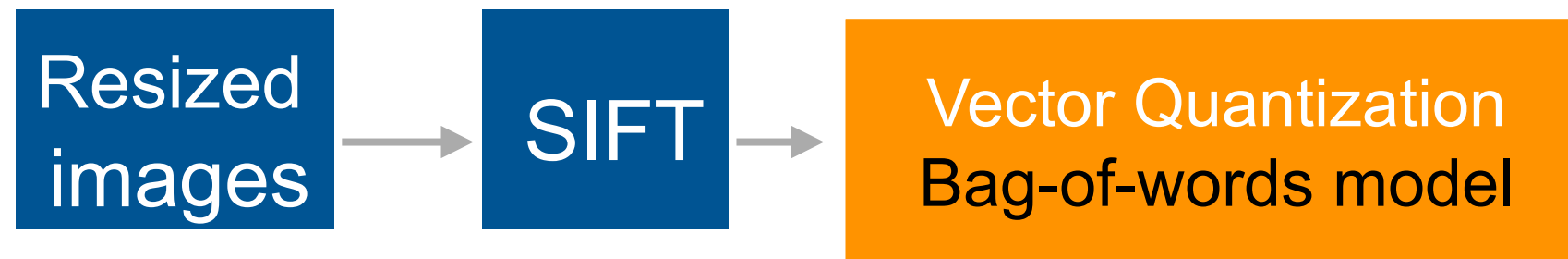
$f(\mathbf{x}) = \text{label of the training example nearest to } \mathbf{x}$

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

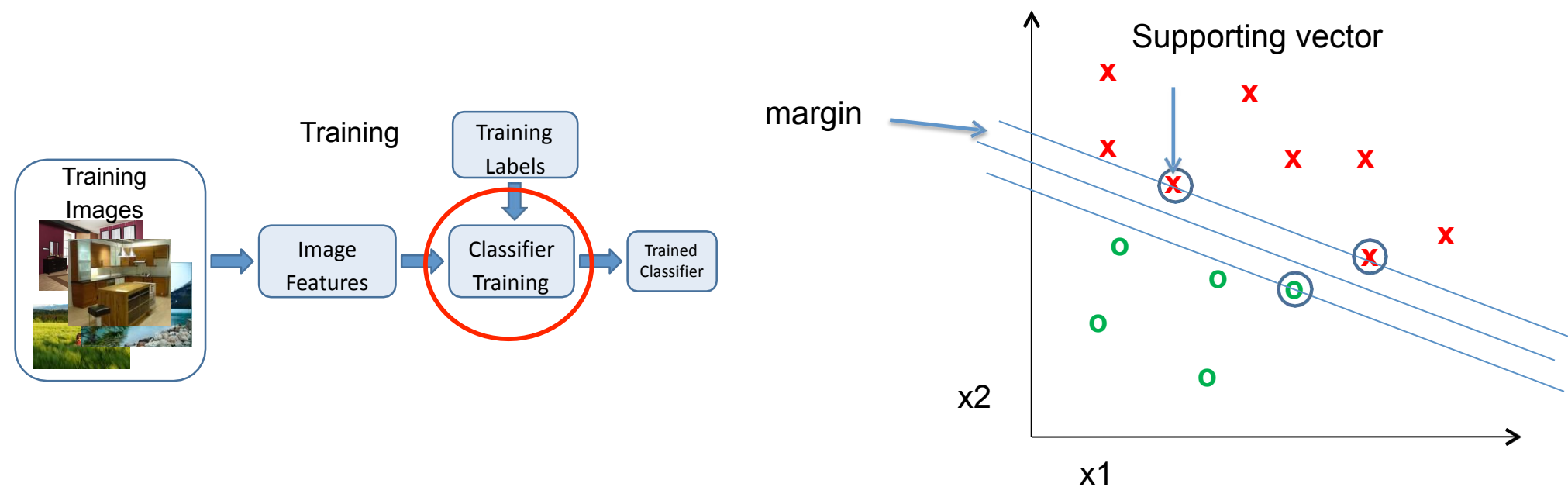
Bag of SIFT representation



Bag of SIFT representation



SVM

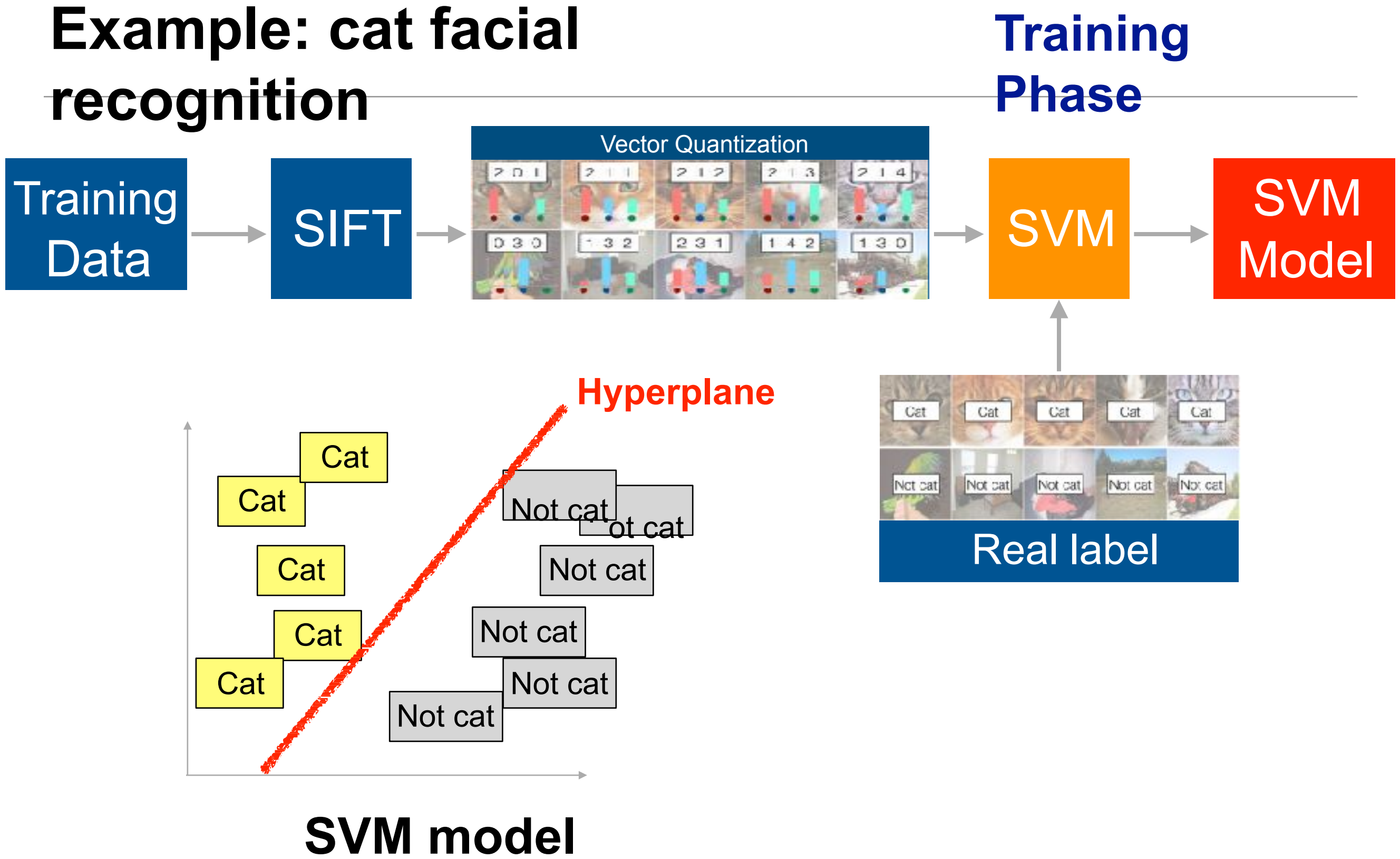


- Find a *linear function* to separate the classes:

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

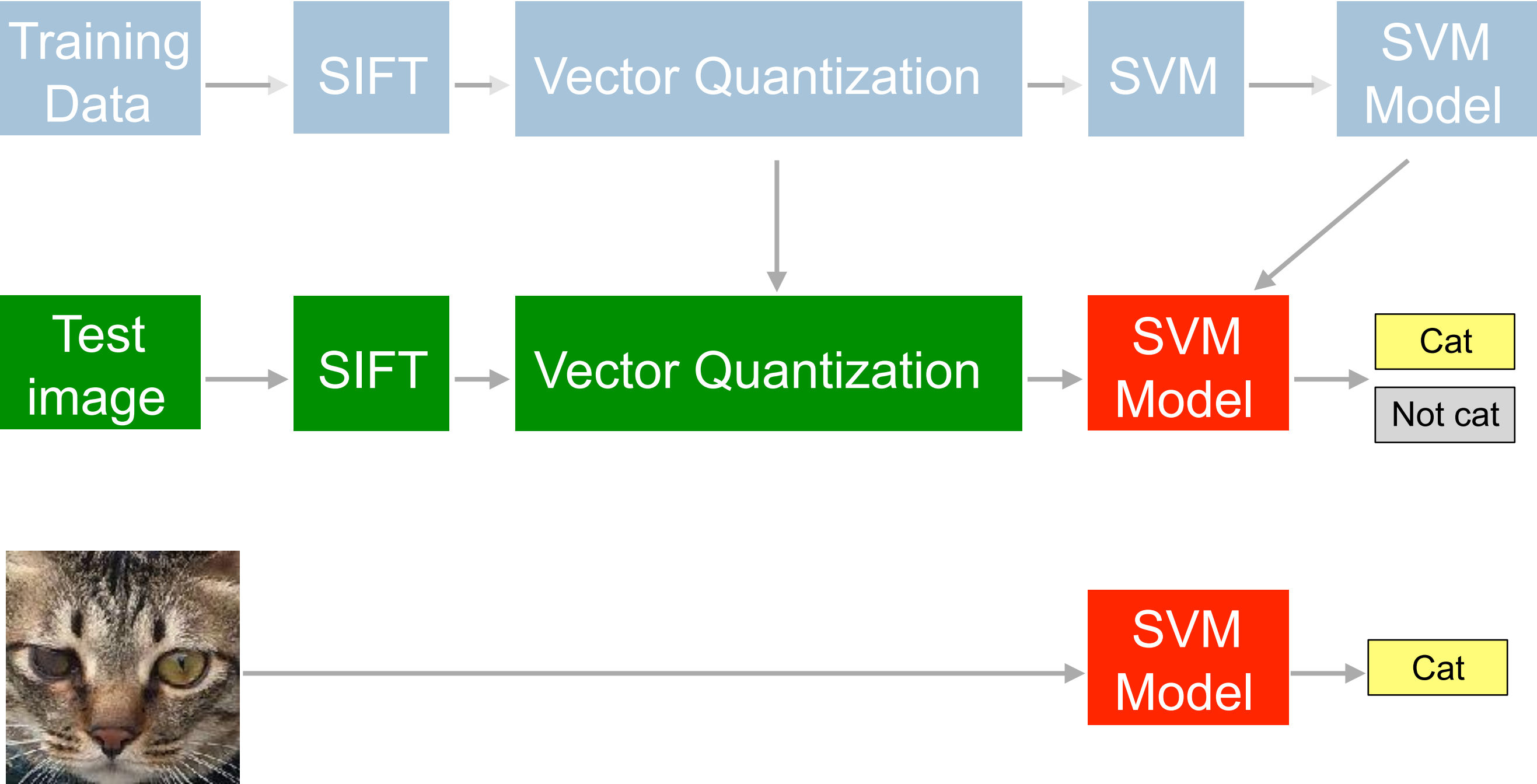
- You can use functions (MATLAB): `fitcsvm`, `predict`

Example: cat facial recognition



Example: cat facial recognition

Detection Phase



Example: Convolutional Neural Network (CNN)

