SESSION 5: SUPPORT VECTOR MACHINE

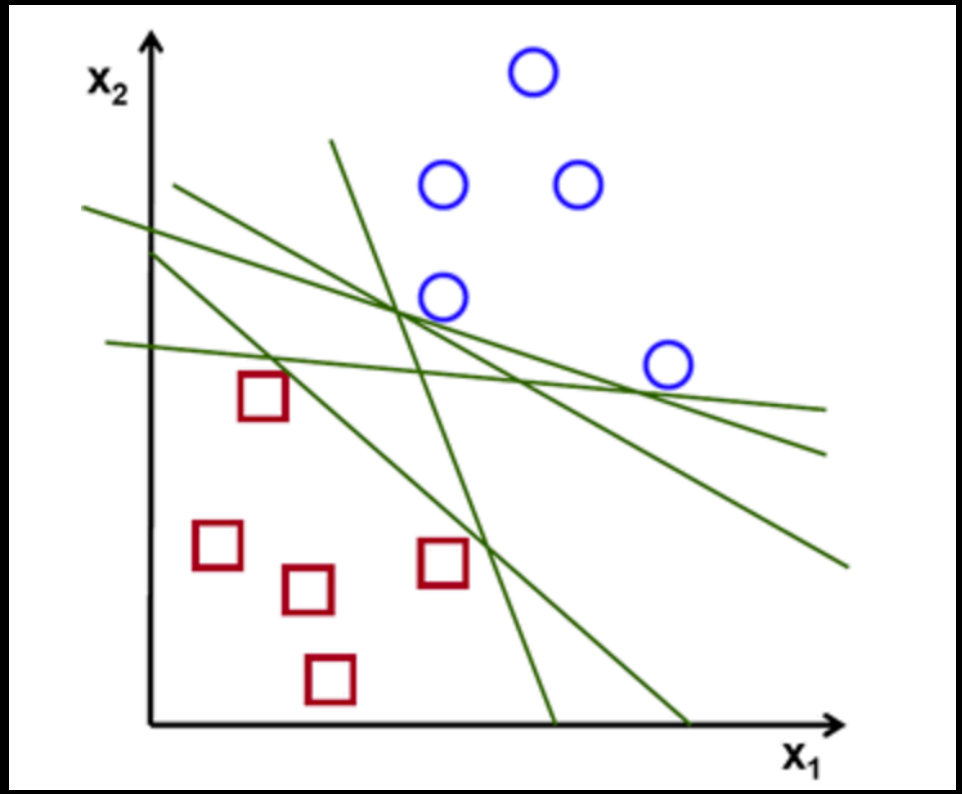
htp://uiuc-cse.github.io/matlab-sp17/
http://pad.software-carpentry.org/matlab-sp17

GOAL

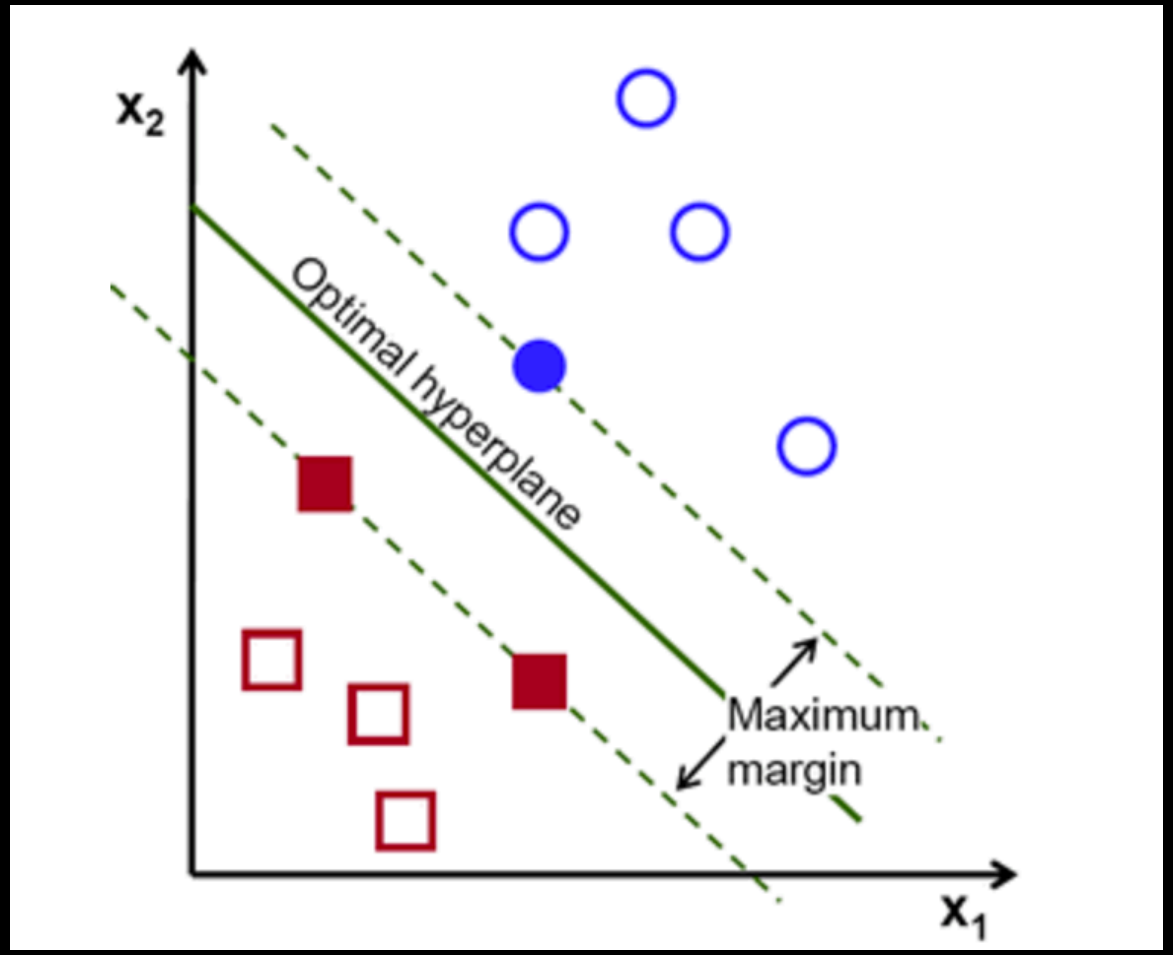
- In this session we will learn how to:
  - Use the built-in functions 'fitcsvm' to build a classifier based on SVMs and 'predict' to test its performance.

WHAT IS SVM

- SVM is a classifier formally defined by a separating hyperplane. So, given labeled training data (*supervised learning*), the algorithm outputs an optimal hyperplane



OPTIMAL HYPERPLANE



SUPPORT VECTOR MACHINE - MATLAB

- **training:**

```
SVMModel = fitcsvm(X,Y,'KernelFunction','rbf',... 'Standardize',true,...
'ClassNames',{'negClass','posClass'});
```

- **classification**:

```
[label,score] = predict(SVMModel,newX);
```

SVM – MATLAB:PREDICTION

```
[YTestHat,score] = predict(SVMModel,XTest);
```

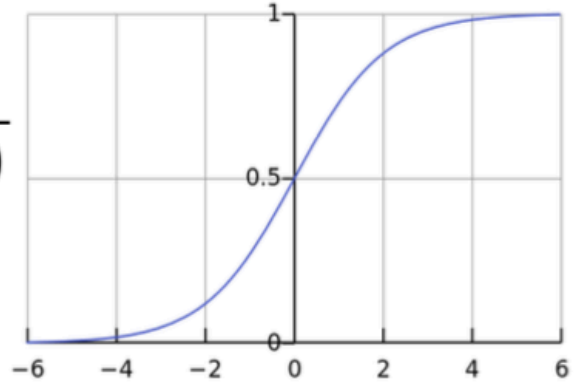
confidence in classification = signed distance to the SVM's decision boundary

normalized confidence in the positive class "1":

$$P(\text{score}) = \frac{1}{1 + \exp(-\alpha\ \text{score} + \beta)}$$

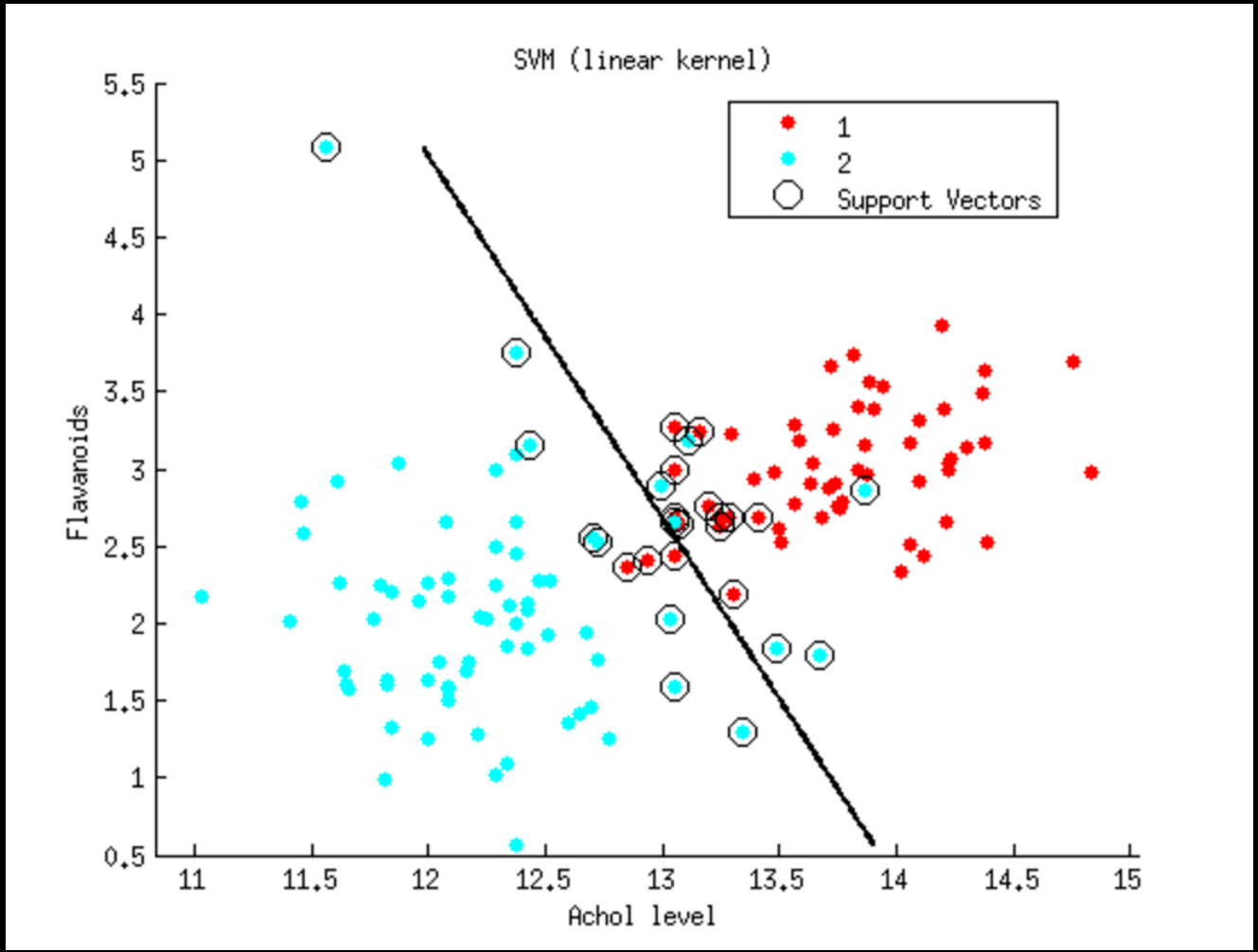
normalized confidence in the negative class "-1":

$$1 - P(\text{score})$$

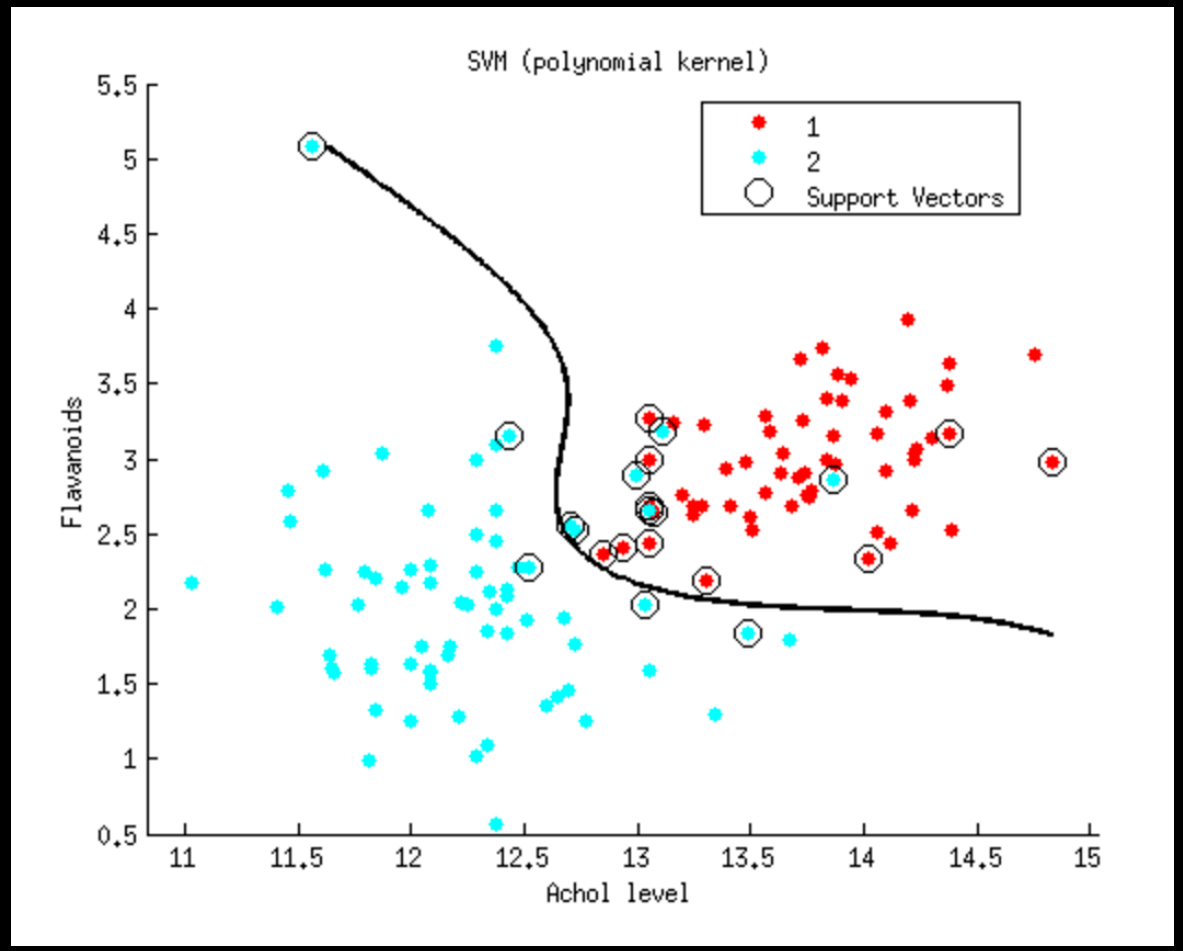


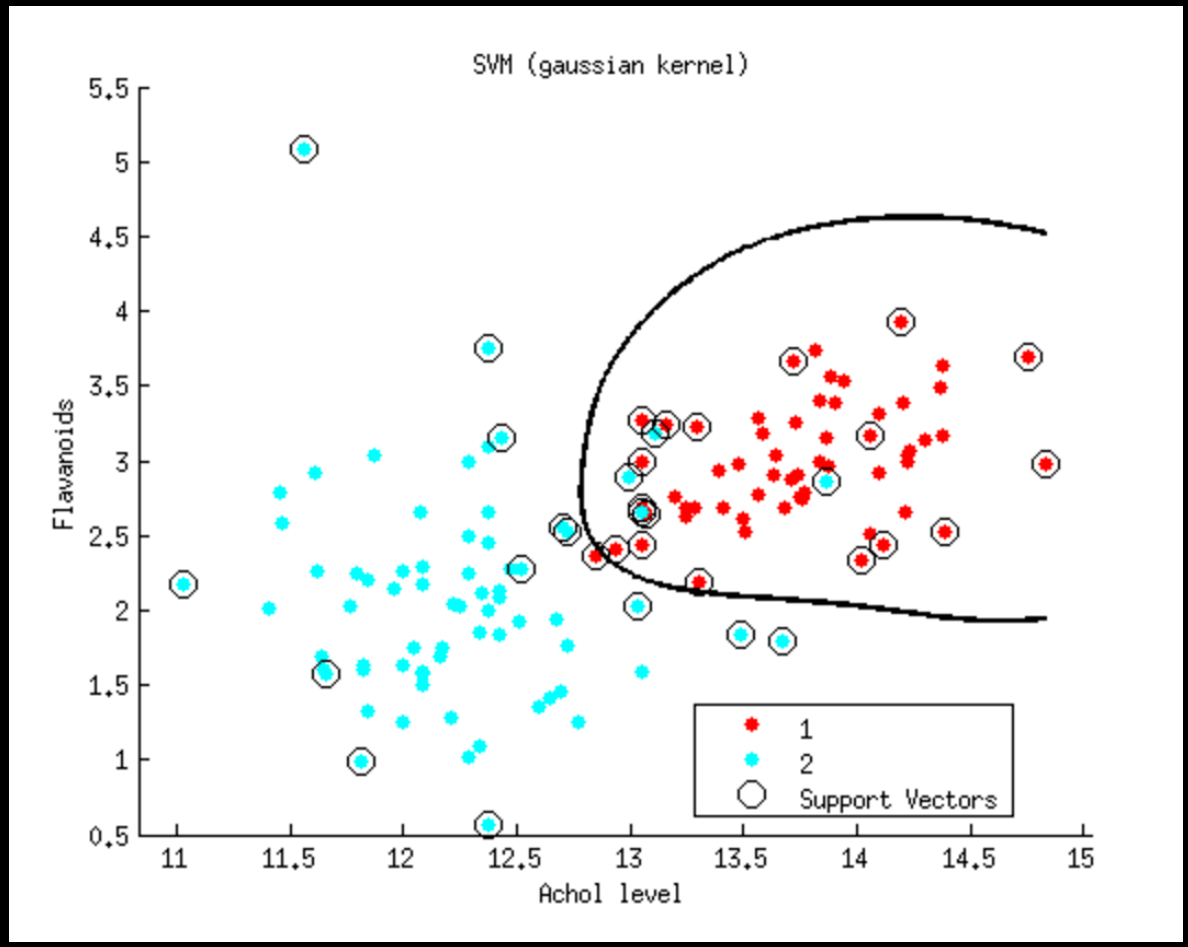
sigmoid function

EXERCISE - LINEAR SVM (1)



EXERCISE – NONLINEAR SVM





MULTI-CLASS CLASSIFICATION