

## Food for Thought

How do SVMs classify and predict data based on numerical features?

Is there a difference in the graph based upon whether the data is 2D or 3D (or n-D)?

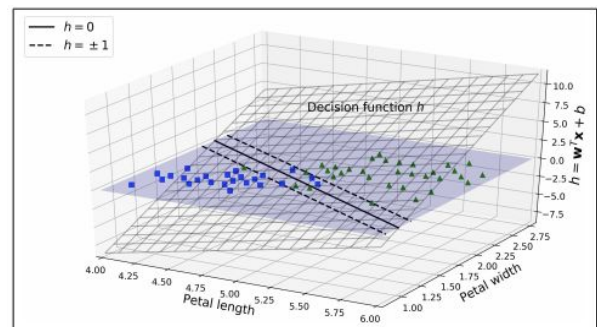
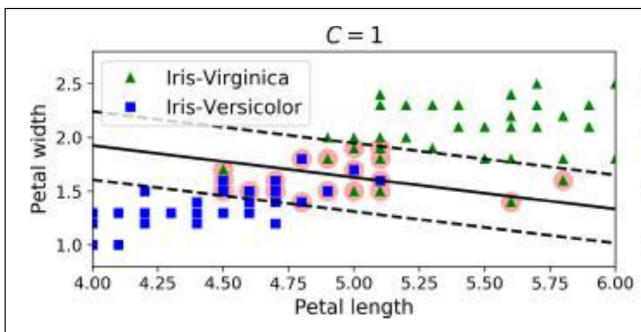
Are all decision functions piecewise, or are there some that can classify data in other ways?

## What is the Classifier Decision Function?

- Tells us on which side of the hyperplane generated by the classifier we are at
- Function that takes a data set as an input and then makes a decision based upon the parameters and the data (see examples to the right)
  - For a two dimensional input, creates lines that separate the sets of data to classify them; in three dimensions, a plane is created to separate the data inputs.
- Think of as If-Else statements
  - Define conditions in the If-Else statement to lead to a decision -- the more elaborate the statement, the larger the decision tree becomes. The Classifier Decision function essentially does this.

Equation 5-2. Linear SVM classifier prediction

$$\hat{y} = \begin{cases} 0 & \text{if } \mathbf{w}^T \mathbf{x} + b < 0, \\ 1 & \text{if } \mathbf{w}^T \mathbf{x} + b \geq 0 \end{cases}$$



## Scikit-learn decision\_function():

Documentation:

[https://scikit-learn.org/stable/modules/generated/sklearn.svm.SVC.html#sklearn.svm.SVC.decision\\_function](https://scikit-learn.org/stable/modules/generated/sklearn.svm.SVC.html#sklearn.svm.SVC.decision_function)

Example: [SVM Exercise — scikit-learn 0.22.1 documentation](#)

## Other Resources

Textbook, chapter 5

Coursera lecture:

<https://www.coursera.org/lecture/python-machine-learning/classifier-decision-functions-0YPe1>

Classifier Decision Functions:

<https://www.codespeedy.com/classifier-decision-functions-in-python>

