

Hyperparameter tuning with SKLEARN

Krithika Iyer

Department of Biomedical Informatics, University of Utah

Difference between model parameters and hyperparameters

- Model parameters is what defines the model and using which predictions are made.
- Example : In linear regression and logistic regression – \mathbf{w} and \mathbf{b}
- Hyperparameters control how the model parameters are updated- knobs on the model which have to be tuned.
- Example – Learning rate, regularization strength

SVM Example

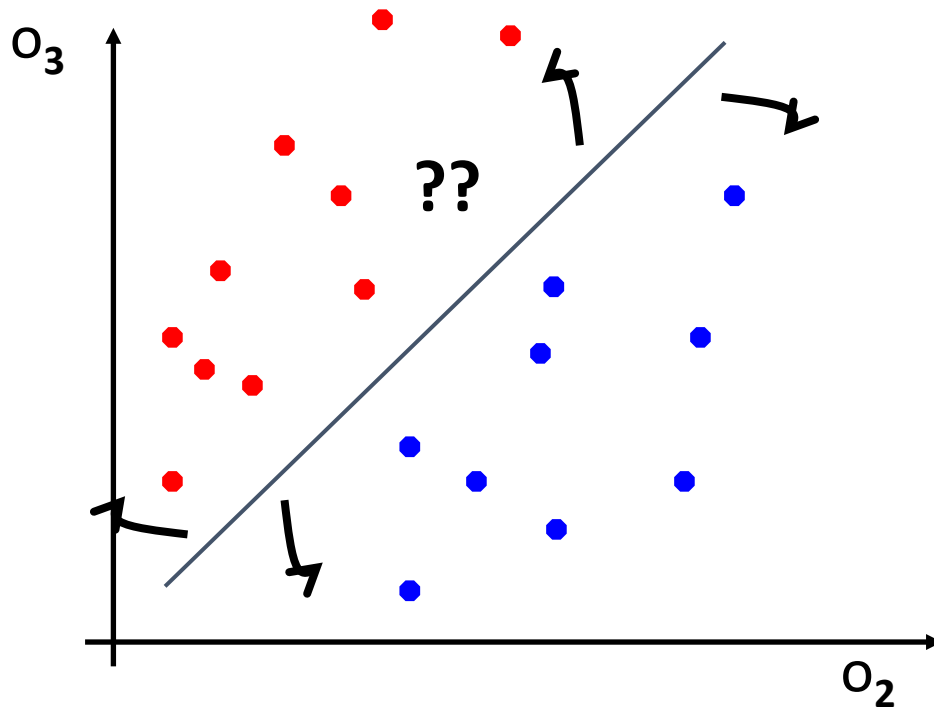
- <http://vision.stanford.edu/teaching/cs231n-demos/linear-classify/>

Jupyter Notebook Examples for Sklearn

- Cross Validation
- Grid Search - All parameter combinations tried
- Random Search - not all parameter values are tried out, but rather a fixed number of parameter settings is sampled from the specified distributions. The number of parameter settings that are tried is given by `n_iter`

Perceptron as a Linear Separator

- Since perceptron uses linear threshold function, it is searching for a linear separator that discriminates the classes.



$$w_{12}O_2 + w_{13}O_3 > T_1$$

$$O_3 > -\frac{w_{12}}{w_{13}}O_2 + \frac{T_1}{w_{13}}$$

**Or hyperplane in
n-dimensional space**

Linear Classifier Limitations

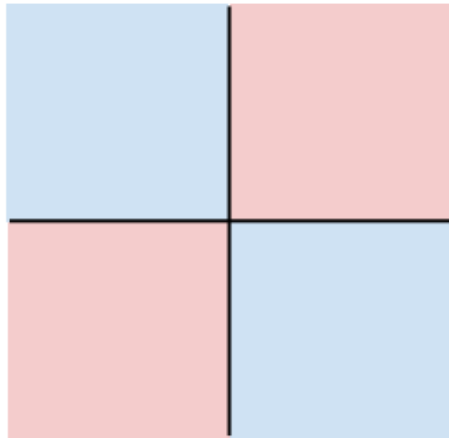
Hard cases for a linear classifier

Class 1:

number of pixels > 0 odd

Class 2:

number of pixels > 0 even

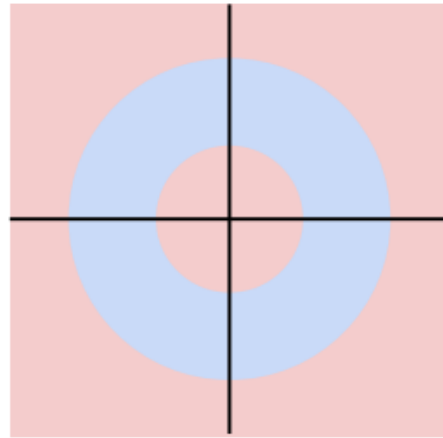


Class 1:

$1 \leq \text{L2 norm} \leq 2$

Class 2:

Everything else

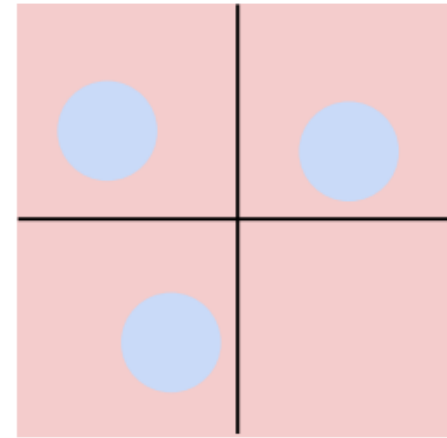


Class 1:

Three modes

Class 2:

Everything else



Neural Network

- All neurons get same input why don't they all produce same outputs?
- <https://playground.tensorflow.org/>

Visualizing Neural Network Weights

- <https://arxiv.org/pdf/1312.6034.pdf>
- <https://cs.nyu.edu/~fergus/papers/zeilerECCV2014.pdf>