

A Multi-dimensional Measure Function for Classifier Performance

by Niklas Laveson and Paul Davidson

a talk given by Adrian Schröter

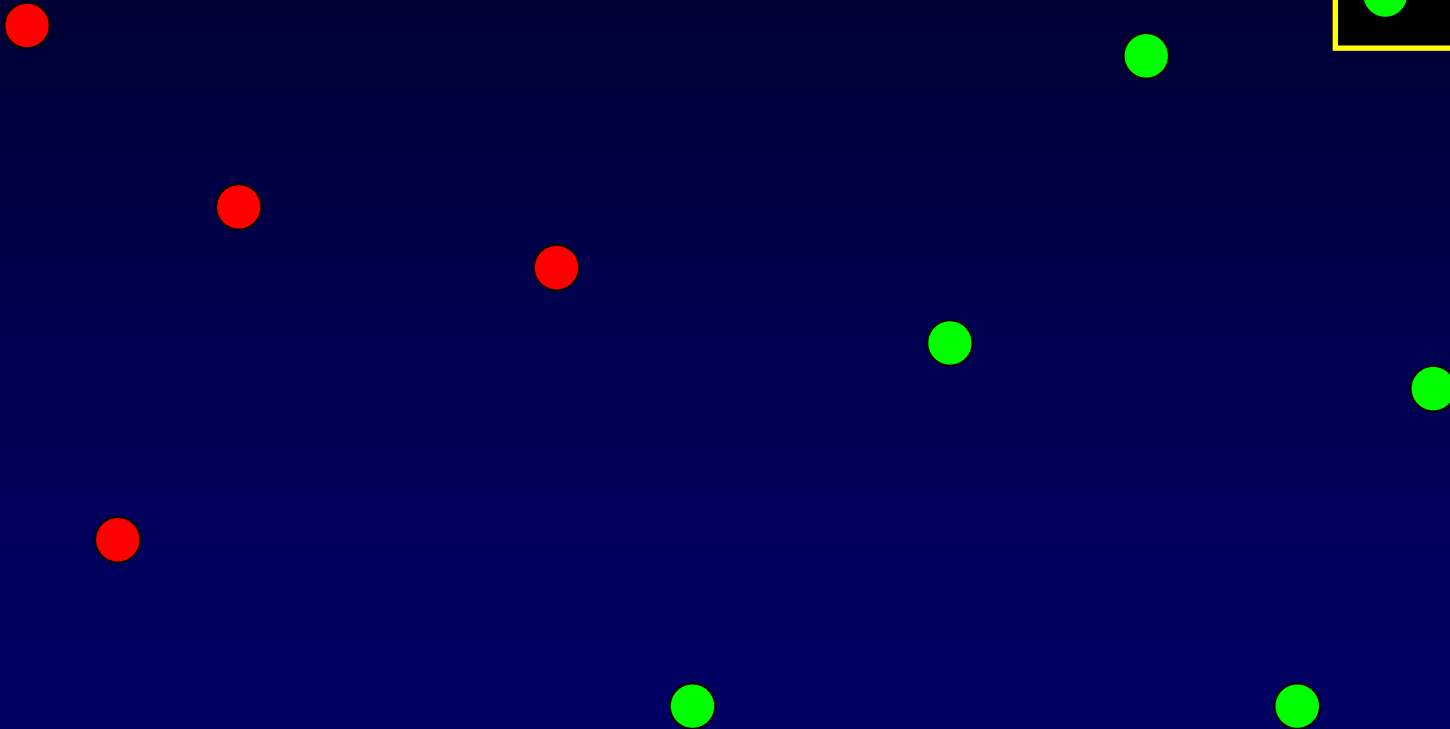
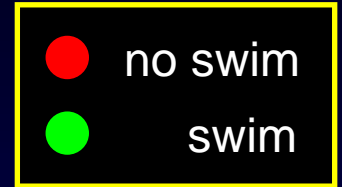
contact me via schroeter@st.cs.uni-sb.de

What's it all about?

- want to measure how good our model will perform
- want to compare different models

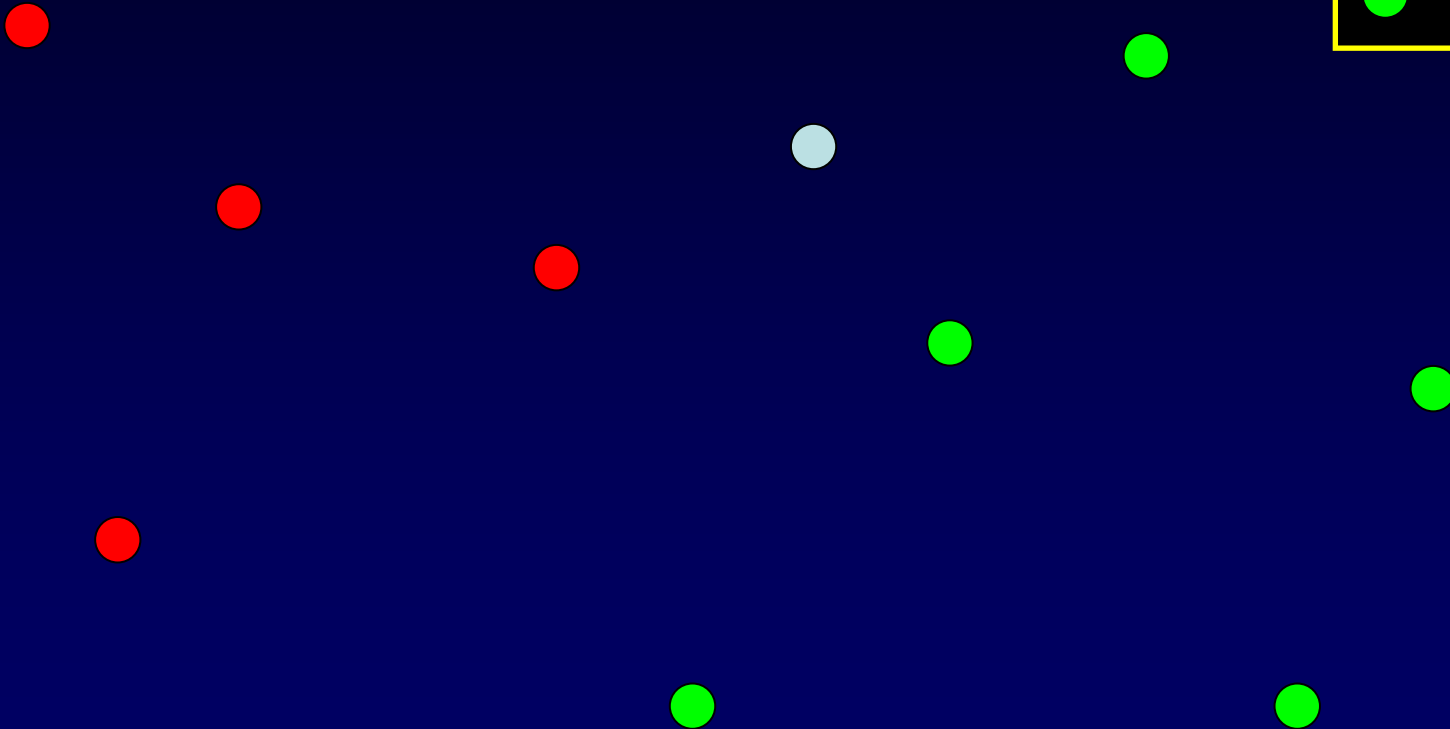
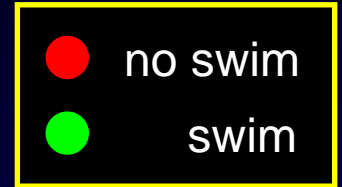
kNN

k – Nearest Neighbors



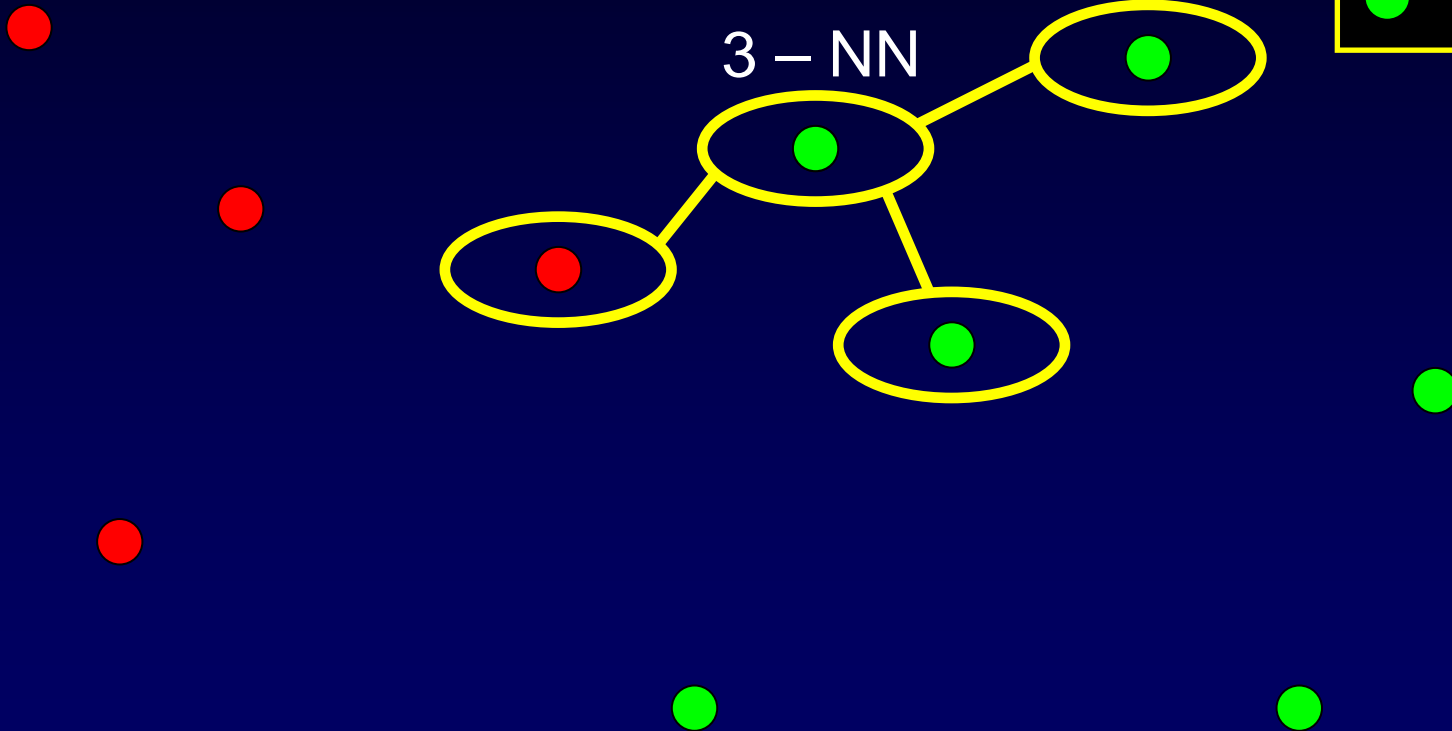
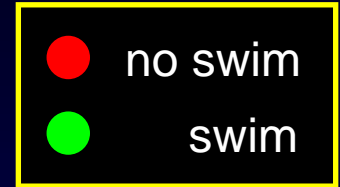
kNN

k – Nearest Neighbors



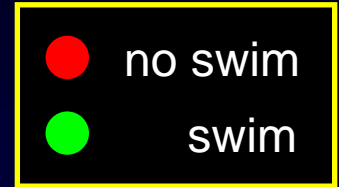
kNN

k – Nearest Neighbors



kNN

k – Nearest Neighbors



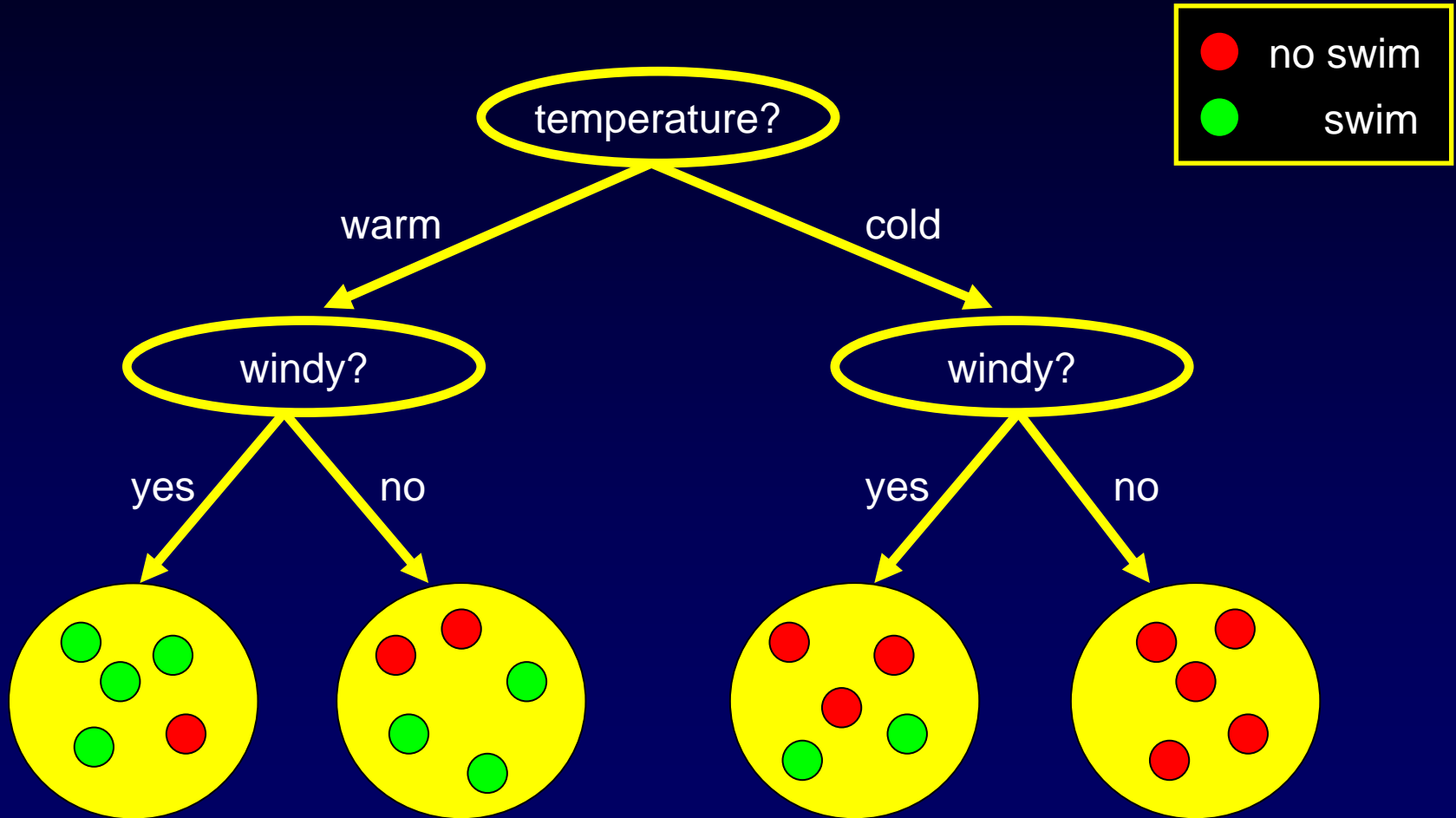
3 – NN



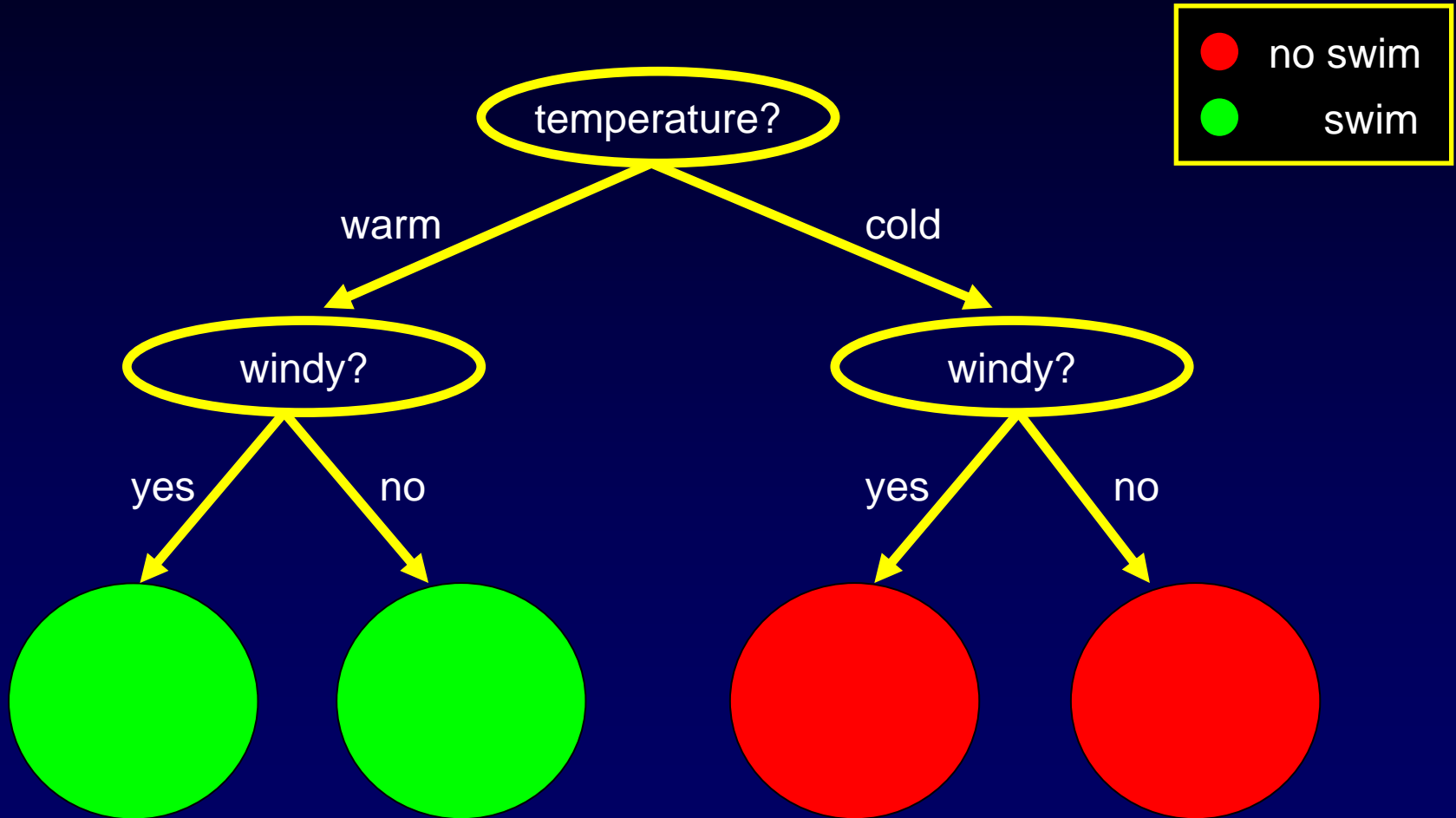
**Intuitive and *fast training*
but *slow predictions.***



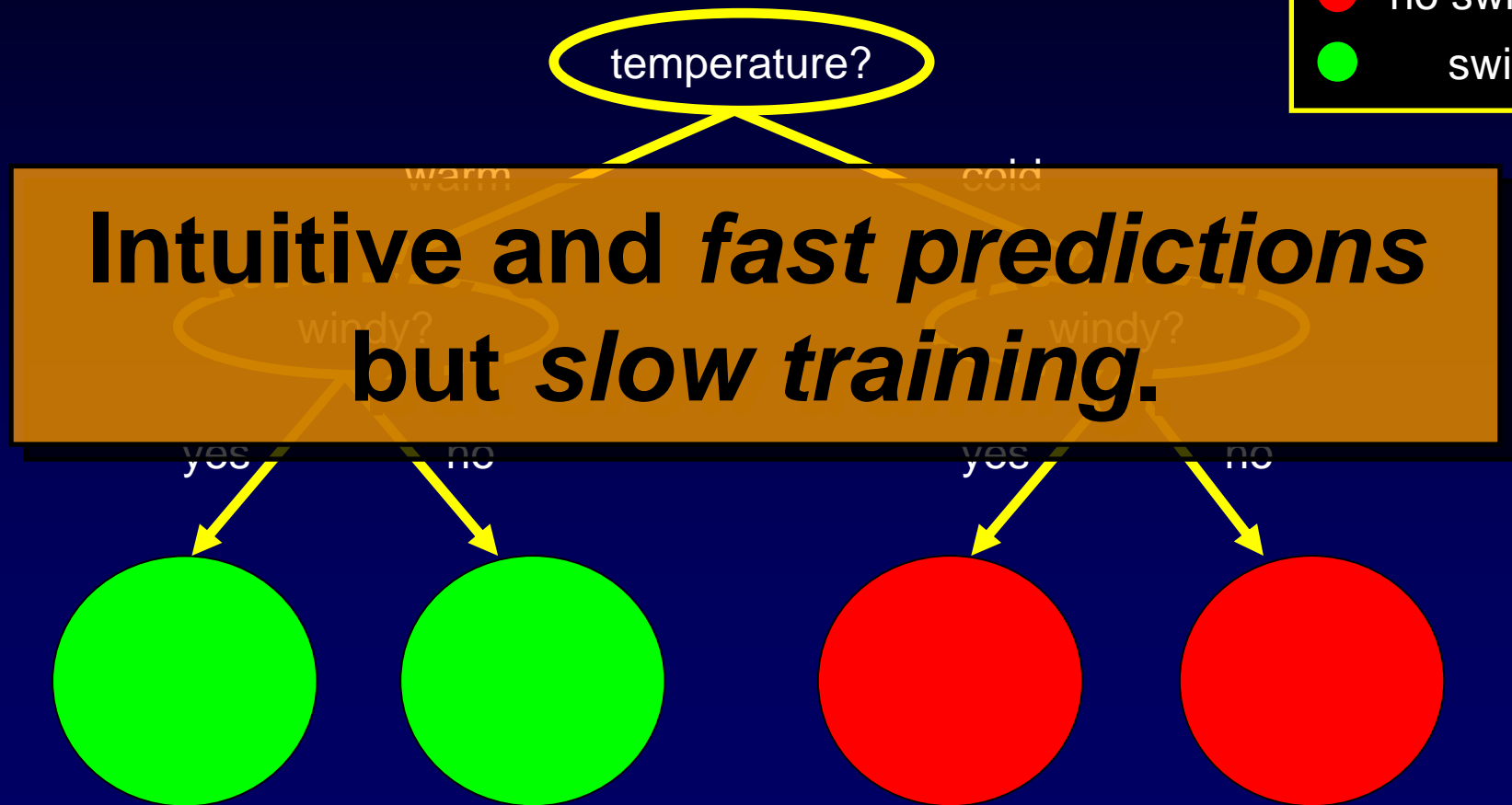
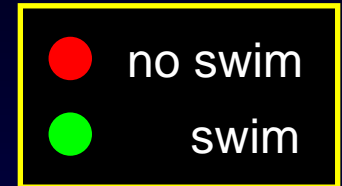
Decision Tree



Decision Tree

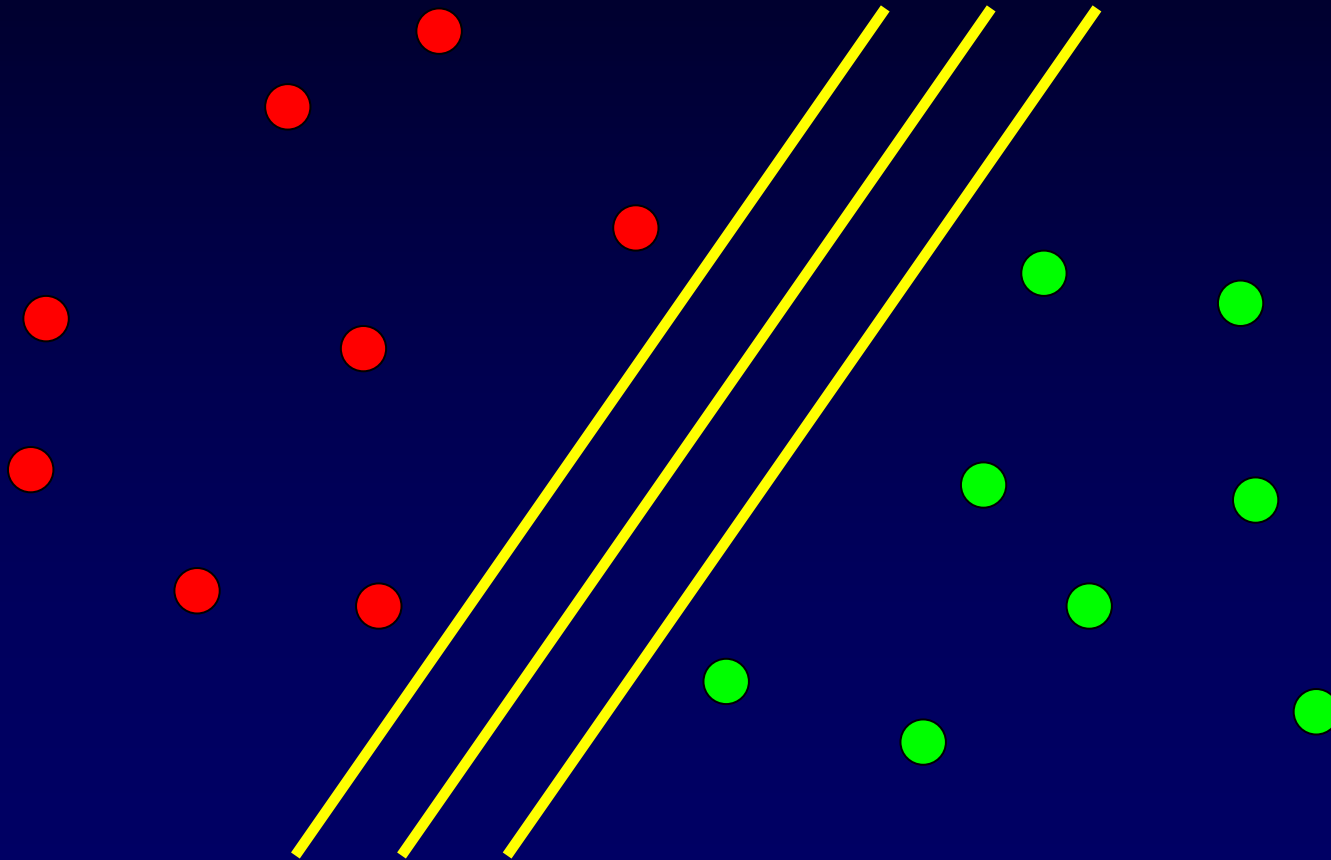


Decision Tree

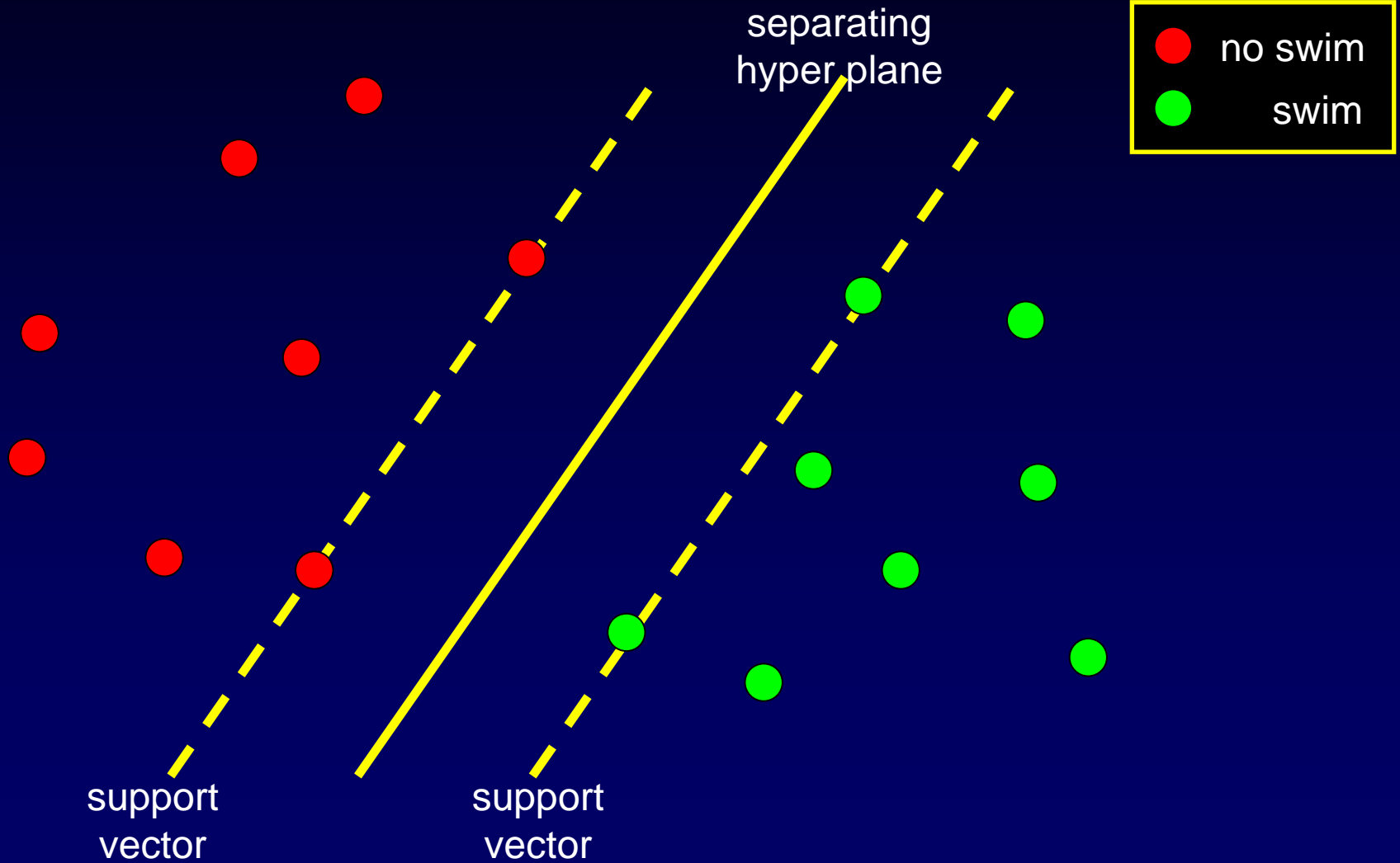


SVM

● no swim
● swim



SVM



SVM

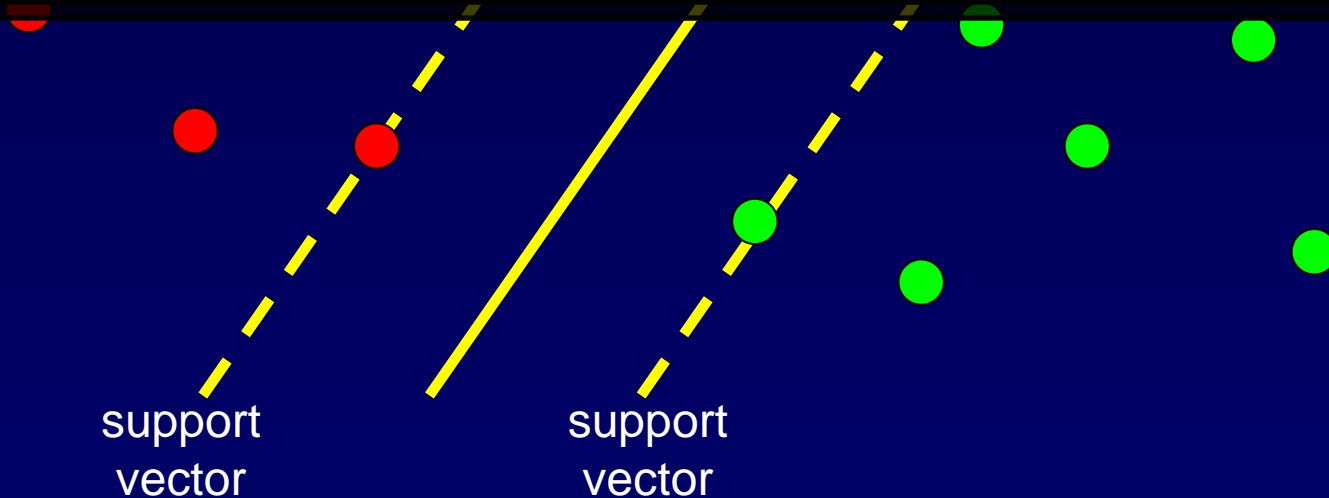
separating
hyper plane

● no swim
● swim

**Not Intuitive and *slow training*
but *fast predictions*.**

support
vector

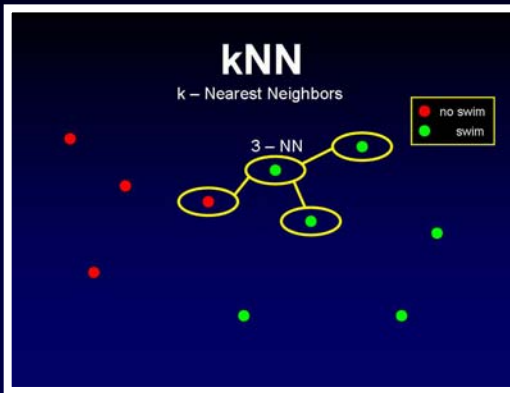
support
vector



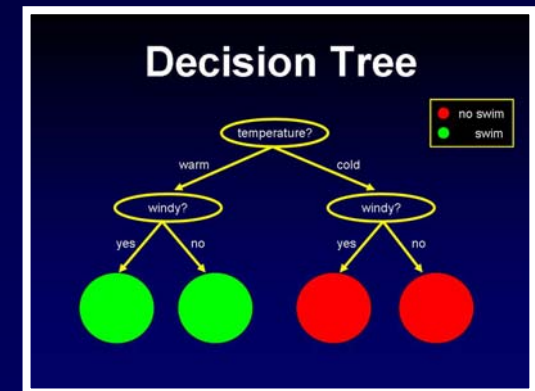
Assessing Models

- Cross Validation (state of the art)
 - k-fold CV
 - Jackknife / Leave One Out CV
 - 10-fold CV

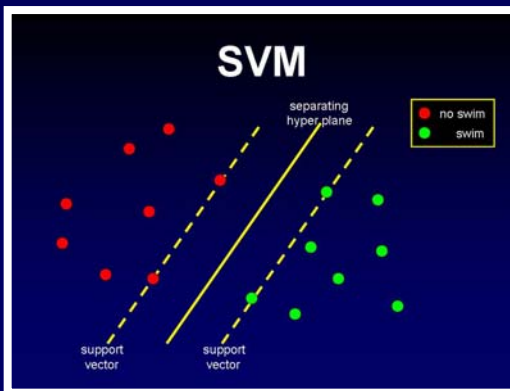
Parameter Tuning



- k - number of neighbors
- distance measure

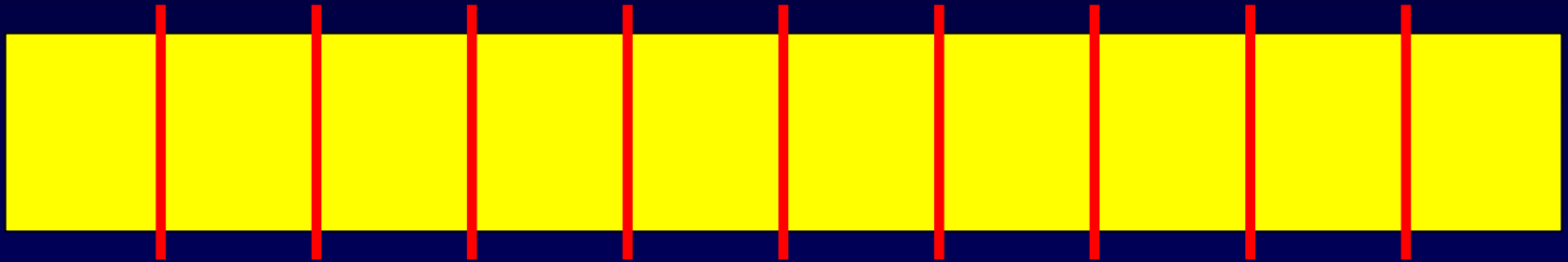


- decision borders
- pruning factor



- penalization of outliers
- kernel parameters

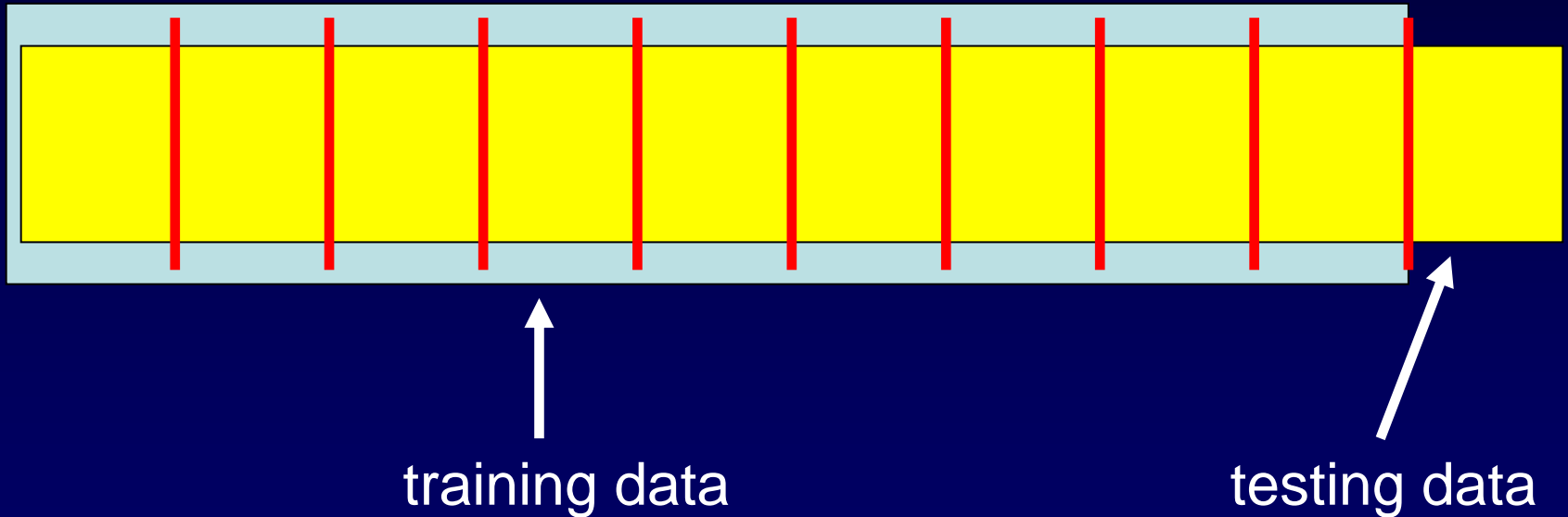
Cross Validation



partition dataset into 10 folds

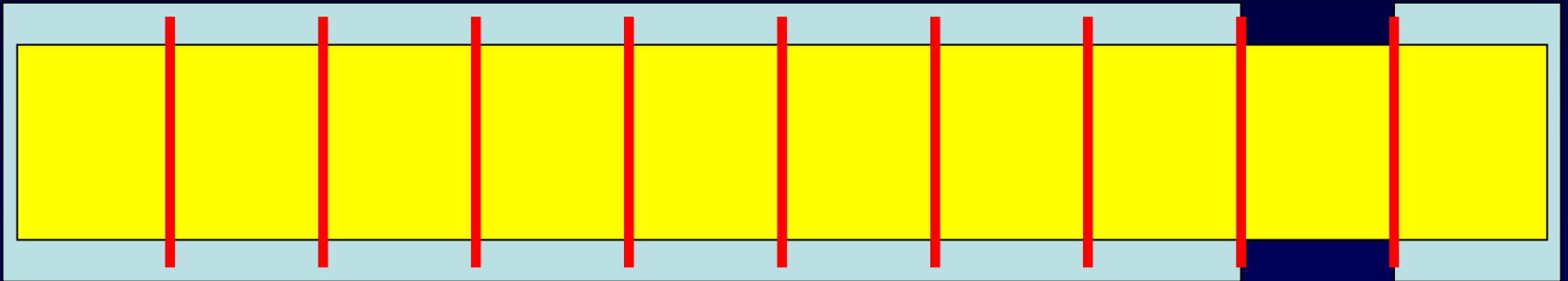
Cross Validation

Select 9 out of 10 folds.



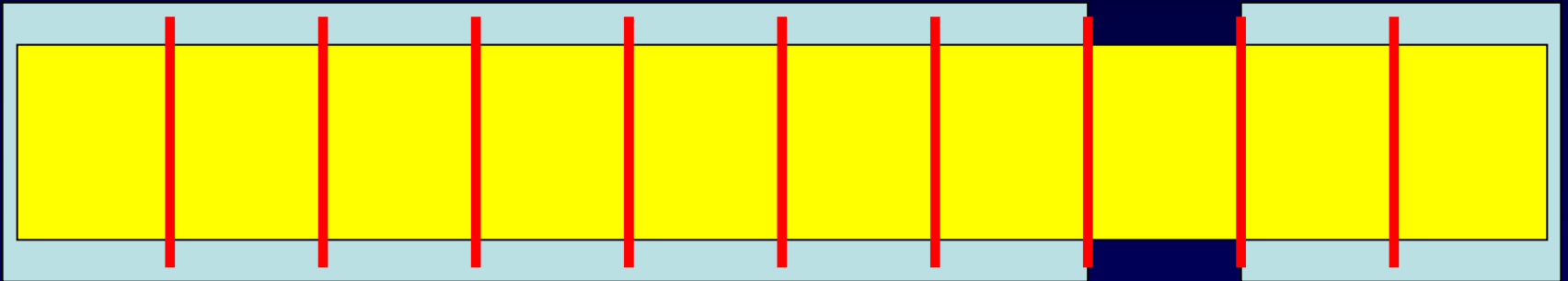
Cross Validation

Select 9 out of 10 folds.



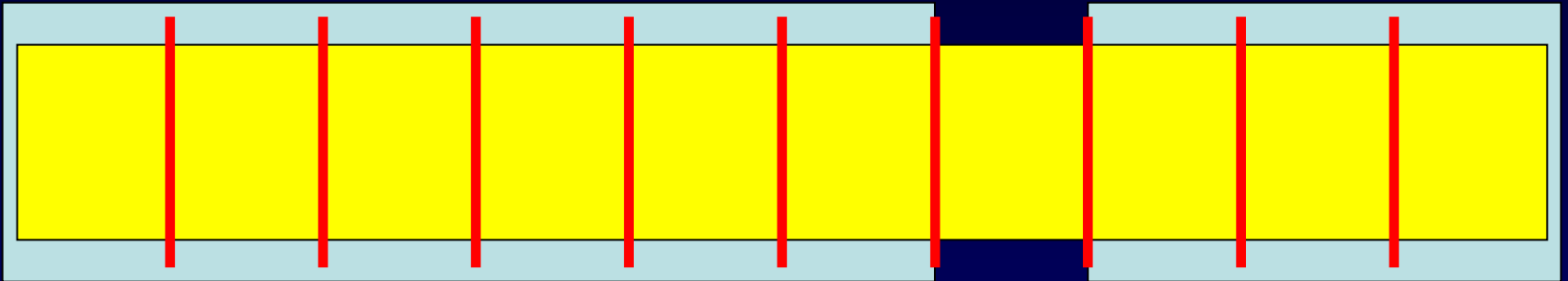
Cross Validation

Select 9 out of 10 folds.



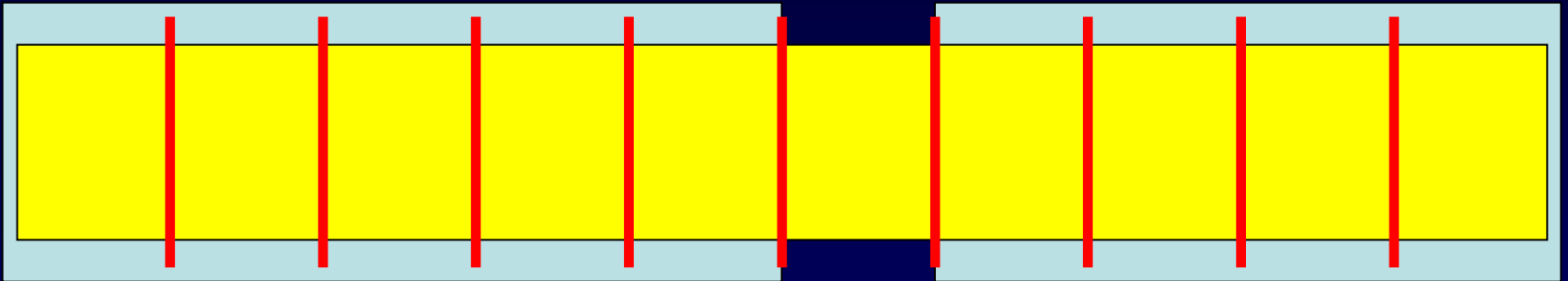
Cross Validation

Select 9 out of 10 folds.



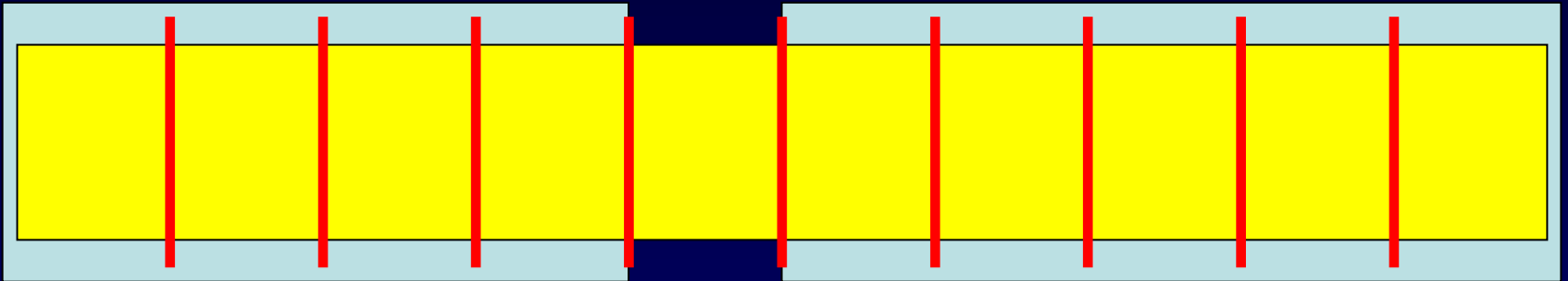
Cross Validation

Select 9 out of 10 folds.



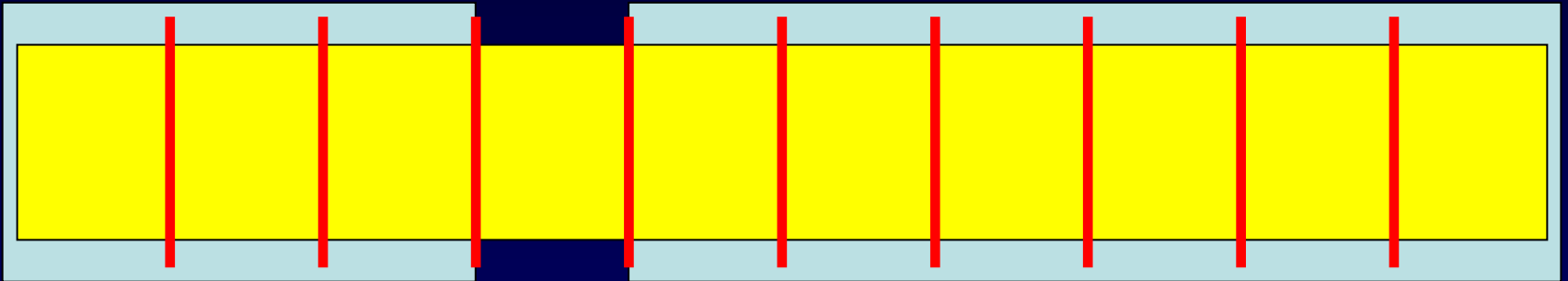
Cross Validation

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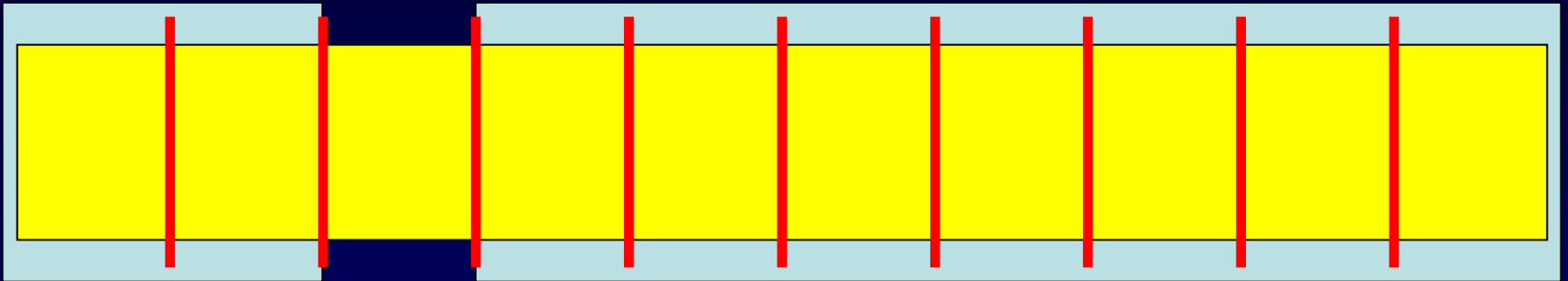
Cross Validation

Select 9 out of 10 folds.



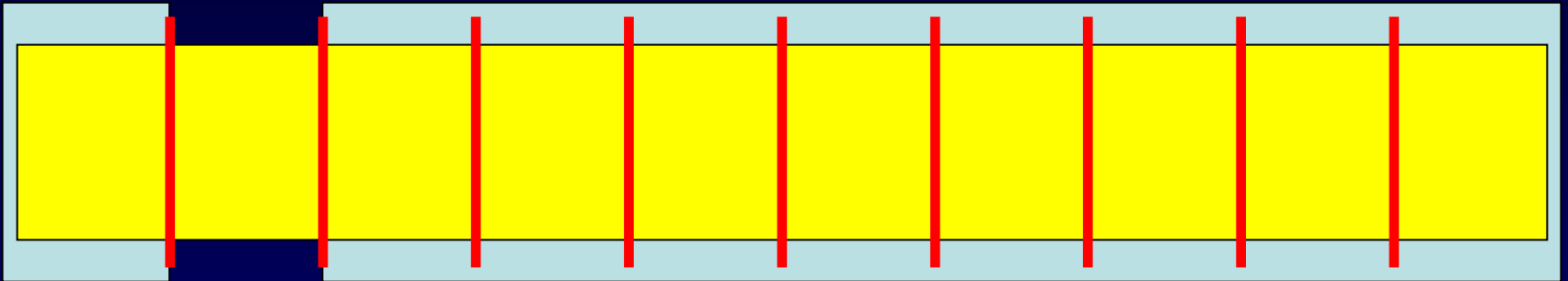
Cross Validation

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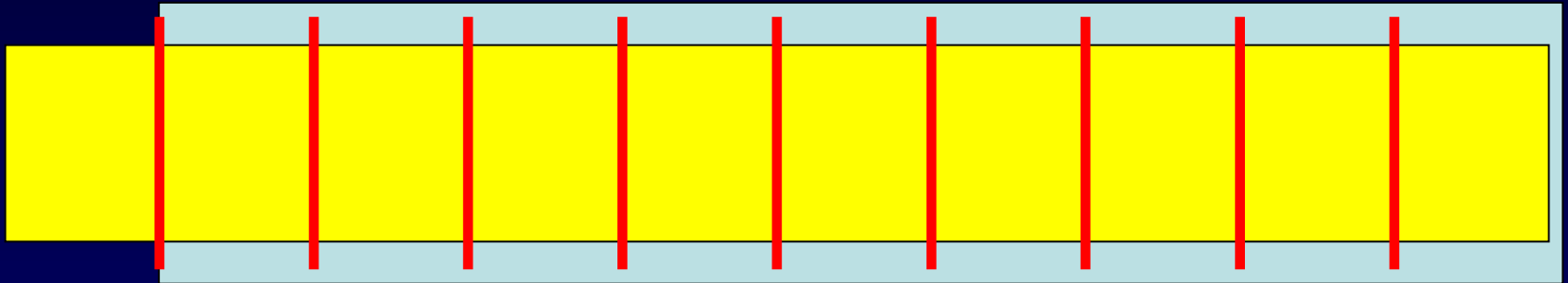
Cross Validation

Select 9 out of 10 folds.



Cross Validation

Select 9 out of 10 folds.

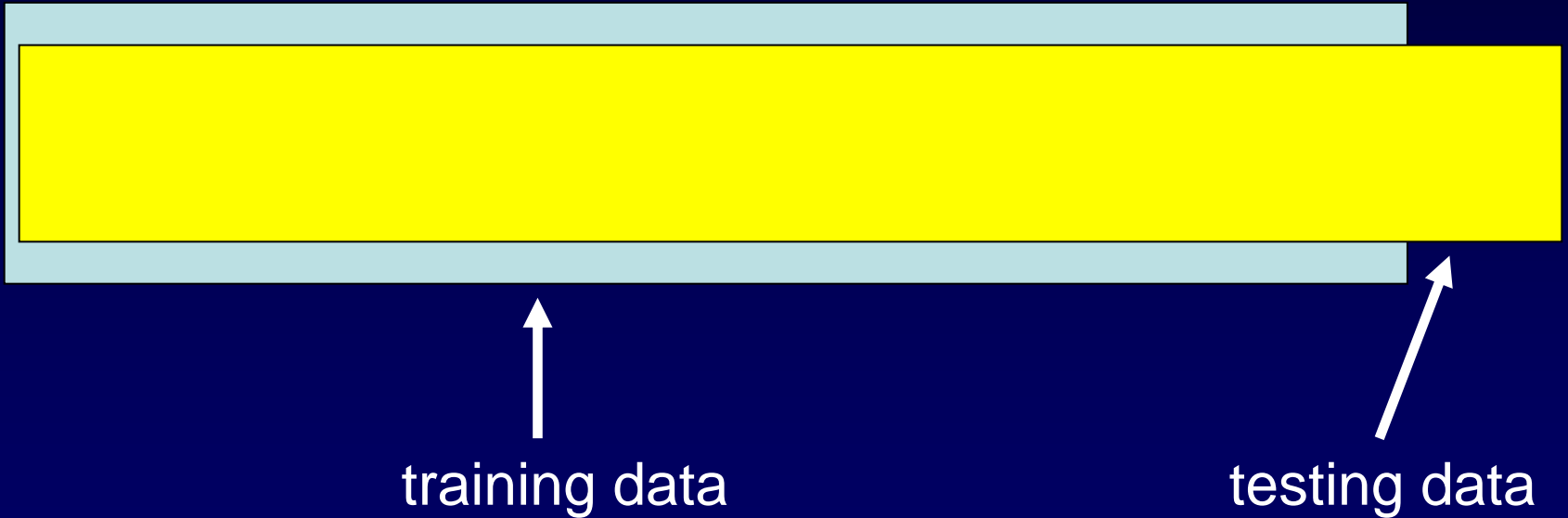


After 10 iterations the results are averaged.

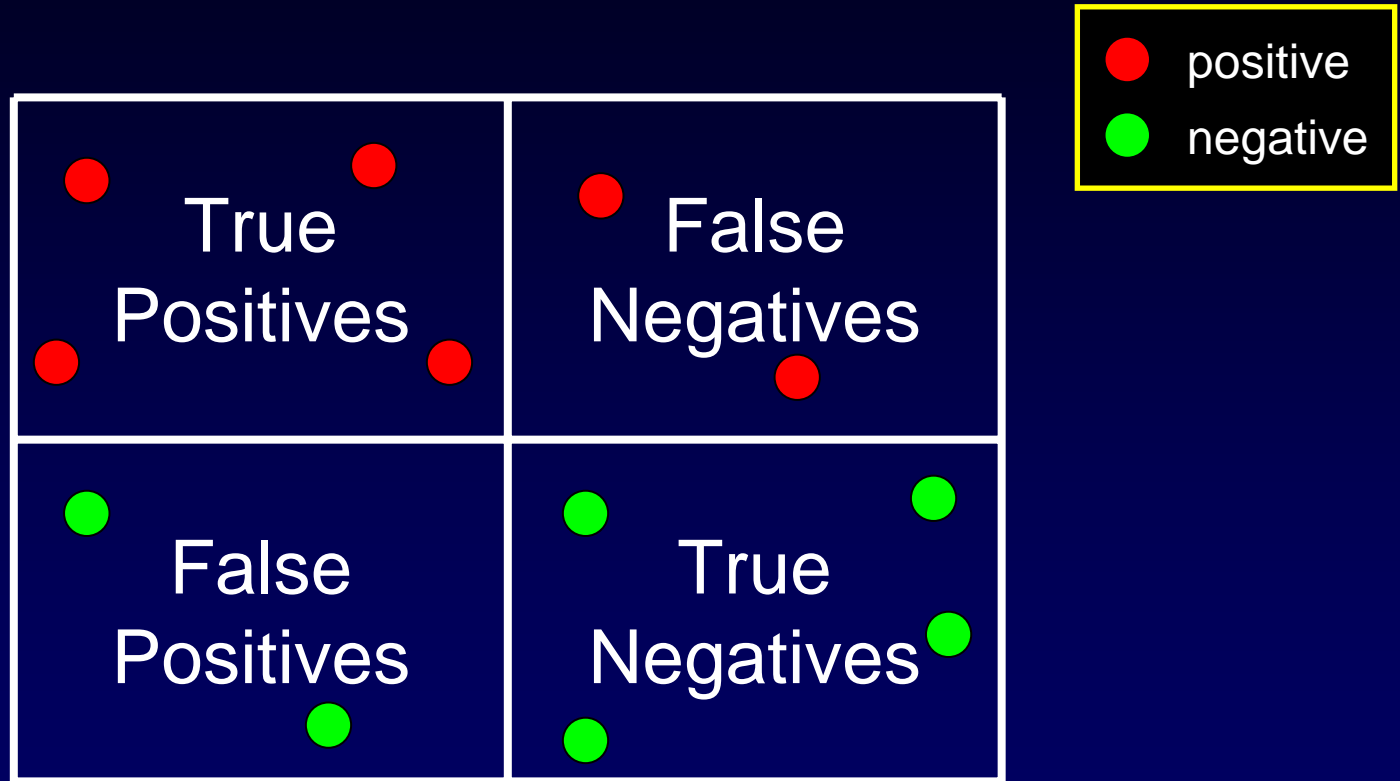
Disadvantage

relies only on subset fit

Subset Fit



How To Measure?

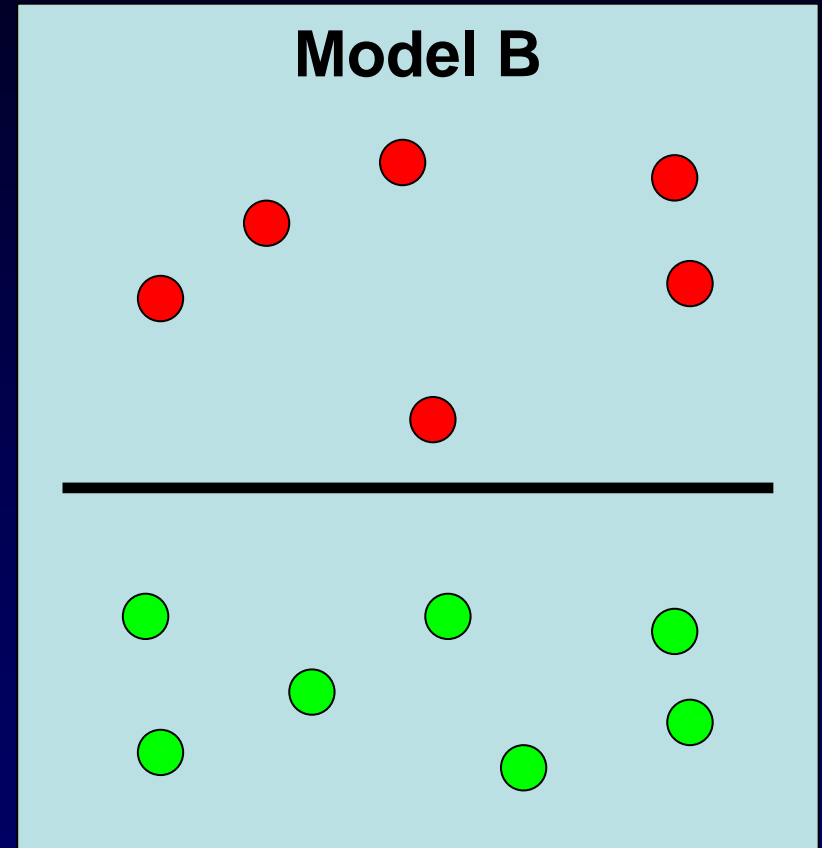
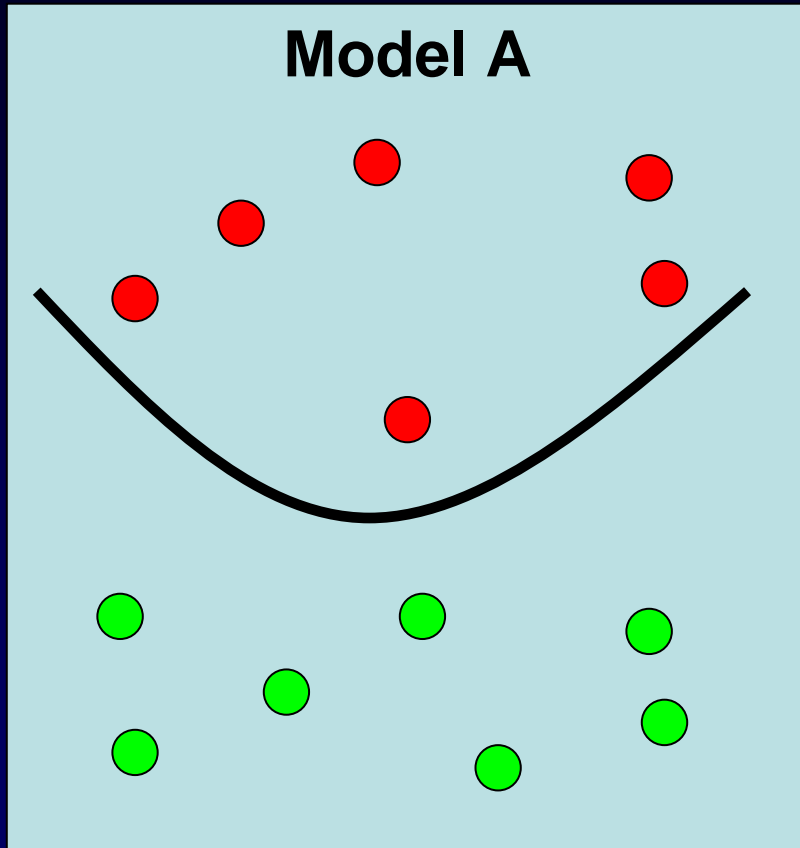


$$\text{Precision} = \frac{TP}{TP + FP}$$

More Measurements

- Similarity
 - similar observations should be classified similarly
- Simplicity
 - the simpler the model the better

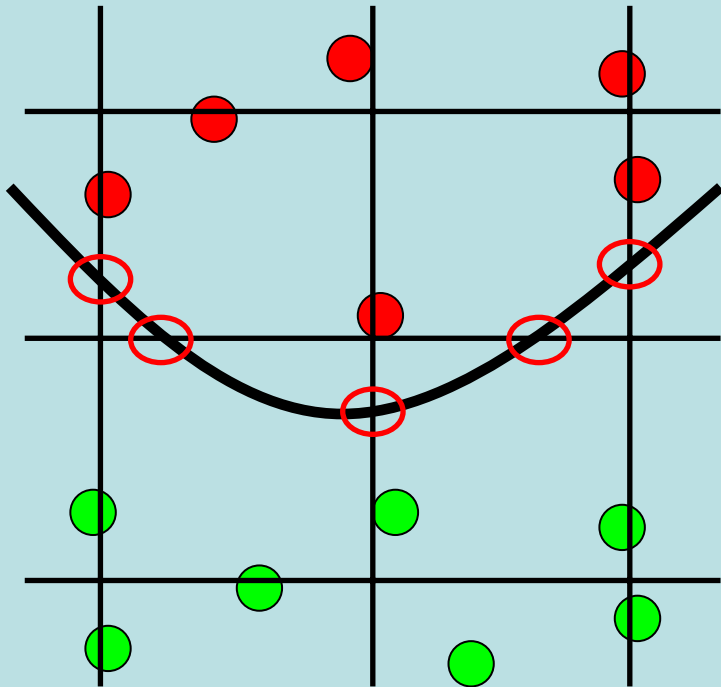
Simplicity



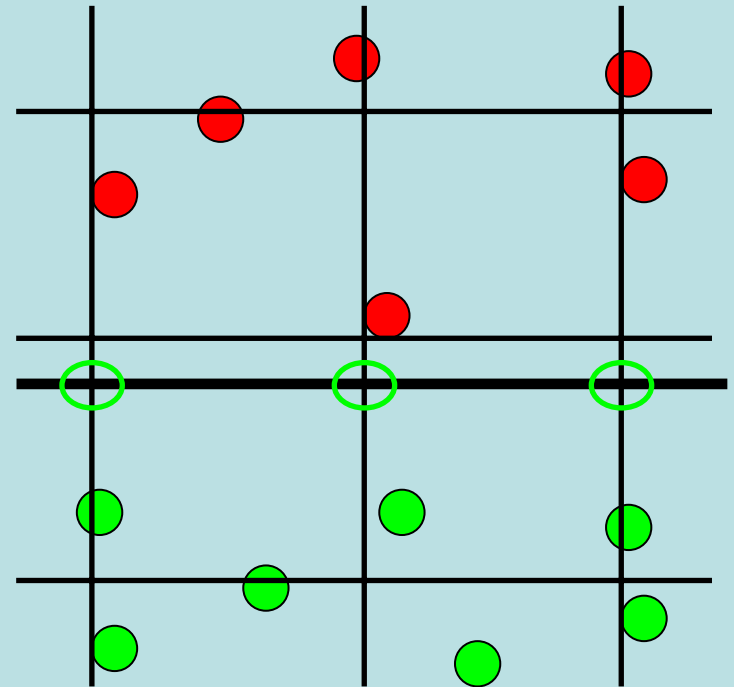
Which model is simpler?

How To Measure?

Model A

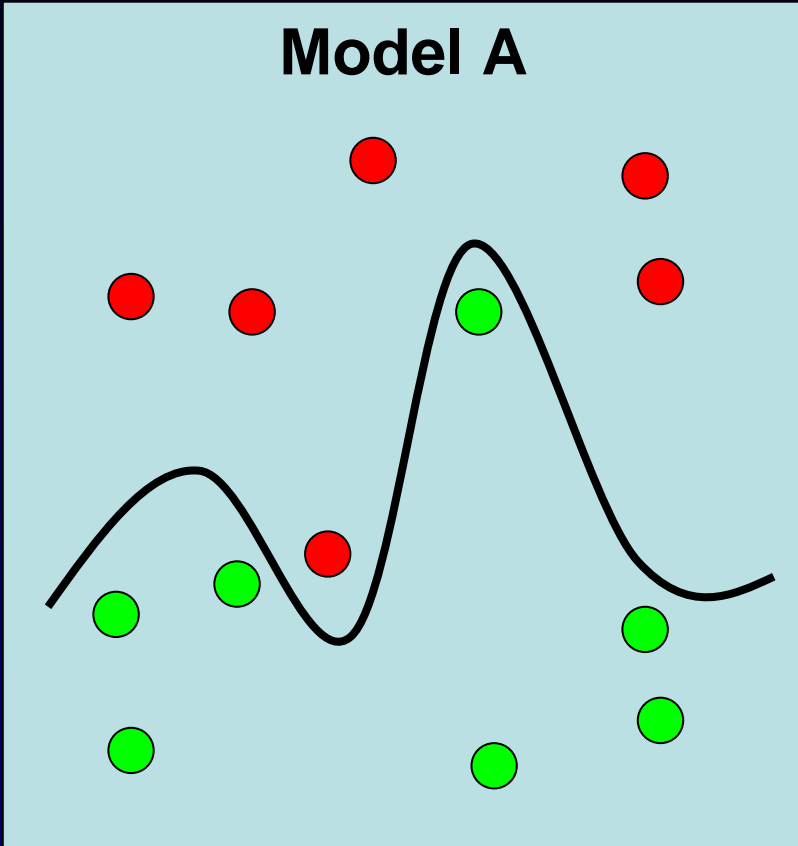


Model B

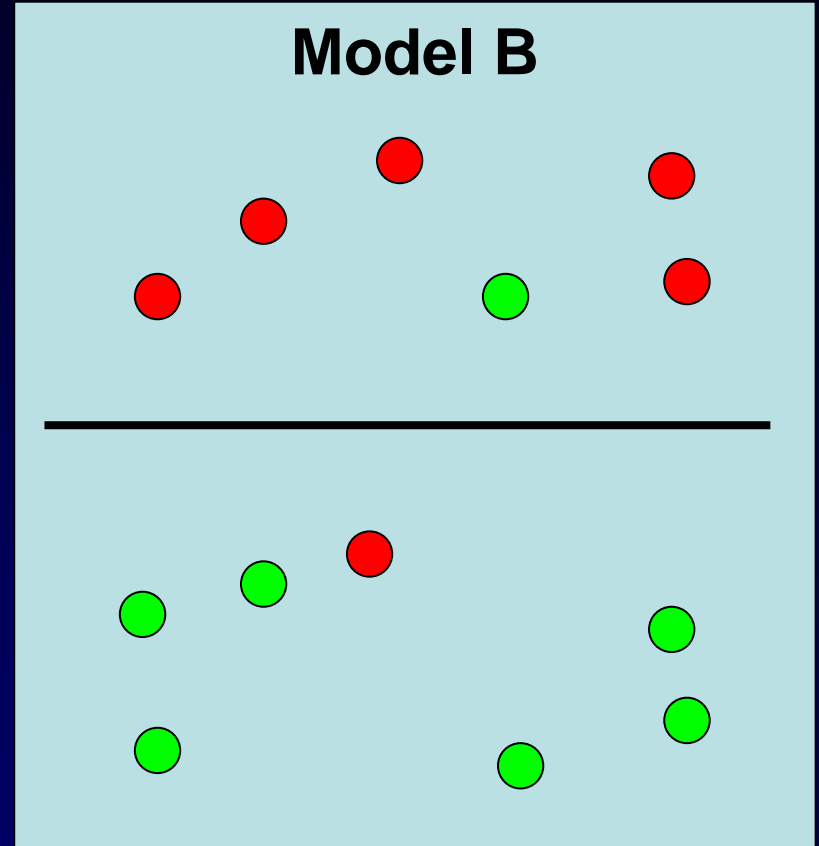


Over Fitting

Model A



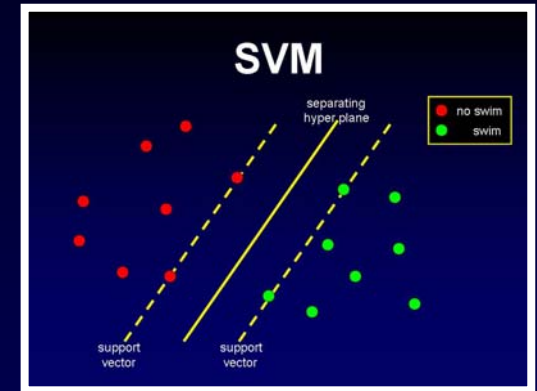
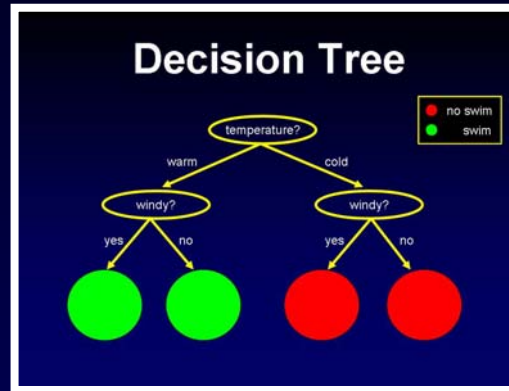
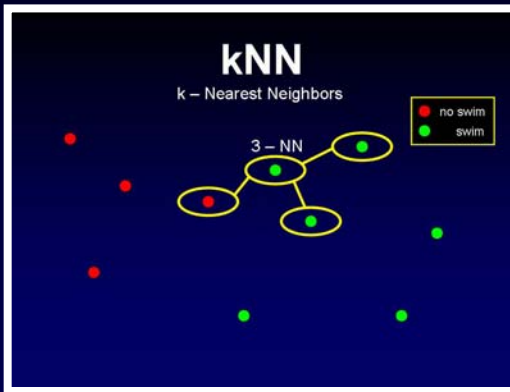
Model B



Measure Function

$a^* \text{subset fit} + b^* \text{similarity} - c^* \text{simplicity}$

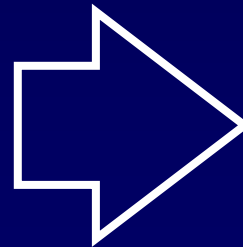
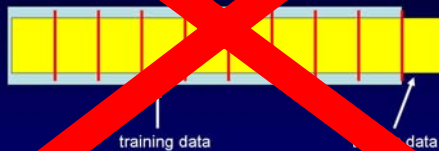
Conclusion



Lots of models and lots of parameters to tune.

State of the Art

~~Cross Validation~~



Measure Function

$$a * \text{subset fit} + b * \text{similarity} - c * \text{simplicity}$$