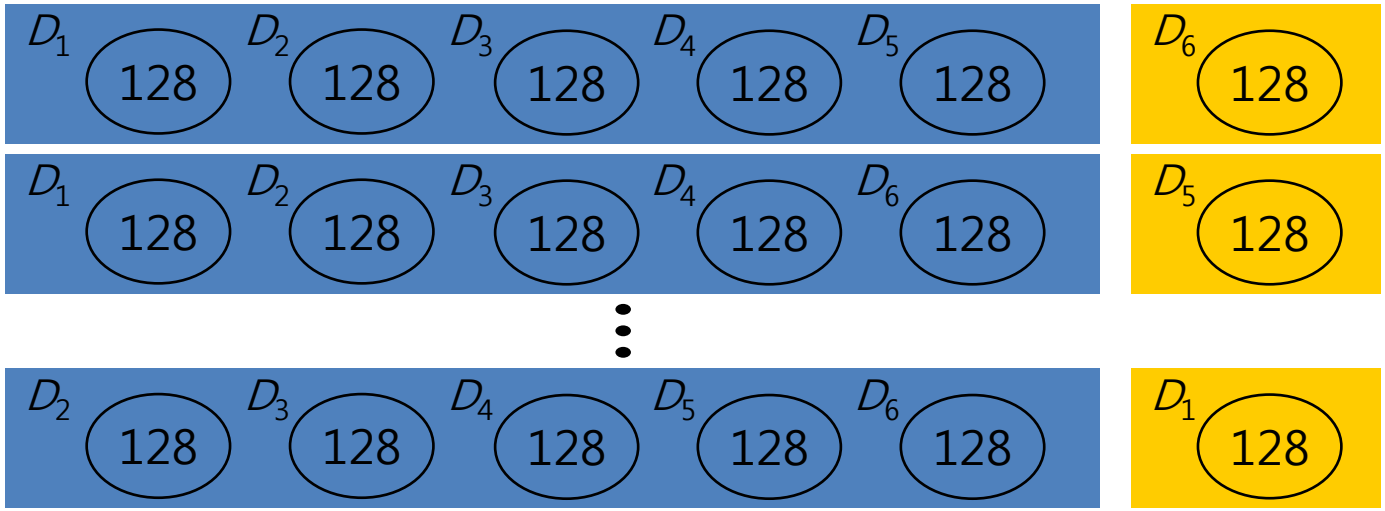
Weka

Evaluation Method - Cross Validation

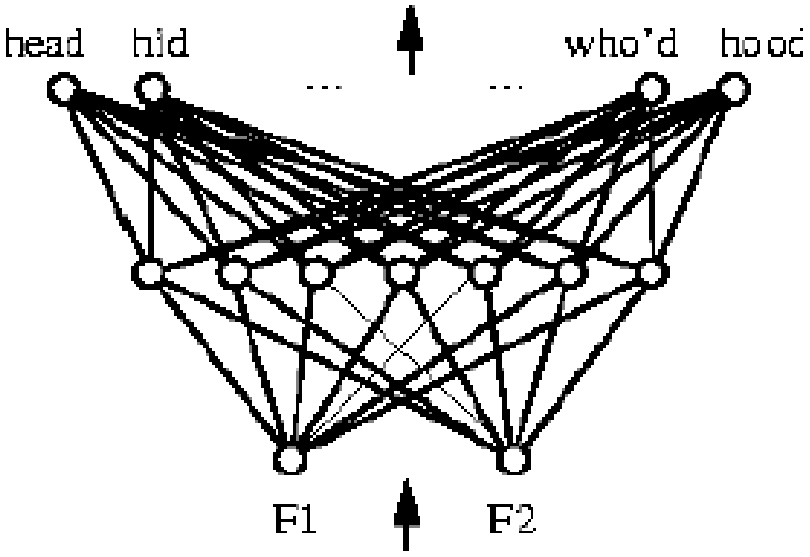
- *K*-fold Cross Validation
  - The data set is randomly divided into *k* subsets.
  - One of the *k* subsets is used as the 'test set' and the other *k*-1 subsets are put together to form a 'training set'.

$$Error = \frac{1}{k}\sum_{i=1}^{k} Error_i$$

6-fold cross validation



MLP with WEKA



Training time

GRADIENT-DESCENT($training\_examples, \eta$)

Each training example is a pair of the form $\langle \vec{x}, t \rangle$*, where* $\vec{x}$ *is the vector of input values, and* t *is the target output value.* η *is the learning rate (e.g., .05).*

- Initialize each w_i to some small random value
- Until the termination condition is met, Do
  - Initialize each Δw_i to zero.
  - For each $\langle \vec{x}, t \rangle$ in *training_examples*, Do
    - Input the instance $\vec{x}$ to the unit and compute the output o
    - For each linear unit weight w_i, Do

$$\Delta w_i \leftarrow \Delta w_i + \eta (t - o) x_i$$

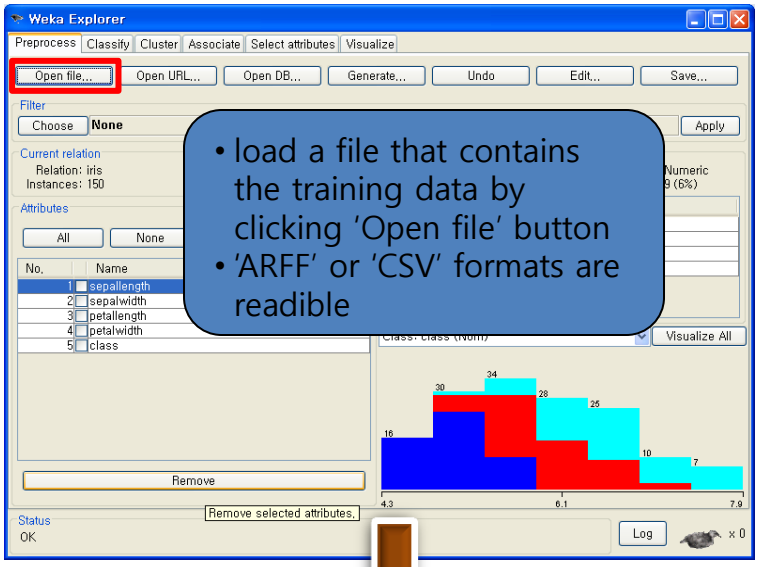
  - For each linear unit weight w_i, Do

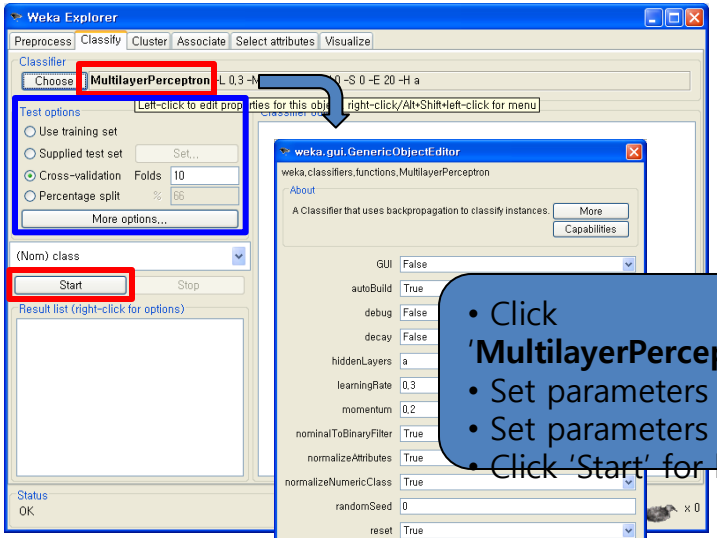
$$w_i \leftarrow w_i + \Delta w_i$$

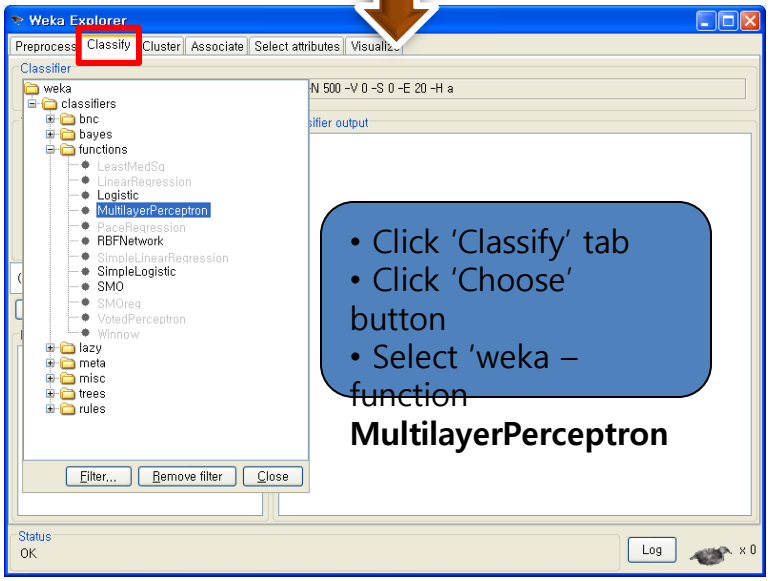
Learning rate

MLP in Weka

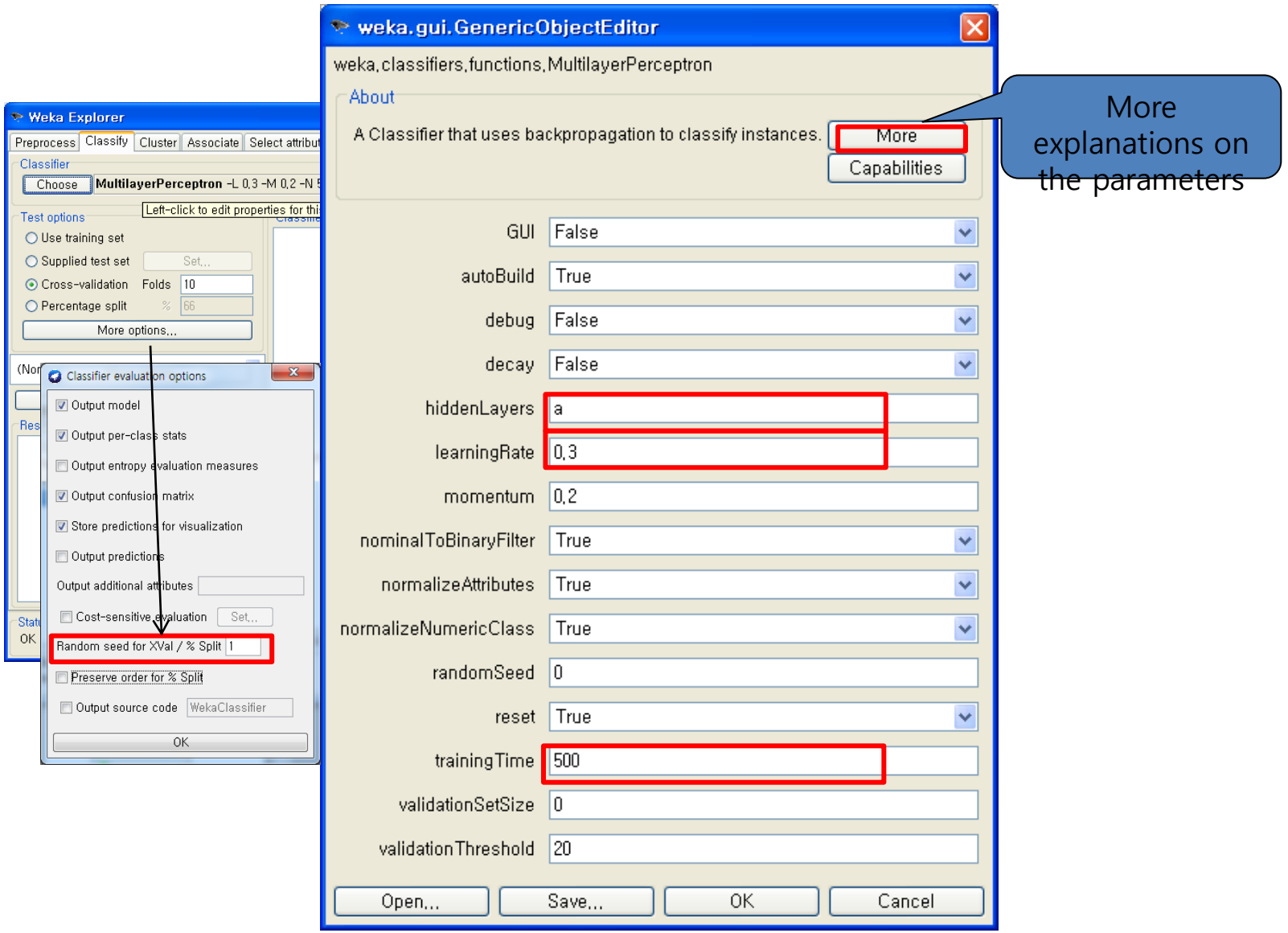

Weka GUI Chooser
Program Visualization Tools Help
click
WEKA
The University of Waikato
Explorer
Experimenter
KnowledgeFlow
Simple CLI
Waikato Environment for Knowledge Analysis
Version 3.6.0
(c) 1999 – 2008
The University of Waikato
Hamilton, New Zealand


Weka Explorer
Open file...
Open URL...
Open DB...
Generate...
Undo
Edit...
Save...
• load a file that contains the training data by clicking 'Open file' button
• 'ARFF' or 'CSV' formats are readible


Weka Explorer
Classifier
MultilayerPerceptron
Test options
Use training set
Supplied test set
Cross-validation
Percentage split
More options...
Start
Stop
Result list (right-click for options)
weka.gui.GenericObjectEditor
• Click 'MultilayerPerceptron'
• Set parameters for MLP
• Set parameters for Test
• Click 'Start' for learning


Weka Explorer
Classify
Classifier
weka
classifiers
bnc
bayes
functions
MultilayerPerceptron
lazy
meta
misc
trees
rules
• Click 'Classify' tab
• Click 'Choose' button
• Select 'weka – function
MultilayerPerceptron

Parameter setting of MLPs

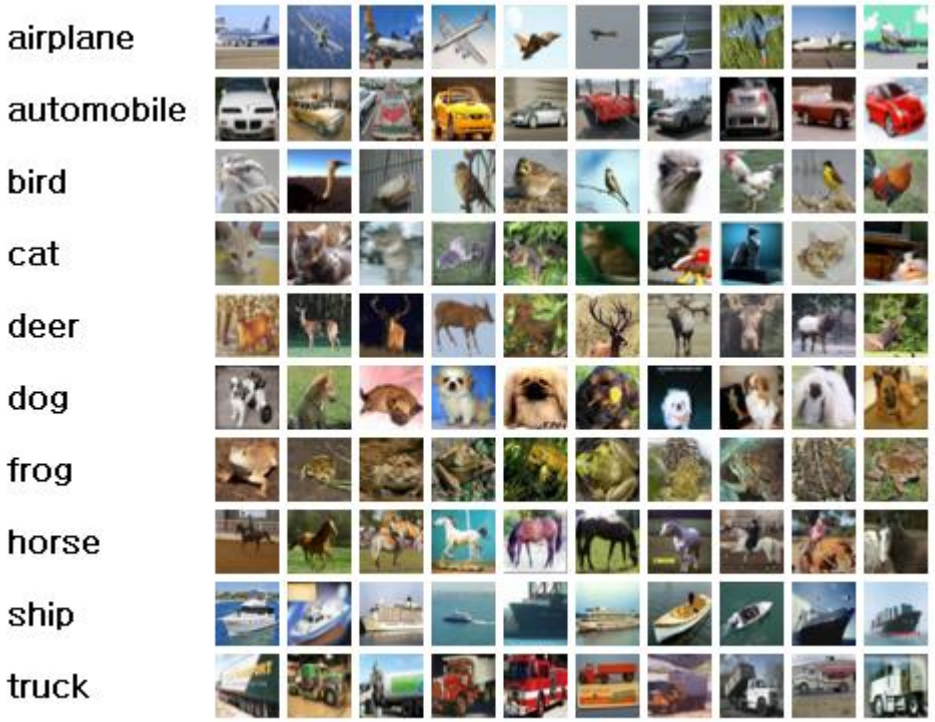


Dataset #1: Handwritten Digits (MNIST)

- Description
  - The MNIST database of handwritten digits contains digits written by office workers and students
  - We will build a recognition model based on classifiers with the reduced set of MNIST
  - http://yann.lecun.com/exdb/mnist/

- Configuration of the data set
  - Attributes
    - pixel values in gray level in a 28x28 image
    - 784 attributes (all 0~255 integer)
  - Full MNIST set
    - Training set: 60,000 examples
    - Test set: 10,000 examples
  - For our practice, a reduced set with 800 examples is used
  - Class value: 0~9, which represent digits from 0 to 9

Dataset #2: CIFAR-10



- Description
  - 32 x 32 colour images
  - 10 class
  - 6000 images per class
  - http://www.cs.utoronto.ca/~kriz/cifar.html
- Configuration of the data set
  - Attributes
    - pixel values in colour level in a 32x32 image
    - R,G,B channels
    - 3072 attributes (all 0~1 real values)
  - Class value: 0~9, which represent digits from 0 to 9

Confusion Matrix

Real / Prediction	Positive	Negative	
Positive	**TP**	**FP**	**All with positive Test**
Negative	**FN**	**TN**	**All with Negative Test**
	All with Disease	**All without Disease**	**Everyone**

$$\text{Accuracy} = \frac{TP + TN}{TP + FP + TN + FN}$$

$$\text{Precision} = \frac{TP}{TP + FP} \qquad \text{Recall} = \frac{TP}{TP + FN}$$

As **recall** ↑ **precision** ↓

conversely:

As **recall** ↓ **precision** ↑

Make an .arff file

```
@RELATION <dataset name>

@ATTRIBUTE <feature1 name> <feature1 type>
@ATTRIBUTE <feature2 name> <feature2 type>
@ATTRIBUTE <feature3 name> <feature3 type>
@ATTRIBUTE <feature4 name> <feature4 type>
.....
@ATTRIBUTE class <classes name>

@DATA
1,2,3,1, apple
3,2,0,1, book
......
```

Header

Data
(feature values + class)

Data format for Weka (.ARFF)

Header

```
@relation heart-disease-simplified

@attribute age numeric
@attribute sex { female, male}
@attribute chest_pain_type { typ_angina, asympt, non_anginal,
    atyp_angina}
@attribute cholesterol numeric
@attribute exercise_induced_angina { no, yes}
@attribute class { present, not_present}

@data
```

Data
(CSV format)

```
63,male,typ_angina,233,no,not_present
67,male,asympt,286,yes,present
67,male,asympt,229,yes,present
38,female,non_anginal,?,no,not_present
```

Note: You can easily generate 'arff' file by adding a header to a usual CSV text file