Weka & Rapid Miner Tutorial

Original version by Chibuike Muoh
Modified by DBDMG

WEKA:: Installation

- Download software from http://www.cs.waikato.ac.nz/ml/weka/
  - If you are interested in modifying/extending Weka there is a developer version that includes the source code
- Set the Weka environment variable for java
  - `setenv WEKAHOME /usr/local/weka/weka-3-0-2`
  - `setenv CLASSPATH $WEKAHOME/weka.jar:$CLASSPATH`
- Download some data from http://mlearn.ics.uci.edu/MLRepository.html

WEKA:: Introduction

- A collection of open source ML algorithms
  - pre-processing
  - classifiers
  - clustering
  - association rule
- Created by researchers at the University of Waikato in New Zealand
- Java based

WEKA:: Introduction .contd

- Routines are implemented as classes and logically arranged in packages
- Comes with an extensive GUI interface
- Weka routines can be used stand alone via the command line
- Weka routines can be used in your own Java code

WEKA:: Data format

- Uses flat text files to describe the data
- Can work with a wide variety of data files including its own ".arff" format and C4.5 file formats
- Data can be imported from a file in various formats:
  - ARFF, CSV, C4.5, binary
- Data can also be read from a URL or from an SQL database (using JDBC)

WEKA:: ARRF file format

```
@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
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
...
```

numeric attribute

nominal attribute

A more thorough description is available here
http://www.cs.waikato.ac.nz/~ml/weka/arff.html

WEKA:: Example

- Using weka from command line
- Example
  - Decision tree: J48
  - Training data: iris.arff
  - Cross-validation (which is the default option)

WEKA:: Example

- Using weka from command line
- The command is

```
java -classpath weka.jar
  weka.classifiers.trees.J48 -t iris.arff
```

- The output is
  - the generated model
  - the cross-validation results

WEKA:: Example

- The model

```
petalwidth <= 0.6: Iris-setosa (50.0)
   petalwidth > 0.6
   |   petalwidth <= 1.7
   |   |   petallength <= 4.9: Iris-versicolor (48.0/1.0)
   |   |   petallength > 4.9
   |   |   |   petalwidth <= 1.5: Iris-virginica (3.0)
   |   |   |   petalwidth > 1.5: Iris-versicolor (3.0/1.0)
   |   petalwidth > 1.7: Iris-virginica (46.0/1.0)
```

WEKA:: Example

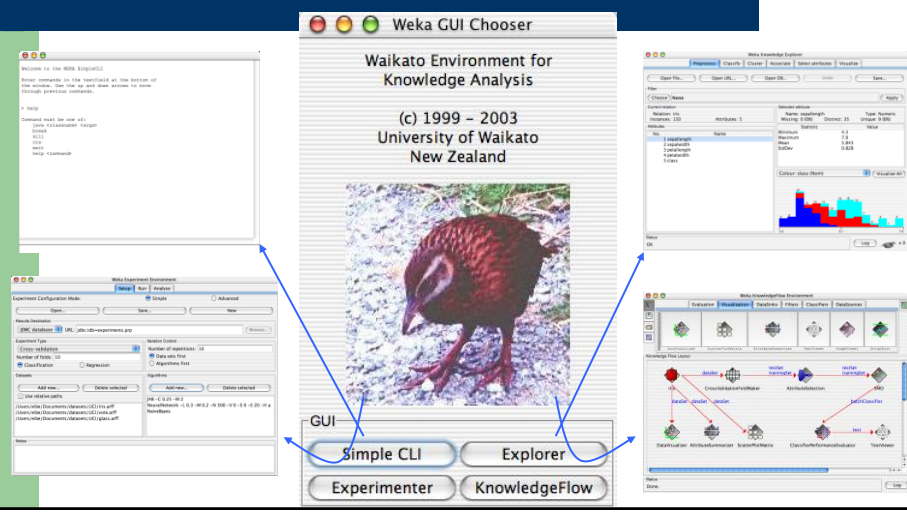
- The results

```
=== Stratified cross-validation ===
   Correctly Classified Instances         144   96%
   Incorrectly Classified Instances         6    4%
    .......
   === Confusion Matrix ===
     a    b  c   <-- classified as
    49  1   0  |  a = Iris-setosa
     0  47  3  |  b = Iris-versicolor
     0   2  48 |  c = Iris-virginica
```

WEKA:: Interface

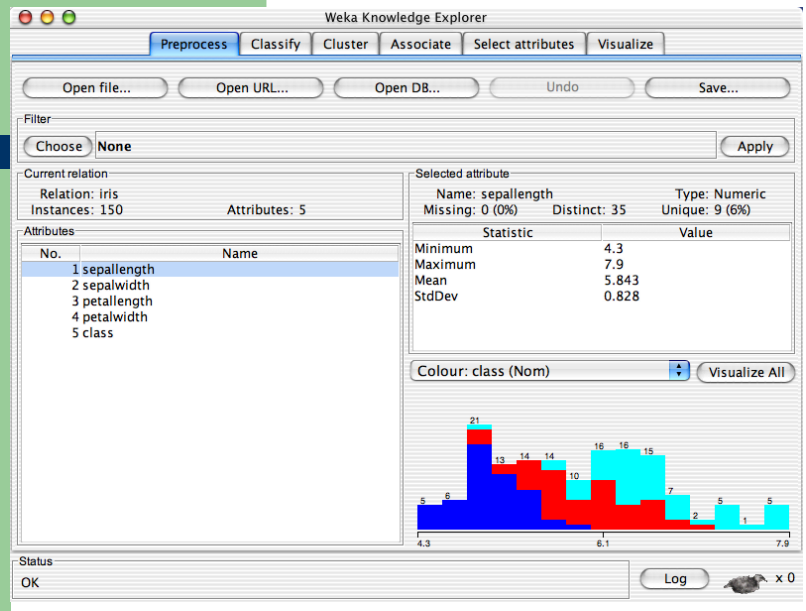
- Simple **CLI** provides a command line interface to weka's routines
- **Explorer** interface provides a graphical front end to weka's routines and components
- **Experimenter** allows you to build classification experiments
- **KnowledgeFlow** provides an alternative to the Explorer as a graphical front end to Weka's core algorithms with drag and drop support.

WEKA:: Interface



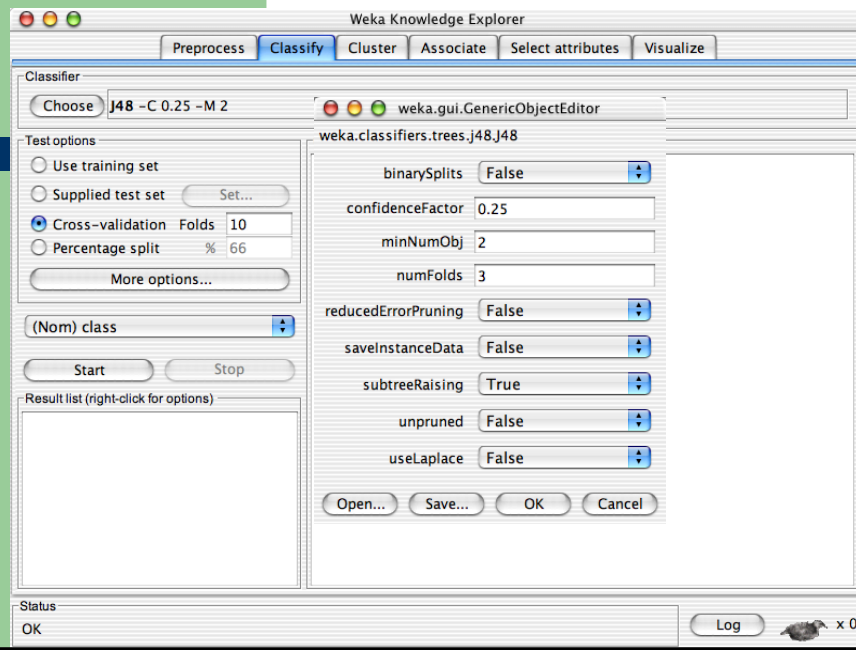
WEKA:: Explorer: Preprocessing

- Pre-processing tools in WEKA are called “filters”
- WEKA contains filters for:
  - Discretization, normalization, resampling, attribute selection, transforming, combining attributes, etc
- Open a file
- Choose the filter
- Select “Apply”



WEKA:: Explorer: building "classifiers"

- Classifiers in WEKA are models for predicting nominal or numeric quantities
- Implemented learning schemes include:
  - Decision trees and lists, instance-based classifiers, support vector machines, multi-layer perceptrons, logistic regression, Bayes' nets, …
- "Meta"-classifiers include:
  - Bagging, boosting, stacking, error-correcting output codes, locally weighted learning, …



WEKA:: Using Weka in your Java code

- Main steps
  1. Creating an **Instances** object to store the dataset
  2. Possible data discretization
  3. Data mining algorithm application
  4. Visualize and save the results

WEKA:: Explorer

- Example showing simple analysis on the Iris dataset

RapidMiner:: Introduction

- A very comprehensive open-source software implementing tools for
  - intelligent data analysis, data mining, knowledge discovery, machine learning, predictive analytics, forecasting, and analytics in business intelligence (BI).
- Is implemented in Java and available under GPL among other licenses
- Available from http://rapid-i.com

RapidMiner:: Intro. Contd.

- Is similar in spirit to Weka's Knowledge flow
- Data mining processes/routines are views as sequential operators
  - Knowledge discovery process are modeled as operator chains/trees
    - Operators define their expected inputs and delivered outputs as well as their parameters
- Has over 400 data mining operators

RapidMiner:: Intro. Contd.

- Uses XML for describing operator trees in the KD process
- Alternatively can be started through the command line and passed the XML process file

RapidMiner:: Screenshot