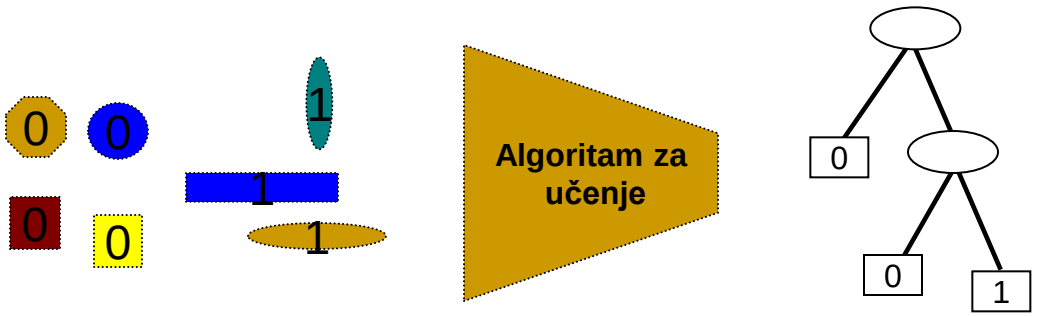
Strojno učenje



- WEKA

WEKA

Zbirka algoritama za strojno učenje (JAVA, GPL)

Ian Witten & Eibe Frank

Knjiga:

"Data Mining – Practical Machine Learning Tools and Techniques", Morgan Kaufmann, 2nd edition.

WEB – site: www.cs.waikato.ac.nz/ml/weka

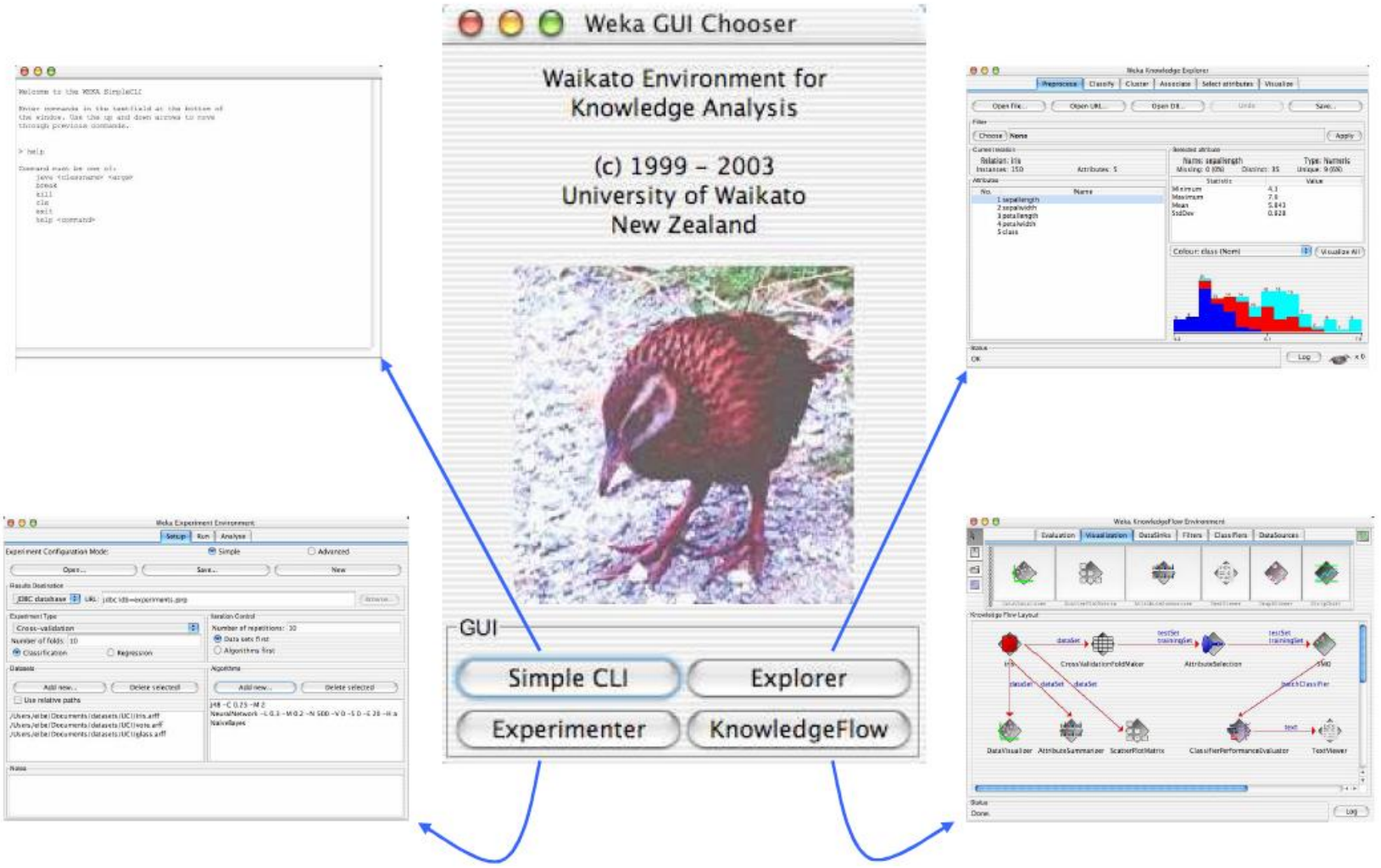
- Pred-procesiranje podataka (re-sampling, filtriranje: atributi, primjeri)
- Nadzirano, nenadzirano učenje
- Klasifikacija, regresija, "clustering", asocijativna pravila,.....
- Algoritmi: Decision trees, rule learning, naiveBayes, NN, Bnets, SVM, Random Forest....
- Meta-learning
- različite resampling sheme (boosting, bagging, stacking) i tehnike za kombiniranje više modela ili algoritama za učenje

WEKA -download

www.cs.waikato.ac.nz/ml/weka

- Requirements (Java 5.0+)
- Download (stabilna verzija 3.6.x + manual !!)
- Documentation, FAQ
- Tutorials (npr. http://maya.cs.depaul.edu/~classes/ect584/WEKA/index.html)
- Datasets (možete downloadati UCI Irvine ML datasets – samo neke – ali već u arff formatu !)
- .....
- Related Projects .....

WEKA -download



WEKA – format ulaznih podataka

- arff; csv, c4.5, binary,... + 10tak drugih formata

- Moj_problem.arff – format podataka

  Komentari – bilo gdje: % - ispred teksta, komentari nisu ograniceni kolicinom

  % 1. Title: moj_problem
  % Author: Tom Smuc
  % 2. Sources:

  @relation moj_problem <= **ime datoteke ili problema**
  <= **prazna linija**
  @attribute x1 numeric <= **prvi atribut - numerički**
  @attribute x2 {plavo, bijelo, "crveno"} <= **2. atribut – kategorički**
  .....
  @attribute xn numeric <= **n-ti atribut – numerički**
  @attribute class {on,off} <= **n+1-vi atribut – default – zadnji atribut = ciljni atribut**
  <= **prazna linija**
  @data <= **odavde pa do kraja datoteke su podaci – CSV format !**
  5.1, plavo,.... ,0.2,on
  4.3, bijelo,.... ,2.2,off
  4.3, **?**,.... ,2.2,off <= **? Označava "nedostajuće" podatke (en. Missing data)**

WEKA – format ulaznih podataka

- iris.arff – problem dataset

```
@RELATION iris

@ATTRIBUTE sepallength       numeric
@ATTRIBUTE sepalwidth        numeric
@ATTRIBUTE petallength       numeric
@ATTRIBUTE petalwidth        numeric
@ATTRIBUTE class {Iris-setosa,Iris-versicolor,Iris-virginica}

@DATA
5.1,3.5,1.4,0.2,Iris-setosa
4.9,3.0,1.4,0.2,Iris-setosa
4.7,3.2,1.3,0.2,Iris-setosa
.....
.....
6.3,2.5,5.0,1.9,Iris-virginica
6.5,3.0,5.2,2.0,Iris-virginica
6.2,3.4,5.4,2.3,Iris-virginica
5.9,3.0,5.1,1.8,Iris-virginica
```

WEKA – format ulaznih podataka

- iris.csv

Sepallength,sepalwidth,petallength,petalwidth,class
5.1,3.5,1.4,0.2,Iris-setosa
4.9,3.0,1.4,0.2,Iris-setosa
4.7,3.2,1.3,0.2,Iris-setosa
.....
.....
6.3,2.5,5.0,1.9,Iris-virginica
6.5,3.0,5.2,2.0,Iris-virginica
6.2,3.4,5.4,2.3,Iris-virginica
5.9,3.0,5.1,1.8,Iris-virginica

WEKA – sa komandne linije

WINDOWS

- **CLASSPATH – environment varijabla**
- **set CLASSPATH=c:\Program Files\Weka-3-5\weka.jar**

U nekom vašem direktoriju .....

%prompt> java weka.classifiers.trees.J48

- Output : help on J48 (stabla odlučivanja – C4.5)

%prompt> java weka.classifiers.lazy.IB1

- Output : help on IB1 (1-nn !)

....

%prompt> java weka.classifiers.trees.J48 – t data\labor.arff

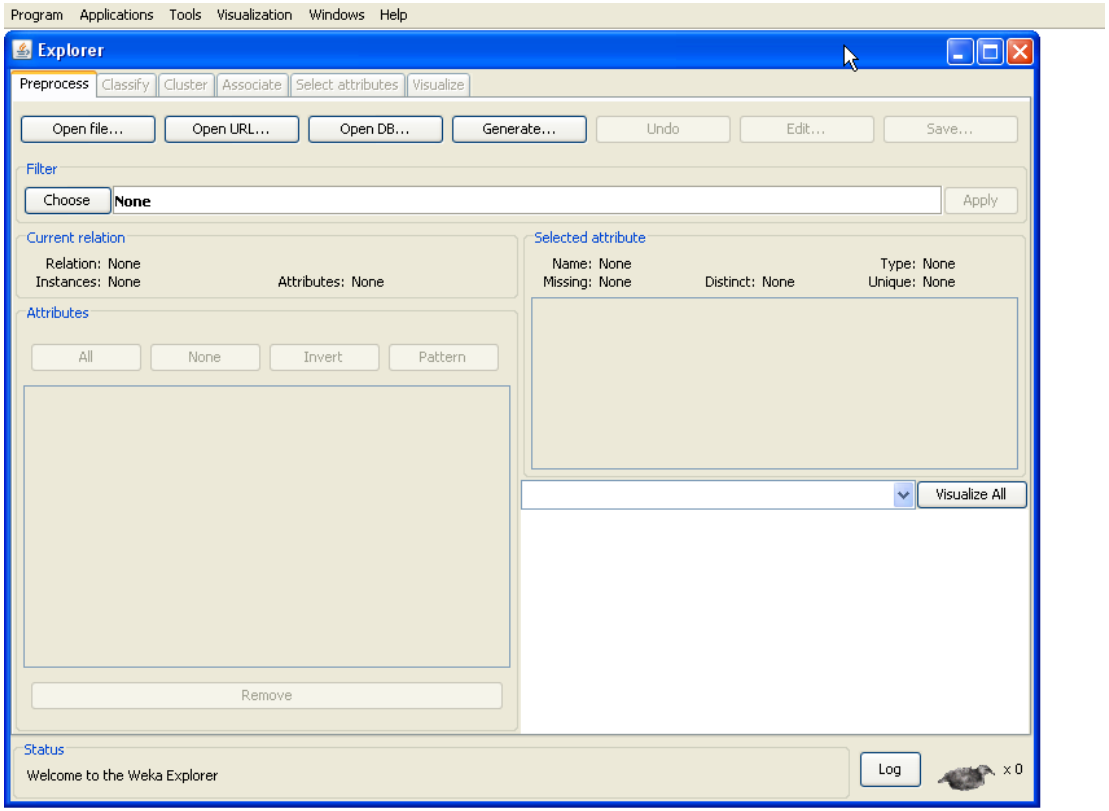
Output: summary rezultata na "training" skupu

-x 10 (opcija koja pokreće 10-fold cross validation)

WEKA – GUI

Applications

- **Explorer**
- Experimenter
- KnowledgeFlow
- SimpleCLI



WEKA – Explorer - preprocessing

Filteri:

- Supervised
- Unsupervised

  - Za primjere (en. instances)

  - za atribute (varijable)

WEKA – Explorer – Classification
Decision Trees - output

```
=== Run information ===

Scheme:       weka.classifiers.trees.J48 -C 0.25 -M 2
Relation:     labor-neg-data
Instances:    57
Attributes:   17
              duration
              wage-increase-first-year
              wage-increase-second-year
              wage-increase-third-year
              cost-of-living-adjustment
              working-hours
              pension
              standby-pay
              shift-differential
              education-allowance
              statutory-holidays
              vacation
              longterm-disability-assistance
              contribution-to-dental-plan
              bereavement-assistance
              contribution-to-health-plan
              class
Test mode:    10-fold cross-validation
```

WEKA – Explorer – Classification
Decision Trees - output

```
=== Classifier model (full training set) ===

J48 pruned tree
------------------

wage-increase-first-year <= 2.5: bad (15.27/2.27)
wage-increase-first-year > 2.5
|   statutory-holidays <= 10: bad (10.77/4.77)
|   statutory-holidays > 10: good (30.96/1.0)

Number of Leaves  : 3

Size of the tree :  5

Time taken to build model: 0 seconds
```

WEKA – Explorer – Classification
Decision Trees - output

```
=== Stratified cross-validation ===
=== Summary ===

Correctly Classified Instances          42               73.6842 %
Incorrectly Classified Instances        15               26.3158 %
Kappa statistic                          0.4415
Mean absolute error                      0.3192
Root mean squared error                  0.4669
Relative absolute error                 69.7715 %
Root relative squared error             97.7888 %
Total Number of Instances               57
```

WEKA – Explorer – Classification
Decision Trees - output

```
=== Detailed Accuracy By Class ===

TP Rate   FP Rate   Precision   Recall  F-Measure   ROC Area  Class
  0.7       0.243      0.609     0.7       0.651      0.695    bad
  0.757     0.3        0.824     0.757     0.789      0.695    good

=== Confusion Matrix ===

  a  b   <-- classified as
 14  6 |  a = bad
  9 28 |  b = good
```

WEKA – vježbe

Pred-procesiranje (podataka)

- Naći podatke (… mogu i vlastiti podaci)
  - Iris
  - zoo
  - Waveform

- Upoznavanje WEKA-e:
  - Filteri
    - sampliranje, spremanje....
  - Vizualizacija podataka:
    - summary stats, scatter plots...

WEKA – vježbe

Klasifikacija

- 3 klasifikatora (možda i koji više...)
  - Decision trees (J48)
  - Naive Bayes
  - k-nn
- Određivanje točnosti klasifikatora
  - Training error
  - Training/test
  - Cross validation
  - ROC krivulje
- Vizualizacija modela

WEKA eksperimenti = 5 dodatnih bodova !

- **UCI datasets**
  - dostupni sa **ww.cs.waikato.ac.nz/ml/weka**
  - Odabrati 4 skupa podataka – po vlastitom nahođenju
  - Napraviti krivulje učenja (ovisnost greške (XV) o veličini skupa za učenje za 4 algoritma: Naive Bayes(NB), Decision Tree (J48), k-nn (IBk), (neuralna mreža) MultiLayer Perceptron
  - veličina skupa za učenje za određivanje krivulje učenja – (10%, 20%, 40%, 80%, 100%)
  - Usporediti algoritme na svakom od ta 4 skupa
  - **Izvještaj u formi kratkog članka**

  - + bodovi: statistički ocijeniti značajnost razlika između algoritama

    { 2 načina:

    a. Koristiti WEKA-u +
    - **članak T.G. Dietterich: Approximate Statistical Tests for Comparing Supervised Classification Learning Algorithms (google – CiteSeer – download)**

    b.
    - **Naučiti koristiti Experimenter u WEKA-i (lakši put :-)**