Description
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KEEL (Knowledge Extraction based on Evolutionary Learning) is an open source (GPLv software tool which empowers the user to assess the behavior of evolutionary learning a Computing based techniques for different kinds of DM problems: regression, classification, clu pattern mining and so on. KEEL is being developed under the Spanish National Projects T 04036-C05, TIN2005-08386-C05 and TIN2008-06681-C06 with the collaboration of the six f Spanish Research Groups:

SCI^{2}S (Spanish National Proyects TIC2002-04036-C05-01, TIN2005-08386-C05-01 and TIN2008-06681-C06-01)

Ayrna (Spanish National Proyects TIC2002-04036-C05-02, TIN2005-08386-C05-02 and TIN2008-06681-C06-03)

GRSI (Spanish National Proyects TIC2002-04036-C05-03, TIN2005-08386-C05-04 and TIN2008-06681-C06-05)

Intelligent Systems and Data Mining (Spanish National Proyects TIC2002-04036-C05-04, TIN2005-08386-C05-03 and TIN2008-06681-C06-02)

Metrology and Models (Spanish National Proyects TIC2002-04036-C05-05, TIN2005-08386-C05-05 and TIN2008-06681-C06-04)

Inte Syste Data (Sp Nationa TIN200 C0

If you want to refer to KEEL in a publication, please cite us using the following references:

KEEL description papers:

J. Alcalá-Fdez, L. Sánchez, S. García, M.J. del Jesus, S. Ventura, J.M. Garrell, J. Otero C. Romero, J. Bacardit, V.M. Rivas, J.C. Fernández, F. Herrera. KEEL: A Software Tool t Assess Evolutionary Algorithms to Data Mining Problems. Soft Computing 13:3 (2009 307-318, doi: 10.1007/s00500-008-0323-y.

J. Alcalá-Fdez, A. Fernandez, J. Luengo, J. Derrac, S. García, L. Sánchez, F. Herrera KEEL Data-Mining Software Tool: Data Set Repository, Integration of Algorithms an Experimental Analysis Framework. Journal of Multiple-Valued Logic and Soft Computin 17:2-3 (2011) 255-287.

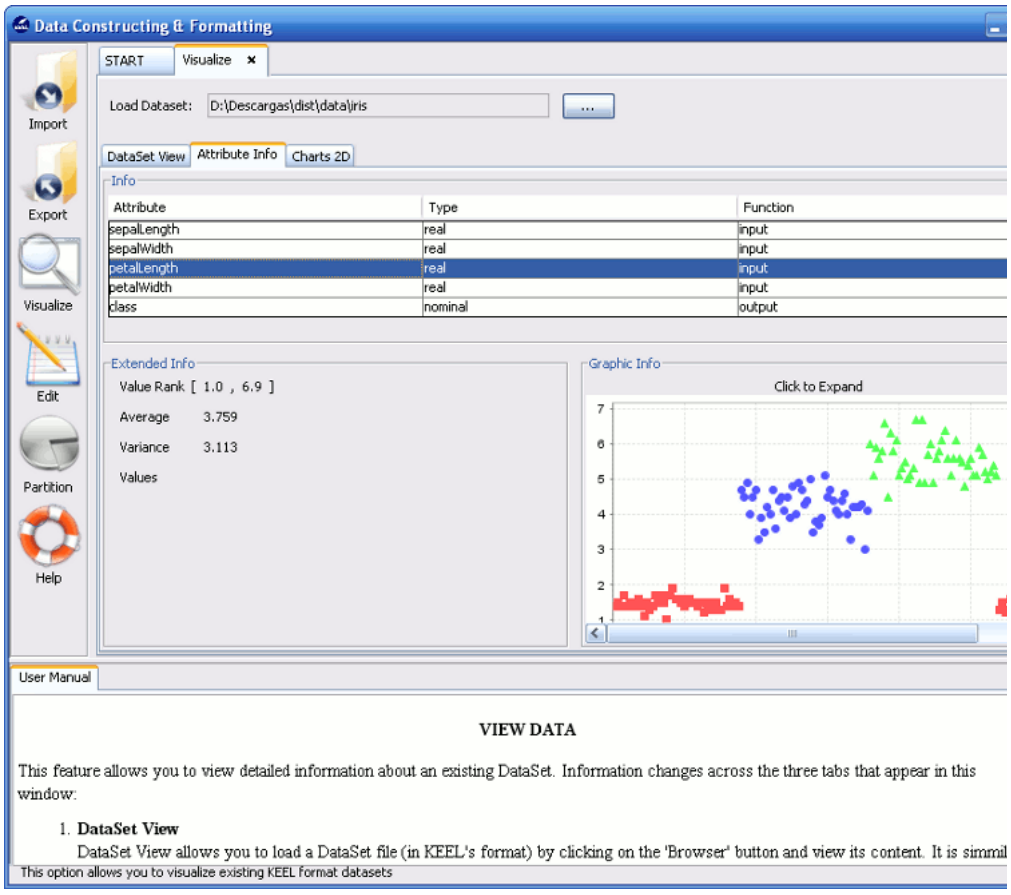
Contents

KEEL description

KEEL is a software tool to assess EAs for DM problems including regression, classification, clu pattern mining and so on. The version of KEEL presently available consists of the following blocks:

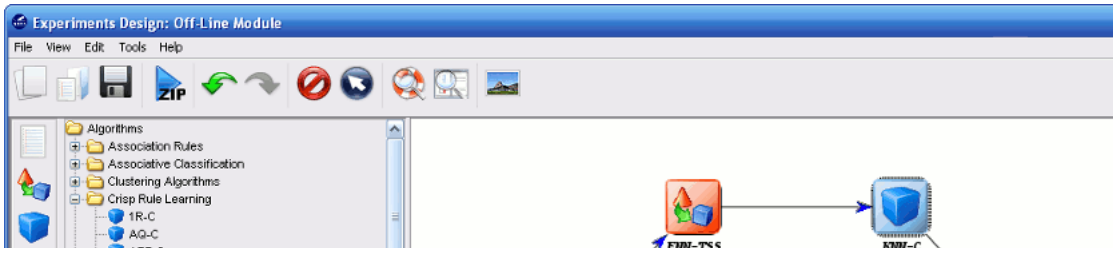
- *Data Management*

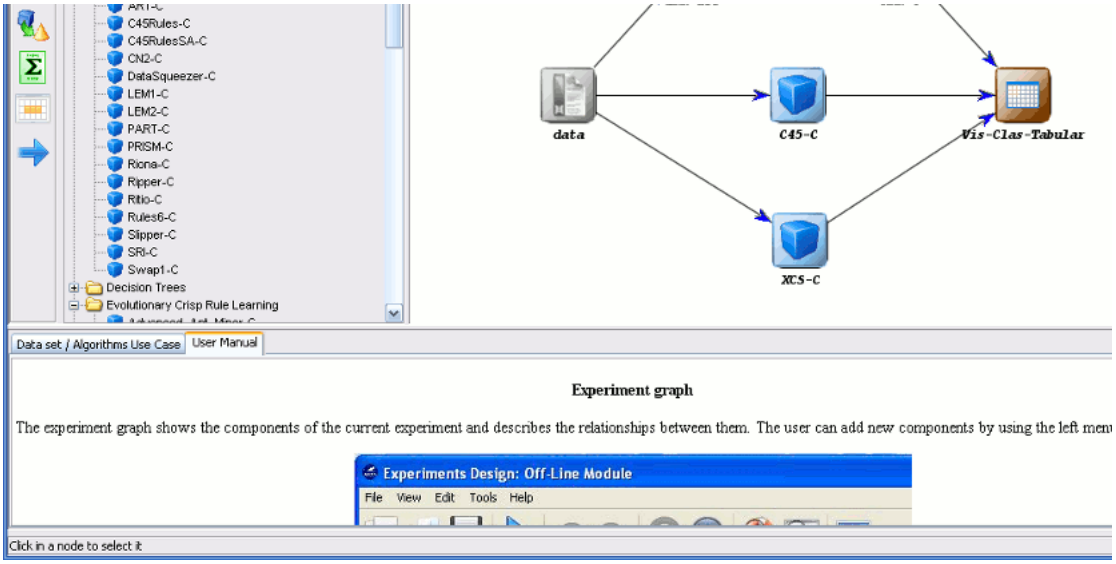
  This part is composed by a set of tools that can be used to build new data, export an data in other formats to KEEL format, data edition and visualization, apply transfor and partitioning to data, etc...



- *Design of Experiments*

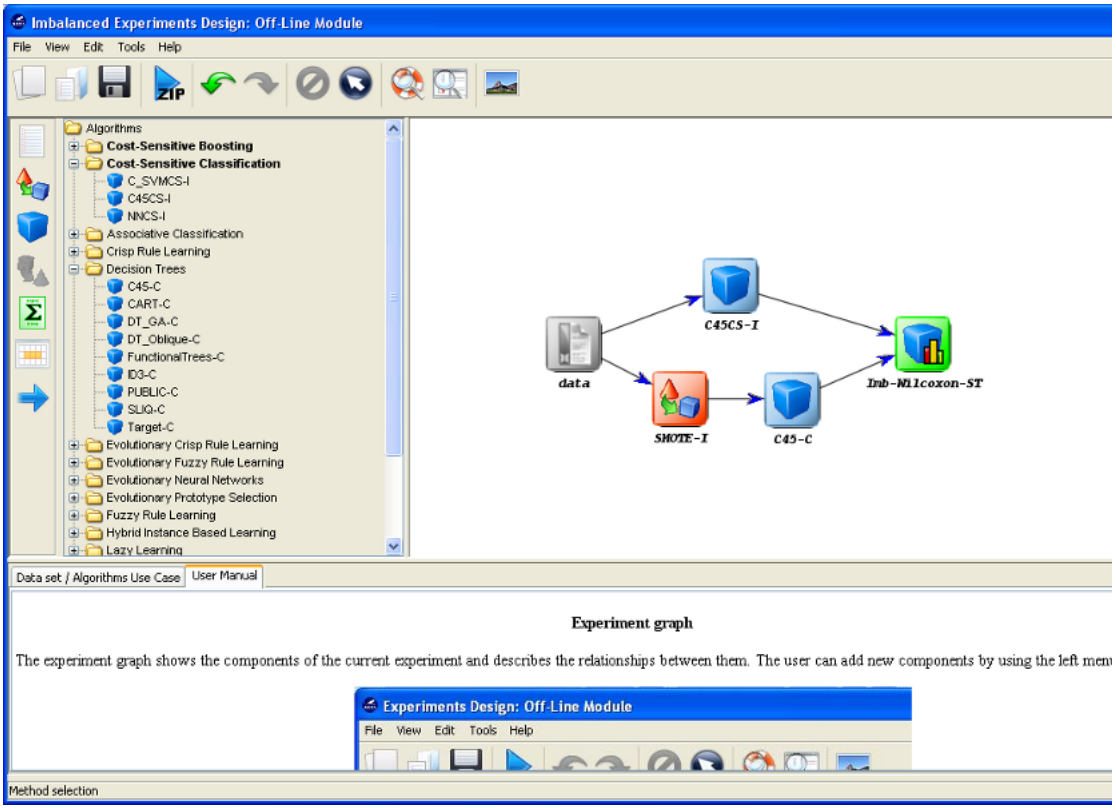
  The aim of this part is the design of the desired experimentation over the selected da It provides options for many choices: type of validation, type of learning (classi regression, unsupervised learning, subgroup discovery), etc...





- *Design of Imbalanced Experiments*

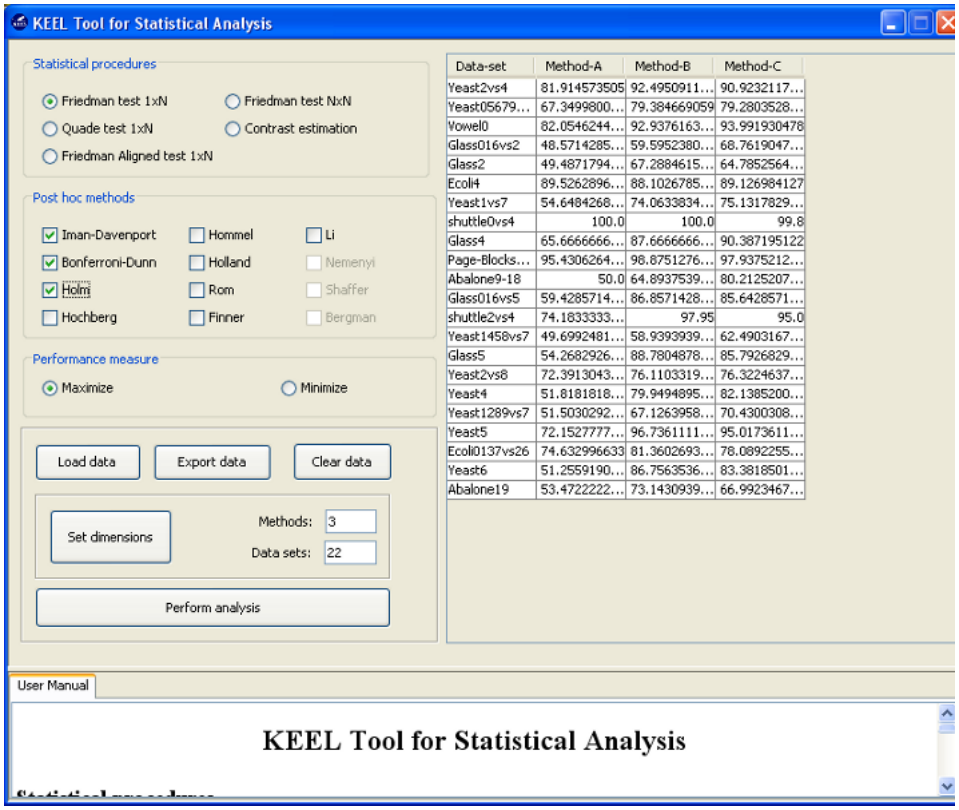
  The aim of this part is the design of the desired experimentation over the imbalanced data sets. These experiments are created for 5cfv datasets and include algorithms for imbalanced data and general classification algorithms.



- *Statistical Tests*

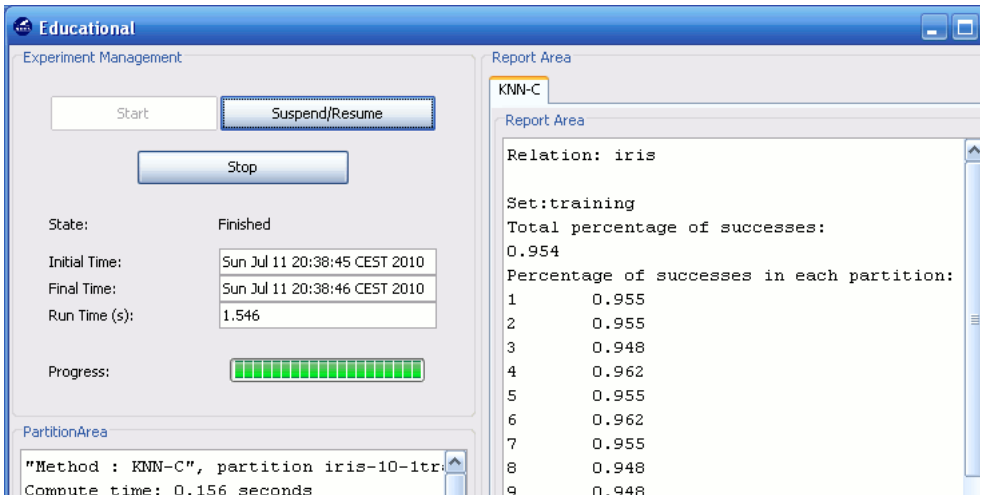
  KEEL is one of the fewest Data Mining software tools that provides to the resea complete set of statistical procedures for pairwise and multiple comparisons. Inside t environment, several parametric and nonparametric procedures have been codec

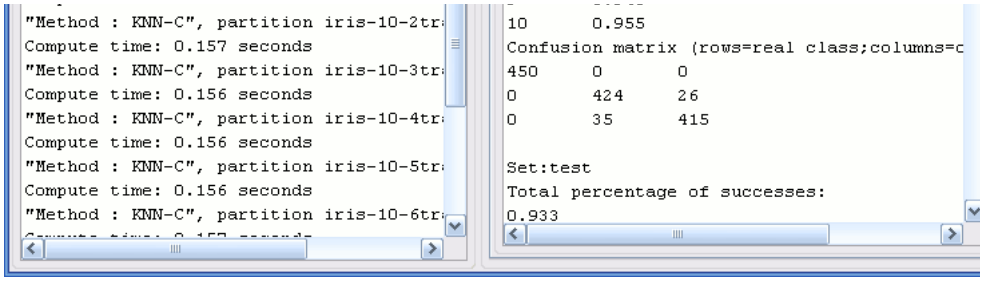
should help to contrast the results obtained in any experiment performed with the s
tool.



- *Educational Experiments*

  With a similar structure to the *Design of Experimets* part, allows us to design an exp
  which can be step-by-step debugged in order to use this as a guideline to show the
  process of a certain model by using the platform with educational objectives.





Taking into account each one of the function blocks, KEEL can be useful by different types which expect to find determined features in a Data Mining (DM) software.

In the following, we describe the user profiles who it is designed for, its main features different ways of working integrated in the software tool.

User Profiles

KEEL is an integration of an environment with a defined architecture and a developr knowledge extraction as expandable modules. It is mainly intended for two categories o researchers and students. Either group has a different set of needs:

- *KEEL as a research tool*

  The most common use of this tool for a researcher will be the automated exec experiments, and the statistical analysis of their results. Routinely, an experimenta includes a mix of evolutionary algorithms, statistical and AI-related techniques. Spe was taken to make possible that a researcher can use KEEL to assess the relevanc own procedures. Since the actual standards in machine learning require heavy compu work, the research tool is not designed to offer a real-time view of the progres algorithms, it is designed to rather generate a script and be batch-executed in a cl computers. The tool allows the researcher to apply the same sequence of pre-pro experiments and analysis to large batteries of problems and focus his attentior summary of the results.

- *KEEL as an educational tool*

  The needs of a student are quite different to those of a researcher. Generally speak objective is no longer that of making statistically sound comparisons between alg There is no need of repeating each experiment a large number of times. If the tool used in class, the execution time must be short and a real-time view of the evolutio algorithms is needed, since the student will use this information to learn how to ad parameters of the algorithms. In this sense, the educational tool is a simplified versio research tool, where only the most relevant algorithms are available. The execution in real time. The user has a visual feedback of the progress of the algorithms, and ca the final results from the same interface used to design the experimentation.

Both types of user require an availability of a set of features in order to be interested in usin Then, this is when we describe the main features of the KEEL software tool.

Main Features

KEEL is a software tool developed to ensemble and use different DM models. We would like to that this is the first software toolkit of this type containing a library of evolutionary algorithms with open source code in Java. The main features of KEEL are:

- Evolutionary Algorithms (*EAs) are presented in predicting models, pre-processing (evol feature and training set selection) and post-processing (evolutionary tuning of fuzzy rules).*

- *It includes data pre-processing algorithms proposed in specialized literature: data transfo discretization, training set selection, feature selection, imputation methods for missing val noisy data filtering methods.*

- *It has a statistical library to analyze algorithms' results. It comprises a set of statistical t analyzing the normality and heteroscedasticity of the results and performing parametric a parametric comparisons among the algorithms.*
- *Some algorithms have been developed by using a Java Class Library for Evolutionary Com (JCLEC)*
- *It provides an user-friendly interface, oriented to the analysis of algorithms.*
- *The software is aimed to create experimentations containing multiple data sets and alg connected among themselves to obtain a result expected. Experiments are independentl generated from the user interface for an off-line run in the same or other machines.*
- *KEEL also allows to create experiments in on-line mode, aiming an educational support in learn the operation of the algorithms included.*
- *It contains a Knowledge Extraction Algorithms Library, remarking the incorporation of evolutionary learning algorithms, together with classical learning approaches. Th employment lines are:*
    - *Different evolutionary rule learning models have been implemented*
    - *Fuzzy rule learning models with a good trade-off between accuracy a interpretability.*
    - *Evolution and pruning in neural networks, product unit neural networks, and rad base models.*
    - *Genetic Programming: Evolutionary algorithms that use tree representations f extracting knowledge.*
    - *Algorithms for extracting descriptive rules based on patterns subgroup discove have been integrated.*
    - *Data reduction (training set selection, feature selection and discretization). EAs f data reduction have been included.*

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