
ILPnet2: A Network of Excellence in Inductive Logic Programming

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Inductive Logic Programming (ILP) is a research field at the intersection of machine learning and logic programming. Its initial focus on the synthesis of logic programs from input/output examples and background predicates/subroutines has broadened to cover learning in relational representations from relational data and domain knowledge: it now covers topics such as relational data mining, learning relational probabilistic models and relational reinforcement learning. ILP is a research field in which Europe has the lead, due also to the strong support by the European Union through several projects funded within the ESPRIT program.

ILPnet2 is a Network of Excellence in Inductive Logic Programming (ILP): an organization of research groups and companies who undertake to improve the coordination and collaboration in research within the field of ILP. It is the successor of ILPnet (1993 - 1996) and has been funded by the European Union for four years (SEP 1998 - AUG 2002) under the INCO COPERNICUS program. In AUG 2002, ILPnet2 comprises 37 universities and research institutes (25 full and 12 associate nodes). The network also actively pursued industrial relations through its End-user-club (with a membership of 16), consisting of companies and other non-academic institutions interested in practical applications of ILP. The network is coordinated by the University of Bristol (Peter Flach, administrative coordinator) and the Jožef Stefan Institute (Sašo Džeroski, scientific coordinator).

ILPnet2 undertakes to co-ordinate ILP research among the nodes of the network; promote the co-operation and exchange of research results among the network nodes; disseminate information on ILP research and applications to the outside world, including both academic and industrial/non-academic institutions; and facilitate the transfer of ILP research results to practice. To this end, it maintains Internet resources on ILP, including information on ILP systems, datasets and applications, and educational materials, as well as an on-line database of bibliographic information (on-line library) related to ILP. It also has a regular newsletter and maintains a calendar of events. ILPnet2 supports the organization of events related to ILP, including scientific conferences and workshops, as well as educational events such as tutorials. The development of an ILP Toolbox to be used for educational purposes has also been supported by ILPnet2. ILPnet2 also supports the organization of educational events/seminars targeted at groups of end-users, as well as data analysis workshops tailored to individual end-users.

ILPnet2 Internet Resources

The ILPnet2 Internet resources include information on ILP systems, applications and datasets, and educational materials. These are maintained by the Jožef Stefan Institute.

ILP Systems

The ILPnet2 Internet resources contain useful information about ILP systems and their availability on and portability to different hardware and software platforms.

Currently, the ILPnet2 list of systems contains entries for approximately 60 ILP systems. Each entry in the list of ILP system descriptions contains at least one of two possible links. One link points to a short description of the system and another one to the WWW page of the system, typically provided by the system developer. The short descriptions of ILP systems provide concise and uniformly structured information, such as a specification of the capabilities and features of the system, details about its implementation (e.g., programming language and current version) and references to relevant papers and/or technical reports.

An important aspect of ILP systems availability is the question whether they are portable to different hardware and software platforms. The issue of portability of ILP systems is also covered in the ILPnet2 Internet resources. Compatibility tests have been carried out for a number of ILP systems by the Research Group on Artificial Intelligence at the Hungarian Academy of Sciences. The results of these tests are regularly reported in the ILP system portability page, which currently provides information about five most commonly used ILP systems.

ILP Applications and Data Sets

The information about applications of ILP systems to various real-world problems is even more relevant to potential users. It is also useful for the developers of ILP systems, because they can use the data sets, collected here, to test the performance of their systems on real-world problems.

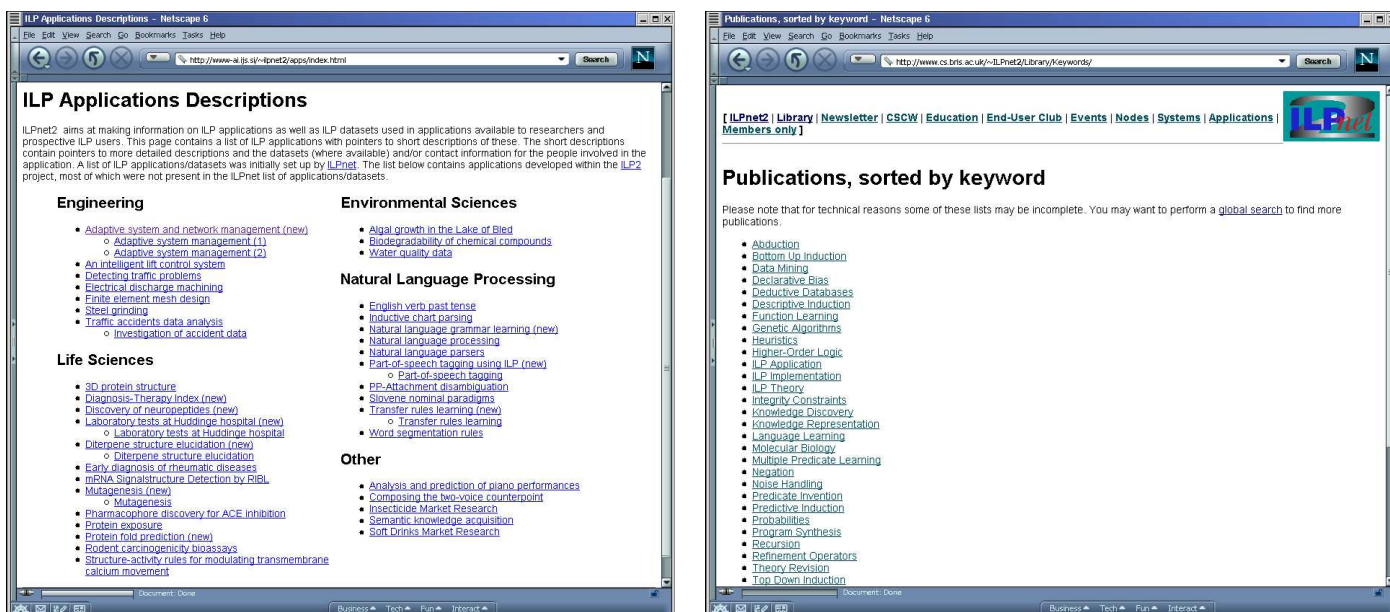


Figure 1: Left hand side: A snapshot of the list of ILP applications and data sets, grouped by application domain. Right hand side: A snapshot of an interactive browse through the ILP library references sorted by keywords.

Short descriptions of applications, similar to the ones for systems, provide concise and uniformly structured information about ILP applications. Each description includes a short digest of the background knowledge from the application domain, a description of the data set with detailed information about its format and size, a report on experiments performed with different ILP systems used in the particular application, comparison with non-ILP approaches (where available) and references to related papers, articles and technical reports. Some of the short descriptions also provide links pointing to more detailed information prepared by the researchers involved in the application.

Currently, this section of ILPnet2 Internet resources provides more than 70 entries on applications of ILP systems (see left-hand side of Figure 1). The entries concern different real-world problems from various application domains, such as engineering, life sciences and environmental sciences, natural language processing and market analysis.

ILP Educational Materials

The ILPnet2 website also aims at dissemination of ILP-related educational materials. Such materials can be used for self-training by potential end users of ILP methods. Using these materials, they can get familiar with the basic ILP methodology, necessary for planning potential future application of ILP methods to their problems.

The materials are collected from different ILP-related university courses, seminars and summer schools. In particular, materials from some of the educational events organized by ILPnet2 (and discussed below) are available. Educational materials are usually in the form of on-line versions of lecture slides or syllabi of courses and seminars.

On-Line Library of ILP-Related References

The on-line library contains ILP-related references from 1970 onwards. The database is maintained by the University of Bristol and contains at the time of writing about 1100 entries by about 500 different authors.

Each entry in the on-line library is listed on its own webpage listing full bibliographic details of the publication, and an abstract if available. Many publications also include a link to an on-line version of the paper, or a webpage where more information can be found. BibTeX records can be obtained for individual publications, for all publications in a year, or for all publications in the library. The user can interactively browse through

the references by author name, keywords (see right hand side of Figure 1), type of publication (journal article, conference paper, book or any other publication type in Bib_TE_X) and publication year. A global search on any term can be formed from the on-line library's homepage.

New entries can be added either through on-line forms, or by submitting Bib_TE_X entries to the ILPnet2 librarian. This is open to anybody with ILP-related publications. ILPnet2 members can also include links to their personal WWW pages, which then appears in all their references in the database. Thus, the database also provides a list of contacts to people in the ILP research community.

ILP-Related Events

ILPnet2 has supported the organization of a number of ILP-related events. These can be grouped into three main categories: scientific conferences/workshops, general educational events or tutorials, and educational events targeted at end-users. The third group is discussed in the End-User-Club section, the remaining two below.

ILPnet2 has supported the organization of four ILP conferences and three LLL workshops.

- *The Ninth International Workshop on Inductive Logic Programming (ILP-1999)* in Bled, Slovenia, June 1999
- *The First Learning Language in Logic Workshop (LLL-1999)* in Bled, Slovenia, June 1999
- *The Tenth International Conference on Inductive Logic Programming (ILP-2000)* in London, United Kingdom, July 2000
- *The Second Learning Language in Logic Workshop (LLL-2000)* in Lisbon, Portugal, September 2000
- *The Eleventh International Conference on Inductive Logic Programming (ILP-2001)* in Strasbourg, France, September 2001
- *The Third Learning Language in Logic Workshop (LLL-2001)* in Strasbourg, France, September 2001
- *The Twelfth International Conference on Inductive Logic Programming (ILP-2002)* in Sidney, Australia, July 2002

ILPnet2 has also supported the organization of the following general educational events/tutorials related to ILP.

- *Inductive Logic Programming Made Easy* tutorial at the *Fourth Conference on Principles and Practice of Knowledge Discovery in Databases (PKDD-1999)* in Prague, Czech Republic, September 1999
- *Knowledge Representation for ILP* tutorial at the *First International Conference on Computational Logic (CL-2000)*, London, United Kingdom, July 2000
- *Applications of ILP* tutorial at the *First International Conference on Computational Logic (CL-2000)*, London, United Kingdom, July 2000
- *From machine learning to ILP: ILP made easy* tutorial at the *Twelfth European Summer School on Logic, Language and Information (ESSLI-2000)*, Birmingham, United Kingdom, August 2000
- *Rule Induction* tutorial at the *European Spring School on Intelligent Data Analysis* in Palermo, Italy, March 2001
- *ILP in the Context of Agents* session at the *European Summer School on Multi-Agent Systems and Applications (ACAI-2001)* in Prague, Czech Republic, July 2001
- *Summer School on Relational Data Mining*, Helsinki, Finland, August 2002

Further information about these events, including reports on them with the highlights to the ILP related aspects, can be found in the ILPnet2 Internet resources. This information is a part of a separate WWW page in the resources where information about forthcoming and past events related to the field of ILP is collected.

ILP Newsletter

The ILP newsletter was initiated by ILPnet in 1993. It was regularly published until ILPnet expired in 1996. The Newsletter has been revived in 1999. Currently, it is being sent to 235 subscribers. The ILP Newsletter includes material relevant to ILPnet2 and ILP in general, including a calendar of ILP events, conference reports (from the ILP perspective), book reviews, etc. On average, three issues per year have been published. The archive of all published issues of ILP newsletter can be accessed from the ILPnet2 website.

ILP Toolbox

ILPnet2 has supported the development of an ILP Toolbox, to be used for educational purposes. This has been developed by the University of Magdeburg and is based on the data mining toolbox KEPLER, developed by GMD and DIALOGIS. It includes three ILP tools (two for rule induction and one for subgroup discovery) incorporated within a graphical environment, together with several propositional tools. It also includes tutorial cases of using the three ILP tools on illustrative problems as well as a realistic problem. The ILP Toolbox is currently only available to ILPnet2 nodes through the ILPnet2 CSCW Workspace.

Industrial Events and Activities (End-User-Club)

ILPnet2 has actively pursued industrial relations through its End-User-Club, consisting of industrial and other non-academic institutions interested in practical applications of ILP. It has supported the organization of educational events/seminars targeted at specific groups of end-users, e.g., in life sciences or in the business sector (see the list below).

- *ILP and Knowledge Discovery* seminar at *Summer school on Knowledge Discovery and Data Mining* in Caminha, Portugal, September 1998
- *Achieving competitive advantages with data mining and decision support* industrial day in Bled, Slovenia, June 1999
- *Data Analysis in Life Sciences* seminar in Ljubljana, Slovenia, May 2000
- *ILP for learning language in logic* tutorial at the *Twelfth European Summer School on Logic, Language and Information (ESSLI-2000)* in Birmingham, August 2000

ILPnet2 has also supported data analysis workshops tailored to individual end-users, where ILP experts work together with domain experts to solve specific data analysis problems. Three such workshops have been organized, where data from protein interaction assays, environmental data and linguistic data have been successfully analyzed with ILP and other techniques.

ILPnet2 Links

ILPnet2 home	http://www.cs.bris.ac.uk/~ILPnet2/
on-line library	http://www.cs.bris.ac.uk/~ILPnet2/Library/
ILPnet2 home @ IJS	http://www-ai.ijs.si/~ilpnet2/
systems	http://www-ai.ijs.si/~ilpnet2/systems.html
applications	http://www-ai.ijs.si/~ilpnet2/apps/
educational materials	http://www-ai.ijs.si/~ilpnet2/education/
related events	http://www-ai.ijs.si/~ilpnet2/events/
newsletter	http://www-ai.ijs.si/~ilpnet2/newsletter/
