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2006 Report of Activities

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1 CENTRIA 2006 report of activities

1.1 General comments on the 2006 activity

The present activity report was unanimously approved by the Scientific Committee of CENTRIA end of April 2007. The plans approved in 2005 for 2006 were on the whole successfully carried out.

The centre's Director, Luís Moniz Pereira, was the recipient of an honoris causa doctorate awarded by T.U. Dresden, Germany, in a 4th December 2006 ceremony, "for his excellence in research, teaching, and international networking in Computational Logic". In June 2006 he was elected vice-president of EASE, the European Association for Semantic Web Education, legalized in Germany as a non-profit organization.

The Portuguese Association for Artificial Intelligence gave its National AI graduation project award to member of CENTRIA Gonçalo Lopes, who won the competion with "A computational approach to the introspective consistency, using logic programming", who was supervised by Luís Moniz Pereira. The work resulted in the publication: Gonçalo Lopes, L. M. Pereira, Prospective Programming with ACORDA, at the workshop Empirically Successful Computerized Reasoning (ESCoR'06), Seattle, USA, August 21, 2006.

The Centre's web pages (visit `http://centria.di.fct.unl.pt/`) were completely redesigned and implemented, and a web page interface provides for easy updating and consulting.

In July 2006, CENTRIA from UNL (coordinator) and GECAD from ISEP/IPP submitted a proposal, titled "COGNOMA", to acquire the status of Associate Laboratory, in accordance to Dec. Lei 125/99 from 20th April, still being evaluated. The Associate Laboratory was proposed with a broad scope in the global area of "Cognition in Humans and Machines", has as its main mission to cooperate in a continuous, capable and efficient manner, in pursuing specific objectives of the national scientific and technological policy, namely in the areas of

- Ambient Intelligence and Embedded Systems

- Bio-Informatics

- Management of Critical Resources

- Computational Processing of Written Portuguese

- Knowledge Based, Cognitive and Learning Systems

- Intelligent Planning and Systems

- Semantic Web

intertwining the competence and know-how accumulated in the two COGNOMA centres, stimulating the integration of research, scientific education as well as the transfer of knowledge and technology to non academic sectors, and contributing to the associated small and medium companies. COGNOMA will be the Artificial Intelligence (AI) Laboratory of reference in Portugal, ensuring its presence in the frontier of the most advanced software applications. The Laboratory brings together the largest AI university centre and the best polytechnic research centre in the area, as well as selected researchers from other institutions. A full proposal document can be had on request by the evaluators. At this point it is still confidential to others.

In September 2006, CENTRIA applied to FCT with 3 projects, in collaboration with other research centres in the topics of Bioinformatics, Oceanography, and Man-Machine Cognition, in order to hire senior postdocs for 5-year positions, according to the call `https://www.fct.mctes.pt/ciencia2007/indexEN.asp`. Evaluation is still pending. Again, the full proposal documents can be had on request by the evaluators. At this point it is still confidential to others.

In July 2006, 4 new research projects were submitted to FCT, for the call `https://www.fct.mctes.pt/projectos/concurso2006/`, which are still being evaluated. A new European project, PROGIGNET, was submitted and approved, as well as a bilateral project with Spain, KRENI (cf. the ongoing projects listing for details).

CENTRIA members, through the department of Computer Science, is participating in the research and education contracts between the Portuguese Government and Carnegie-Mellon University, and the University of Texas at Austin, prepared at the end of 2006.

During academic year 2005/06, the "European MSc in Computational Logic" (launched in 2004 and supported at UNL by CENTRIA members) continued its operation[1], with partial funding from the European Erasmus Mundus programme. We recall the objective of the program is to impart to the student a profound theoretical and practical knowledge required for professional practice in the field, to give him a survey of the individual disciplines of Computational Logic and to develop his ability to work according to scientific methods. In addition, the student is given the opportunity to plan his studies to fit a particular practical application. To acquire practice-oriented knowledge he may choose appropriate combinations of modules. By means of visits abroad and English as the language of instruction, the student is to be prepared for the increasing internationalism of science, commerce and industry.

Also noteworthy, a 3-year European funded Asia-Link project "Computational Logic as a Foundation for Computer Science and Intelligent Systems" begun in September 04, continued on in academic year 05/06, in partnership with T.U. Dresden, Germany, U. Indonesia[2] at Jakarta, and T.U. Hanoi, Vietnam. We recall the objective of the project is to promote the area of formal computational foundations of logic, computer science and intelligent systems, i. e., the area of Computational Logic, in South East Asia. It aims at upgrading the staff of the Asian partners within a joint team schema, joint supervision of MSc and PhD students within a sandwich schema, courses of European professors and lectures at the Asian universities, the organization of international summer schools, the development of curricula for single modules at the Asian universities. In particular, in 2006, a course was given by us at U. Indonesia on Computational Logic Agents (`http://www.centria.fct.unl.pt/~lmp/UI_CAgents/ComputationalAgents.htm`), and two at the Jakarta Summer School in August 2006, on "Constraint Logic Programming and Bioinformatics Applications" and "Declarative Programming" (`http://www.cs.ui.ac.id/summerschool/`). Several students and professors from Vietnam and Indonesia were received at CENTRIA.

Also of general significance, the 4-year European funded project, "REWERSE - Reasoning on the Web with Rules and Semantics", involving all areas of CENTRIA, which was initiated in March 04 (Cf. `http://www.rewerse.org/` for project details and our activities in 2006), continued on. REWERSE strives for advanced Web systems and applications sometimes referred to as Semantic Web. The term refers to one of the major current endeavours world wide in Information Technologies. Its goal may be briefly described as enriching the existing Web with meta-data and data processing (and meta-data processing) so as to provide Web-based systems with advanced (so-called intelligent) capabilities, in particular with context-awareness and decision support, strengthening a person centred, everyday use of the Web.

CENTRIA's participation involves a coordinating role in one of the major work-packages, "Evolution and Reactivity". CENTRIA is a major participant in REWERSEs Education and Training work-package, besides its major participation in other important work-packages mentioned in the project, namely "Rule Markup", and "Bio-informatics", so that all of CENTRIA's areas are involved.

Pursuant to its new strategic ends, the centre hired or renewed in 2006, 2 FCT postdocs, from Portugal and the USA.

The reconfiguration of MEI, the department's MSc in Computer Science, began in 2003/04, continued in 2004/05 and 2005/2006, and afforded us with the opportunity to include in it AI and Information Technology profiles, the latter including a semantic net component, also figuring prominently in the recent Computational Logic MSc.

Both the Computer Science and the Computational Logic MSc degrees were submitted and officially accepted by the Ministry as part of the new Bologna 2nd cycle scheme.

Our evolution can then best be gauged by comparing the plans with the present report: an overall positive evolution. The global indicators in the tables in Section 7 show and highlight, with

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[1] See `http://ssdi.di.fct.unl.pt/masters/mcl/` for details.

[2] See `http://europa.eu.int/comm/europeaid/projects/asia-link/index\_en.htm` for project details and our activities in 2005.

respect to 2006 compared with 2005, that:

- Regarding publications:. The total number of publications decreased from 67 to 58, though the number of journal publications increased from 11 to 12. There are two explanations for this: First, in 2005 was the occasion of the Portuguese AI conference, whose proceedings are published in LNAI and recognized by the SCI, where CENTRIA naturally had many publications, but which taks place only every two years, and so not in 2006. Second, 2006 was a complicated year for most Portuguese academic researchers, inasmuch we had to revamp and adapt all our undergraduate and postgraduate courses to the 3 Bologna teaching cycles, and that took a lot of time and energy.

  Also taking the latter two points into account, the publications in collaboration with non-members have remained high. Significantly, the international collaboration publications have greatly increased in proportion to the national collaboration publications, from 27/7 to 22/2.

- Regarding Projects: We submitted an Associate Lab proposal (July 2006) and 3 interdisciplinary projects to hire senior Postdocs (September 2006), still under evaluation. Although, the number of ongoing projects has decreased, from 15 in 2005 to 11 in 2006, it is not basically our fault really. There was no national call for projects at all in 2005, and the call with July 2006 deadline (to which we submitted 4 project proposals) is still under evaluation in April 2007. Also, the European FP6 was winding down by 2006, with little remaining funds. We saved ourselves for FP7 projects in 2007. Consequently, we expect a significant increase in number of projects and their funding in 2007.

- Regarding Events Organization: This figure went from a high level of 4 in 2003, to an exceptional level of 7 in 2004, and an exceptional level of 6 in 2005, continued nevertheless in 2006. This has provided an added impact on the visibility of the centre.

- Postgraduate MSc and PhD students: The overall attraction of the centre for these postgraduate students continues. Their overall of number has increased from 23 in 2003 to 32 in 2004, to 37 in 2005, and 35 in 2006. See our comments forthwith.

  As expected, the launching of the international MSc course in Computational Logic, started 2004, produced a substantial increase in ongoing MSc thesis, from 20 to 25, which was decreased 20 in 2006, although the number of completions went up significantly from 6 to 11. To understand this, one must realize that the start of the Bologna 2nd cycle has introduced a temporary slump in entry because students no longer wanted to go for a 2 year MSc after their 5-year undergraduate degree, and our 2 Bologna MSc's were not yet recognized by the Government, which only happened end of 2006, with effect on the next academic year. As said in the introductory general comments, both the Computer Science and the Computational Logic MSc degrees have been officially accepted by the Ministry as part of the new Bologna 2nd cycle scheme. We hope thus, that after this transition period, there will be a substantial pick up of MSc students, namely because they now can enroll in the MSc after their first Bologna cycle of only 3-years.

  The number of ongoing PhD students increased from 12 to 15. The output however has been null in 2006, where we had an expectation of 2 thesis to complete, now moved to 2007.

Other indicators, including a more detailed examination of types of publication, and publications by each subarea, are to be found in the annexes, and mentioned in each of the subarea reports.

The 2006 budget was executed according to plan, and the funding has been again received on time with the new government.

The distribution of the running funds among the members was made as usual on the basis of publication productivity, in number and type, according to a pre-defined set of rules we have been using over the past years. We intend to make good in the 2007 budget the revision of points assigned to each publication type to further encourage publication in journals and highly recognized conferences.

The Advisory Committee was duly notified of last year's report and informally congratulated us on the activities reported. No specific recommendations were made.

The detailed rendition of each of the subareas' activities is to be found below. A number of scientific bridges were pursued between the subareas, to reinforce the unity and cross-fertilization within the CENTRIA. The activities of 2007 and beyond will further promote the construction of these bridges.

See the new CENTRIA web pages for more information.

1.2 Subarea: Knowledge Representation and Reasoning, and Logic Programming

Work continued in the area of "Knowledge Representation and Reasoning, and Logic Programming" on the foundations of logic programming for knowledge representation and reasoning, applications and implementation of logic programming systems, with special focus this year on applications in the areas of the Semantic Web and Multi-Agent Systems, the former mostly due to the significant participation in an European project in the area. The scientific projects covering this activity were REWERSE, SIIUE, PROGICNET, and KRENI.

CENTRIA members co-organized the following scientific meetings in this area:

- José Alferes was Programme Chair of the 4th Workshop on Principles and Practice of Semantic Web Reasoning – PPSWR'06, Budva, Montenegro, June 2006.

- Carlos Damásio was local chair of Reasoning Web 2006 Summer School, Monte de Caparica, Portugal, September 4th-8th, 2006. (URL: `http://www.reasoningweb.org/2006`)

- Reinhard Kahle was co-organizer of the Workshop Proof, Computation, Complexity - PCC '06 hold at the Technical University of Ilmenau, Germany, July 2006.

- Reinhard Kahle was co-organizer of the Workshop Days in Logic hold at the Departmento of Mathematics, University of Coimbra, January 2006

The education and training aspects have been covered by our MSc in Computer Science, as explained in the introduction, and with support from Erasmus Mundus and Asia Link European programmes. On the international cooperation teaching side, L. M. Pereira gave the course Computational Logic Agents, in Jan/Feb 06, at U. Indonesia, Jakarta.

It is worth mentioning that L. M. Pereira was awarded a honoris causa doctorate in December 4, 2006, by the T.U. Dresden, Germany, for his excellence in research, teaching, and international networking in Computational Logic.

Regarding procedures for logic programming languages, during the year 2006 the study of tabulation in several settings has been explored [39, 38, 30, 11]. We have extended the propositional tabulation proof procedures for fuzzy-like languages first presented in [11], for the first-order case [38] and studied their theoretical properties and optimisations in [39]. The know-how of CENTRIA in tabulation proof procedures allowed us to participate in the specification of advanced query engines for rule based policy systems in peer to peer systems [30].

Still related to procedures and implementations, the SIIUE.sac project has come to a close, in terms of development with declarative tools. It spurred the development of a language and its associated tools (ISCO) as well as providing a large scale testbed for applications developed with Contextual Logic Programming. Development of the ISTO language reached a first formulation and a prototype implementation. ISTO is based on our previous work and makes use of an improved form of Contextual Logic Programming, relying on temporally annotated units, contexts and goals. This tool will be useful for constructing complex and evolving information systems.

Dealing with fuzzy and imperfect information was continued in the already mentioned papers [39, 38, 11]. The expertise of CENTRIA in these approaches resulted in a joint standardization international effort in the specification of rule based languages with uncertainty for the Semantic Web, presented in [40]. The authors have been invited to submit an extended version of this work.

The work on Semantic Web was complemented with an important contribution on the mixture of open and closed world reasoning in rule systems for the Semantic Web, reported in [36, 37]. Still in this area, work was continued on Statistical Default Logic, and began on a general probability framework, as part of PROGICNET project that started during this year. This work extends previous work on evidential probability and on probability logics.

Research work started in 2006 on prospective logic programming, that is scenaria construction based on preferences and updating, on the basis of iterated observations and actions, and was conducive to a number of publications, namely [68] and [53] . The latter publication, reporting the first author's final year project, won him the 2006 national AI association competition of such projects. Work continued on preferential theory revision [58] and its applications [63]. Also continued was work on the use of updating for control, viz. [42, 41]. Still related to the work on semantics of logic programs with preferences, there was work on argumentation semantics for expressing some preferences in the context of distributed arguing agents [22, 29].

The place of logic and of reasoning in a new theoretical approach to evolutionary epistemology started being investigated in [21].

Application were pursued in diagnosis. Work was done about the use of a logic programming systems for a real application of diagnosis of power system protections [47]. This paper was selected for the best paper award of conference IEA/AIE 2006.

Following the work on the development of Dynamic Logic Programming and EVOLP based multi-agent systems, an architecture with evolving abilities was defined [25] and applied in the context of role playing games [50]. The extension of 3APL, an existing multi-agent system, to benefit from Dynamic Logic Programming was also addressed. This led to two publications, one reporting on its use to enrich 3APL's belief base [55] and one reporting on its use to extend its goal base [51]. There was also work on the extension of EVOLP to cope with event languages and algebra, and on turning it into a full-fledged event-condition-action reactive language [27, 26]. Also related to event processing, work was developed in the definition and implementation of complex event detector engines [28].

A line of investigation on the application of Dynamic Logic Programming in the context of User Modeling for Recommender Systems was initiated and preliminary results appeared in [51]. During 2006, four invited lectures were presented, in this sub-area of multi-agent systems, and one tutorial at AAMAS'06 titled "Programming languages and Development Tools for MAS".

In the context of Semantic Web development, the work continued mainly in the context of EU project Rewerse. As better detailed in the Ìntelligent Information Systems" subarea, we participated in the development of a language for defining modular composition of rule bases in the Semantic Web, and integrate the Fuzzy RuleML technical group. Moreover, we continued to co-ordinate the working group on "Evolution and Reactivity" of Rewerse. In this working group, we developed the prototype r3 (Resourceful Reactive Rules) for dealing with reactive rules in the semantic web, as well as several sub-engines integrating other languages in the framework. Still related to implementations and application to the Semantic Web, a B-domain demonstrator was developed, to semantically query protein databanks.

1.3 Subarea: Intelligent Information Systems

During 2006 research work in area of Intelligent Information Systems was done on the following topics: Data warehouses and integration of heterogeneous databases; tools for the semantic web; Ontologies; Intelligent agents for automatic classification of documents; natural language dialogue systems.

In the Data warehouses topic, regarding the project with the Instituto do Ambiente (Environment Protection Agency of Portugal) a final prototype for analyzing the pollutant emissions reported by the industry was delivered and is currently in full use. A prototype for a Spatial OLAP was developed by Rosa Matias and is described in her MSc. thesis; we intend to pursue this promising area in 2007. With Valeria Pequeno (PhD. student) we pursue the works on Specification, maintenance and implementation of materialized object views in an object-relational data warehouse, resorting partly to the ISCO language. Two internal reports will be published: (i) A

survey on Handling Time in Data Warehouses; (ii) a proposal for a Formal Object-Relational Data Model. It is expected for 2007 that the following M. Sc. thesis will concluded:

- To be presented at Universidade Nova de Lisboa, Portugal:

    - Ana Lopes, Data Warehouse for Environmental Data: Requirements study and multi-dimensional model
    - Ricardo Ferreira, Extensible Metadata Repository for Information Systems.
    - Ricardo Raminhos, Extraction and Transformation of Data from Semi-structured text files using a declarative approach.

- To be presented at University of Technology in Wroclaw, Poland.

    - Monika Urbanowicz, Extensible System for Course evaluation.
    - Izabela Kurzeja, Questionnaire design and information extraction.

In the topic of integration of heterogeneous databases, development of tools based on the contextual ISCO logic programming framework has continued: as of late 2006, there are 4 MSc. students doing their thesis work on aspects of the language or applications thereof. These cover SPARQL, RDF and OWL integration, a system for workflow management and execution, partly based on UML and AJAX technology, as well as an intelligent network monitoring framework. All of these efforts are on track to produce results in mid-2007.

The importance of temporal representation and reasoning is well known not only in the database community but also in the artificial intelligence one. Contextual Logic Programming (CxLP) is a simple and powerful language that extends logic programming with mechanisms for modularisation which was recently re-specified and for which a new implementation was built, around GNU Prolog. It was shown how this language could be seen as a shift into the Object-Oriented Programming paradigm. A temporal extension of this language was proposed, called Temporal Contextual Logic Programming (TCxLP). This extension follows a reified approach to the temporal qualification that, besides the acknowledged increase in expressiveness endowed by reification, allows us to capture the notion of time of the context. Together with the syntax of this language an operational semantics was introduced and applications are being developed, namely in the management of workflows. This work was published in the ICLP 2006 and WFLP 2006 conferences.

Work in the area of tools for semantic web was developed within the project REWERSE - Reasoning in The Web with Rules and Semantics. The Centria team participated in the development of a language for defining modular composition of rule bases in the Semantic Web, reported in joint publications. Centria team also integrates the Fuzzy RuleML technical group, where Cottbus partner is also represented. During year 3 of the project, Centria has participated in the definition of an extension of the markup language RuleML in order to express rule bases with imperfect information (fuzzy, probablilistic, etc.). This has been published in the RuleML 2006 conference. This paper has been invited for the journal with the best papers of RuleML 2006, currently under evaluation process.

In the topic of Ontologies, a methodology to automatically create ontologies from natural language documents was proposed this year and it was evaluated and extended in the context of the PhD work of José Saias (1 paper was published describing some of the proposed extensions). In the context of the PhD work of Cássia Santos, algorithms to map concepts in different ontologies were proposed. The approach was implemented in a multi-agent architecture and a prototype was created and evaluated (this work was presented in several international conferences).

In the topic Intelligent agents for automatic classification of documents, the use of linguistic information to improve the results of the classification task using Support Vector Machines (SVM) was investigated and the obtained results allowed the creation of a better classifier (as published in international conferences). This work was done in the context of the PhD work of Teresa Gonçalves (expected to be finished in June 2007). The classifier can be used to automatically detect and extract relevant information from documents.

In the topic natural language dialogue systems, several papers where published and work done during 2006 includes carrying the SIIUE dialogue system into the multimedia database search

interface of the Project DOMIR. Luis Martinho has been working on the use of the prototype dialogue system on a collection in the cultural heritage domain. This has required building the data structures to support the syntactic, semantic and pragmatic analysis, the configuration of the natural language modules in a new software environment and still requires more extensive testing. The prototype uses a tool to automatically generate rules for the semantic/pragmatic interpretation of user sentences from the OWL ontology. This tool was developed in an integrated logic programming framework, based on constraint logic programming using the GNU Prolog/CX language and the ISCO framework. The use of this LP framework allows the integration of Prolog-like inference mechanisms with classes and inheritance, constraint solving algorithms and provides the connection with relational databases, such as postgreSQL. The semantic/pragmatic rules generated by this tool gives us the questions' pragmatic interpretation in a way that enables us to handle ambiguity, Proper Nouns resolution and the pp-attachment problem - and on an efficient dialogue mechanism - which is able to place relevant questions to clarify the user intentions in a straightforward manner.

The development of Question-Answering System with clarification dialogues has a prototype for evaluation, this work has been done as part of Luis Quintano's PhD thesis.

1.4   Subarea: Soft Computing and Constraints

Work on constraints area has proceeded during 2006, mainly in two directions: improvement of constraint solving efficiency and Bioinformatics applications. The improvements on constraint solving have been sought in two different directions. On the one hand, there has been work in exploiting symmetries that occur in most constraint solving problems, to avoid repeating search in parts of the search space that are symmetrical with respect to other parts already exploited. In particular, the work has focussed in problems that are modelled with constraints over sets, such as the social golfers problem, where some interesting results have been obtained ([31, 32]). On the other hand, work has proceeded in Casper, a library of constraint solving modules that is being implemented with a generic programming approach, and where a number of experiments have been made with different constraint propagation strategies, namely one that takes into account the type of events that trigger propagation. Although the advantages of Casper will only be visible when the full system is implemented (namely dealing with nogoods and restarts), the propagation has been found to be competitive with state of the art solvers, such as ILOG and Gecode ([35]). An interesting application of constraint solving was also studied for the formatting of HTML documents, and will be possibly used in a Portuguese company of the student Gil Loureiro that developed it in his M.Sc. research work, finished in 2006. Also work has started on the integration of constraint and preference reasoning on continuous domains, in which a new project has started in September, and a new Ph.D. student, Elsa Carvalho, has joined CENTRIA. In the area of Bioinformatics, a number of changes have been prepared to the constraint based implementation of the Chemera System, that is used by several biochemists researchers ([14], [15]). The changes have mostly concerned with the possibility of interfacing Chemera with Bioinformatics servers applying some of the techniques that are being developed in the Rewerse project, in particular to make it aware of updates in the bioinformatics servers (for example, new protein structures being stored in the servers, or new references being made in the scientific literature to newly found interactions). In addition to these changes, the potential application of the system in many useful bioinformatics scenarios has been discussed in [24], and an integrated view of the application of constraint solving techniques to structural bioinformatics problems has been presented in [48]. This application has been quite successful and drawn the attention of the research community in declarative programming, and we were asked to provide an invited lecture in the PADL'07 conference, in January 2007. It should also be noticed in this area of constraints the efforts made in the organisation of scientific events, both in "pure" constraint programming and in Bioinformatics. In the former, Pedro Barahona and Francisco Azevedo organised the 11th ERCIM workshop on Constraint Solving and Constraint Logic Programming ([3]). In the latter, Pedro Barahona was involved in the Steering Committee of the Rewerse Summer School on the Semantic Web, namely with the task of organising a track on bioinformatics applications for the Semantic Web ([4]).

In the Machine Learning area work has still been driven by applications, namely in structural bioinformatics and in Automatic water eddy detection. In the former, a very thorough datamining exercise has been made in order to predict the level in which amino acids are buried within proteins or lie on their surface. This problem is important to predict protein interactions but we were interested in studying it for helping in structure prediction. José Carlos Santos has obtained interesting results in his M.Sc. research work (approved in early January 2007) and is now in a Ph.D. programme on Bioinformatics in the Imperial College, London, where we hope to establish good research contacts in the area. Also in this area, a new Post-doc researcher, Olivier Perriquet has started working in Centria, in September 2006, as suggested in the last review of CENTRIA. In the context of the RENA Project, an important project in the area of Machine Learning, the research activity has mainly focused on the continuation of the development of fuzzy clustering techniques for the problem of colour image segmentation from sea surface temperature (SST) maps. A random ellipse fitting algorithm is being developed to identify the regions-of-interest (ROI) of eddies. ([45]). Complementary to pre-processing with the optical flow method, we also apply the Fuzzy c-Means which provides fuzzy partitions whose clusters enhance complementary aspects of eddies ROIs due to the fuzzy constraints. The membership values assigned to the transactions between eddies and non-eddies regions should provide a better measurable input to the binary image. Also, these values are easily interpretable to the Oceanographer. Also in the RENA project, work on neural classification of eddies according to context has continued, mainly in the framework of MsC thesis of Gracindo Machado. Gracindo has found the relevance of Laws extracted at higher distances than the 5 Km being used until this time and has improved some of the visualization procedures that can be directly applied over temperature maps. Gracindo is expected to conclude his M.Sc. during 2007.

Regarding the area of tagged text mining, project TOURS (PTDC/EIA/65850/2006) was proposed for funding to FCT. This project aims to integrate knowledge extraction from text in a Web2.0 recommender system. Project TOURS also focus on knowledge aware data mining techniques, including neuro-symbolic integration techniques. Indeed, the work done in the group headed by Professor Steffen Hölldobler at the International Center of Computational Logic at Technische Universität in Dresden, Germany allows encoding of background knowledge expressed as a, possibly incomplete, rule base into neural networks. The generated neural networks can then be trained to further improve classification according to a given test set. Further contacts regarding this area will be pursued during 2007. Work on Temporally Annotated Contextual Constraint Logic Programming (TaCCxLP) has progressed ([25, 57, 56]) and a prototype implementation is being prepared for more general use. Initial contacts with Dr. Werner Kriechbaum at IBM's Böblingen research center have been made and preliminary work is being made towards designing and implementing a parallel constraint solving framework for use on multi-core platforms, in particular the Cell processor.

2 List of ongoing projects in 2006

Name	REWERSE - Reasoning on the Web with Rules and Semantics
Status	Ongoing (started March 1st 2004, for 4 years)
Funding Institution	EU-IST
Funding for 2005	75.000 (our part)
Principal researcher	Luís Moniz Pereira (national part)
Participants (involving all 3 major areas of CENTRIA)	CENTRIA
Description:	REWERSE strives for advanced Web systems and applications sometimes referred to as Semantic Web, a term coined in 2001 by Tim Berners-Lee et. al. in the article The Semantic Web in Scientific American. This term refers to one of the major current endeavours world wide in Information Technologies. Its goal may be briefly described as enriching the existing Web with meta-data and data processing (and meta-data processing) so as to provide Web-based systems with advanced (so-called intelligent) capabilities, in particular with context-awareness and decision support, strengthening a person centred, everyday use of the Web. Cf. http://www.rewerse.org/.
Results	Meetings, deliverables, and publications, in the area of our responsibility for Working Group Evolution and Reactivity. And according to participation in WGs Education and Training, Rule Markup Languages, Towards a Bioinformatics Semantic Web, and Personalised Information Systems.

Name	International M.Sc. Program in Computational Logic
Status	Ongoing (started September 2004, for 5 academic years)
Funding Institution	EU Erasmus Mundus
Funding for the duration	75.000 (our part)
Principal researcher	Luís Moniz Pereira (national part)
Participants	UNL, TU Dresden, U. Bolzano, TU Wien, UP Madrid
Description:	One major activity was to setup and launch a joint distributed european MSc degree in Computational Logic with 4 other partners, initiated in the context of project CoLognet. This involved the creation of a new MSc in Computational Logic at UNL. Cf. http://ssdi.di.fct.unl.pt/masters/mcl/.
Results	Project continued in academic years 04/05 and 05/06. Several coordinating meetings. Yearly report.

Name	Knowledge Representation with Negative Information (KRENI)
Status	Ongoing (submitted and approved in 2005, to start January 2006, for two years)
Funding Institution	Council of Rectors (CRUP)
Funding for the duration	2.300 (our part)
Principal researcher	Luís Moniz Pereira (national part)
Participants	UNL, UPM Madrid
Description:	The study of the negative information, its formalization and the way of representing and implementing this information in Logic Programming
Results	Accepted proposal.

Name	Computational Logic as a Foundation for Computer Science and Intelligent Systems
Status	Ongoing (started September 2004, for 3 years)
Funding Institution	EU-IST Asia-Link/VN/001
Funding for the duration	75.000 (our part)
Principal researcher	Luís Moniz Pereira (national part)
Participants	CENTRIA, TU Dresden, U. Indonesia, TU Hanoi
Description:	The objective of the project is to promote the area of formal computational foundations of logic, computer science and intelligent systems, i. e., the area of Computational Logic, in South East Asia. The European partners are already engaged in an effort to turn Europe into the leading place for education and training in this area. The three-year project aims at upgrading the staff of the Asian partners within a joint team schema, joint supervision of MSc and PhD students within a sandwich schema, courses of European professors and lectures at the Asian universities, the organisation of international summer schools, the development of curricula for single modules at the Asian universities, and the incorporation of video-teaching methods in cooperation and teaching. Cf. http;//www.computational-logic.org/content/projects/asialink/.
Results	Received several students from Vietnam and Indonesia for 6 month stays. Hosted a professor from T.U. Hanoi for 1 month. Taught a course at T.U. Hanoi in Jan/Feb05. Participated with one lecturer in the Summer School at T.U.Hanoi, August 05. Project coordination meetings. Yearly report.
Name	PRACTIC: Processing and Reuse of Advanced Computational Techniques to Improve Constraint Solving
Status	Ongoing (end December 2007)
Funding Institution	Fundação para a Ciência e Tecnologia
Participant Institutions	CENTRIA and INESC-ID
Funding for 2005	15744 Euro (our part)
Principal researcher	Pedro Barahona
Participants	Francisco Azevedo, Marco Correia
Description	The project aims at developing advanced computing techniques, focussing in constraint programming, and to show how their integration with other techniques such as automated learning and meta-heuristics optimisation, can be used to solve large combinatorial problems. In particular, the techniques should be a very important problem: the determination of protein structure from Nuclear Magnetic Resonance (NMR) spectroscopy
Results	3 publications, 1 prototype (by CENTRIA members of the project).

Name	PRECISE - in Science and Engineering
Reference	POSI/EIA/59786/2004
Status	Ongoing (start April 2005; end March 2008)
Funding Institution	FCT-MCES
Participant Institutions	CENTRIA
Funding for FCT/UNL in 2005	11500
Principal researcher	Pedro Barahona
CENTRIA Participants	Pedro Barahona, Jorge Cruz
Description	This project aims at a) investigating possible ways of introducing probabilities (or mere likelyhoods) in the continuous constraint framework; b) developing extensions to our previous work in constraint propagation techniques in continuous constraints to address this extended framework; and c) Evaluate and validate this research, in a number of applications, namely biomedical and engineering.

Name	Remote Detection of Mediterranean Water Eddies in the Northeast Atlantic (RENA)
Reference	PDCTE/CTA/49945/2003-RENA
Status	Ongoing
Funding Institution	FCT/MCES
Funding in 2005	5200 Euro (our part)
Principal researcher	Isabel Ambar (Instituto de Oceanografia-Faculdade de Ciencias /Universidade de Lisboa)
CENTRIA Participants	Nuno C. Marques, Susana Nascimento, Marco Castellani, Armando Fernandes, 1 scholarship student
Description	Establishment of a methodology for the remote identification of Mediterranean Water (MW) eddies with a synergistic use of satellite remote sensing data from the ERS and ENVISAT missions, ocean circulation numerical models and artificial neural networks. A census of MW eddies in the Northeast Atlantic and the estimation of their generation frequency will be attempted based on the results. The project also aims at determining the physical mechanisms controlling the interaction between the MW undercurrent/eddies and the coastal upwelling current system off the Iberian Peninsula.
Results	5 publications, 2 prototypes.

Name	PROGICNET – Probability Logics and Probabilistic Networks
Status	Ongoing (April 2006 - April 2008)
Funding Institution	The Leverhulme Trust
Funding for 2006	60,000 euros
Principal researcher	Gregory Wheeler
Participants	Jon Williamson, Rolf Haenni, Jan-Willem Romeijn
Description	Probability theory and deductive logic both tell us how we should reason. However, they offer very different formalisms for reasoning: probability theory tells us how uncertainties interact while deductive logic tells us how the structure of sentences can be exploited to draw conclusions. A probabilistic logic offers a richer formalism, one that combines the capacity of probability theory to handle uncertainty with the capacity of deductive logic to exploit structure.
Results:	Conference: Probability Logics and Networks (Progic 2007), University of Kent, September 2007; Forthcoming special issue of the Journal of Applied Logic on " probability logics and probabilistic network", edited by Fabio Cozman, Rolf Haenni, Jan-Willem Romeijn, Federico Russo, Gregory Wheeler, Jon Williamson.

Name	DIRPI – Desenvolvimento e Integração de Recursos para a Pesquisa de Informação
Status	Finished (2002–2006)
Funding Institution	GRICES/CAPES (2k euro in 2006)
Principal Researcher	Paulo Quaresma
Participants	Renata Vieira (UNISINOS/Br)
Description	Develop natural language processing tools for the Portuguese language in order to increase the power of information retrieval systems.
Results	5 papers and 2 visits in 2006.

Name	LOIS – Lexical Ontologies for Information Sharing
Status	Finished in March 2006
Funding Institution	European Commission (eContent program)
Funding for 2006	4500 euros
Principal researcher	Paulo Quaresma
Participants	2 scholarship students
Description	Development of an ontology for the legal domain in six EU languages.
Results	2 publications in 2006.

Name	DOMIR – Dialogs and Ontologies for Multimedia Information Retrieval
Status	Started in March 2005, finished in 2007
Funding Institution	FCT POSC/EIA/61109/2004 (90000 euros)
Principal researcher	Maria Cristina de Carvalho Alves Ribeiro (INESCN)
Participants	Irene Pimenta Rodrigues, Paulo Miguel Torres Duarte Quaresma, José Miguel Gomes Saias, Luis Jorge Catela Quintano
Description	To go beyond text retrieval, the analysis of document components such as audio or image segments is required. The Metamedia prototype (FEUP) currently incorporates the extraction of audiovisual features and the automatic association of the corresponding descriptors to the document. Further work is required on audiovisual extraction, in order to create more expressive descriptors. Ontologies will be used at this point: both the inclusion of audiovisual descriptors in ontologies and their combination with domain ontologies will be explored. A second component is dialog management. The retrieval task can be significantly improved by gathering information from the user interaction and analyzing the dialog to extract user intentions and plans. Retrieval is an intrinsically imprecise task and therefore this line has to be complemented by appropriate evaluation procedures and tools. A third line of research is the refinement of the database model to encompass the association of metadata to objects at different levels, the compliance with audiovisual standards and the use of heterogeneous descriptors in the computation of similarity measures for retrieval. Audiovisual descriptors are commonly multi-dimensional and quantitative; the similarity measures required in retrieval open a large ground for new approaches.
Results	Working prototype

Name	SIIUE.sac – Universidade de Évora's Integrated Information System
Status	Finished in 2006
Funding Institution	Universidade de Évora
Principal researcher	Salvador Abreu
Participants	Vitor Nogueira
Description	Continued design and implementation of a logic language to build web-based information systems, featuring transparent use of hetherogeneous databases. Application to the academic management of the University (Évora).
Results	several publications and a production system.

3 List of M.Sc. and Ph.D. students and topics in 2006

3.1 M.Sc. Students

Name	Matthias Knorr
Degree	M.Sc.
Supervisor	Reinhard Kahle (co-supervised by Steffen Hölldobler (Dresden))
Topic	A Comparative Study of Disjunctive Well-Founded Semantics
Start date	2005
Finish date	May 2006

Name	Gil Loureiro
Degree	M.Sc.
Supervisor	Francisco Azevedo
Topic	Formatação optimizada de Documentos usando Restriç(õ)es no XSL:FO
Start date	October 2003
Finish date	July 2006

Name	Luís Rodrigues Soares
Degree	M.Sc.
Supervisor	Luís Moniz Pereira
Topic	Revise Well-founded Semantics a new semantics for logic programs
Start date	November 2005
Finish date	October 2006

Name	Pedro Patinho
Degree	MSC.
Supervisor	Salvador Abreu
Topic	Extensions to the GNU Prolog system
Start date	December 2002
Finish date	September 2006

Name	Luis Almas
Degree	MSC.
Supervisor	Salvador Abreu
Topic	Distributed constraint programming toolkits
Start date	September 2005
Finish date	September 2006

Name	Nuno Lopes
Degree	MSC.
Supervisor	Salvador Abreu
Topic	Semantic web aspects for the ISCO language (front ends)
Start date	September 2005
Finish date	Early 2007 (expected)

Name	Claudio Fernandes
Degree	MSC.
Supervisor	Salvador Abreu
Topic	Semantic web aspects for the ISCO language (back ends)
Start date	September 2005
Finish date	Early 2007 (expected)

Name	Tiago Fernandes
Degree	MSC.
Supervisor	Salvador Abreu
Topic	Contextual Logic Programs for Distributed Systems
Start date	September 2005
Finish date	Early 2007 (expected)

Name	Nuno Morgadinho
Degree	MSC.
Supervisor	Salvador Abreu
Topic	Distributed Multithreaded GNU Prolog
Start date	September 2005
Finish date	Early 2007 (expected)

Name	Nuno Miguel Soares Datia
Degree	M.Sc.
Supervisor	João Moura-Pires
Topic	Decision Support Techniques Applied to Audiometry Data
Start date	February 2004
Finish date	March 2006

Name	Nuno Carlos Santos Simôes Viana
Degree	M.Sc.
Supervisor	João Moura Pires
Topic	A Analysis, Design and Development of an Extraction, Transformation and Loading Software Architecture for Space-Oriented Activities with Real-time Constraints.
Start date	September 2004
Finish date	January 2006

Name	Rosa Isabel Alves Cordeiro Matias
Degree	M.Sc.
Supervisor	João Moura Pires
Topic	Integration of geographical information in OLAP systems.
Start date	September 2004
Finish date	July 2006

Name	Ana Sofia Carapinha da Cunha Lopes
Degree	M.Sc.
Supervisor	João Moura-Pires
Topic	Decision Support System for Environmental Data
Start date	September 2004
Finish date	October 2006

Name	José Palmeiro
Degree	M.Sc.
Supervisor	Paulo Quaresma
Topic	A BDI architecture for information retrieval
Start date	October 2004
Finish date	January 2007

Name	Ana Aires
Degree	M.Sc.
Supervisor	Paulo Quaresma
Topic	Anaphora resolution in Portuguese Documents
Start date	October 2004
Finish date	December 2006

Name	Gaston Tagni
Degree	M.Sc.
Supervisor	José Alferes
Topic	An Approach to Complex Event Detection in the Web
Start date	March 2006
Finish date	March 2007 (expected)

Name	José Carlos Almeida Santos
Degree	M.Sc.
Supervisor	Pedro Barahona
Topic	Mining Protein Data Banks for Structure Prediction
Start date	February 2005
Finish date	June 2006
Name	Vivek Nigam
Degree	M.Sc.
Supervisor	João Leite
Topic	Dynamic Logic Programming for 3APL
Start date	October 2005
Finish date	May 2006
Name	Martina Babini
Degree	M.Sc. (University of Bologna)
Supervisor	João Leite
Topic	Dynamic Logic Programming for Recommender Systems
Start date	October 2005
Finish date	June 2006
Name	Gustavo Alexandre Laboreiro
Degree	M.Sc.
Supervisor	Irene Pimenta Rodrigues
Topic	Métodos para extracção e representação de conhecimento de bases de documentos usando ontologias.
Start date	October 2005
Finish date	2007 (expected)

3.2 Ph.D. Students

Name	João Fernando Lima Alcântara
Degree	Ph.D.
Supervisor	Carlos Viegas Damásio and Luís Moniz Pereira
Topic	Paraconsistent Disjunctive Extended Logic Programs
Start date	September 2001
Finish date	Mid 1007 (expected)
Name	Alexandre Miguel Pinto
Degree	Ph.D.
Supervisor	Luís Moniz Pereira
Topic	Ontologia para linguagens de especificação de acçĩntencionais para regras reactivas
Start date	September 2005
Finish date	August 2009 (expected)
Name	Federico Banti
Degree	Ph.D.
Supervisor	José Alferes
Topic	A language for executing and reasoning about evolution of logic based agents
Start date	October 2003
Finish date	June 2007 (expected)

Name	Teresa Gonçalves
Degree	Ph.D.
Supervisor	Paulo Quaresma
Topic	Automatic Classification of Portuguese Documents
Start date	October 2003
Finish date	July 2007 (expected)

Name	José Saias
Degree	Ph.D.
Supervisor	Paulo Quaresma
Topic	Automatic construction of ontologies and their application in the semantic web context
Start date	October 2004
Finish date	December 2007 (expected)

Name	Ana Luisa Leal
Degree	Ph.D.
Supervisor	Paulo Quaresma
Topic	Rhetorical Structures and Question Answering Systems
Start date	October 2004
Finish date	September 2008 (expected)

Name	Cássia Santos
Degree	Ph.D.
Supervisor	Paulo Quaresma
Topic	A Multi-Agent Architecture for Question-Anwering
Start date	October 2005
Finish date	September 2008 (expected)

Name	Vítor Nogueira
Degree	Ph.D.
Supervisor	Salvador Abreu and Gabriel David (Faculty of Engineering, University of Porto)
Topic	Constraint and Logic Languages for Hetherogeneous Database Systems
Start date	October 2001
Finish date	2007 (expected)

Name	Valeria Magalhães Pequeno
Degree	Ph.D.
Supervisor	João Moura Pires
Topic	Specification, maintenance and implementation of materialized object views in an object-relational data warehouse
Start date	July 2005
Finish date	September 2008 (expected)

Name	Luis Quintano
Degree	Ph.D.
Supervisor	Irene Pimenta Rodrigues
Topic	Natural Language Dialogues for IR from BD
Start date	October 2003
Finish date	October 2007 (expected)

Name	Marco Vargas Correia
Degree	Ph.D.
Supervisor	Pedro Barahona
Topic	Advanced Techniques for Improving Constraint Solving in Finite Domains
Start date	October 2004
Finish date	December 2008 (expected)

Name	Gonçalo Lopes
Degree	Ph.D.
Supervisor	Luís Moniz Pereira
Topic	Computational Logic for proactive agents
Start date	December 2006
Finish date	December 2010 (expected)
Name	Luís Soares
Degree	Ph.D.
Supervisor	Luís Moniz Pereira
Topic	Computational Logic belief revision with updating
Start date	September 2005
Finish date	December 2010 (expected)
Name	Mário Abrantes
Degree	Ph.D.
Supervisor	Luís Moniz Pereira
Topic	Computational Logic semantics of contradiction removal
Start date	September 2005
Finish date	December 2010 (expected)
Name	Matthias Knorr
Degree	Ph.D.
Supervisor	José Alferes
Topic	Combining open and closed world knowledge representation for reasoning on the semantic web
Start date	September 2006
Finish date	March 2010 (expected)
Name	Elsa Cristina Batista Bento Carvalho
Degree	Ph.D.
Supervisor	Pedro Barahona & Jorge Cruz
Topic	Integration of Guaranteed and Preferred intervals in Constraint Programming over Continuous Domains
Start date	October 2006
Finish date	October 2009 (expected)

4 Publications

4.1 Edited books and journal special issues

[1] José Júlio Alferes, James Bailey, Wolfgang May, and Uta Schwertel, editors. *Principles and Practice of Semantic Web Reasoning, 4th International Workshop, PPSWR 2006, Budva, Montenegro, June 10-11, 2006, Revised Selected Papers*, volume 4187 of *Lecture Notes in Computer Science*. Springer, 2006.

[2] José Júlio Alferes and João Alexandre Leite. Special issue arising from the 9th european conference on logics in artificial intelligence. *J. Applied Logic*, pages 1–3, April 2006.

[3] Francisco Azevedo, Pedro Barahona, Francois Fages, and Francesca Rossi, editors. *CSCLP 2006, Annual ERCIM Workshop on Constraint Solving and Constraint Logic Programming*, Caparica, Portugal, June 2006.

[4] Pedro Barahona, François Bry, Enrico Franconi, Nicola Henze, and Ulrike Sattler, editors. *Reasoning Web*, volume 4126 of *Lecture Notes in Computer Science*, Caparica, Portugal, September 2006. Springer.

[5] Reinhard Kahle and Isabel Oitavem, editors. *Days in Logic '06*, volume 38 of *Textos de Matemática*. Departamento de Matemática, Universidade de Coimbra, 2006.

[6] Reinhard Kahle and Peter Schroeder-Heister, editors. *Proof-theoretic semantics*, volume 148 of *Synthese*. 2006. Special issue.

[7] Karl-Heinz Niggl, Reinhard Kahle, and Birgit Elbl, editors. *5th International Workshop on Proof, Computation, Complexity, PCC '06*. Universitätsverlag Ilmenau, 2006.

[8] Renata Vieira, Paulo Quaresma, Maria das Graças Volpe Nunes, Nuno Mamede, Claudia Oliveira, and Maria Carmelita Dias, editors. *Computational Processing of the Portuguese Language, 7th International Workshop, PROPOR 2006, Itatiaia, Brazil, May 13-17, 2006, Proceedings*, volume 3960 of *Lecture Notes in Computer Science*. Springer, 2006.

4.2 In International Journals

[10] R.H. Bordini, L. Braubach, M. Dastani, A. El F. Seghrouchni, J.J. Gomez-Sanz, João Alexandre Leite, G. O'Hare, A. Pokahr, and A. Ricci. A survey of programming languages and platforms for multi-agent systems. *Informatica*, 30:33–44, 2006.

[11] Carlos Viegas Damásio, Jesús Medina, and Manuel Ojeda-Aciego. Termination of logic programs with imperfect information: applications and query procedure. *Journal of Applied Logic*, 2006. Melhores artigos da conferência JELIA'2004.

[12] Reinhard Kahle. David hilbert and the paradoxes. *Bulletin of Symbolic Logic*, 12, June 2006.

[13] Reinhard Kahle. A proof-theoretic view of necessity. *Synthese*, 148, 2006.

[14] Ludwig Krippahl, Palma PN, Moura I., and Moura JG. Modelling the electron-transfer complex between aldehyde oxidoreductase and flavodoxin. *Eur. J. of Inor. Chem*, 2006:3835–3840, 2006.

[15] S Monaco, M Gioia, J Rodriguez, GF Fasciglione, D Di Pierro, G Lupidi, Ludwig Krippahl, S Marini, and M. Coletta. Modulation of the proteolytic activity of matrix metalloproteinase-2 (gelatinase a) on fibrinogen. *Biochem J*, Epub ahead of print, 2006.

[16] Paulo Quaresma, Irene Rodrigues, Carlos Prolo, and Renata Vieira. Um sistema de pergunta-resposta para uma base de conhecimentos. *Letras de Hoje - Revista da Pontifícia Universidade Católica do Rio Grande do Sul*, 144:43–64, June 2006.

[17] Cássia Trojahn, Márcia Moraes, Paulo Quaresma, and Renata Vieira. A negotiation model for composing ontology matching approaches. *Scientia, UNISINOS, Brazil*, 16:12–27, 2006.

[18] Gregory Wheeler. On the structure of rational acceptance. *Knowledge, Rationality & Action*, pages 117–134, 2006.

[19] Gregory Wheeler. Rational acceptance and conjunctive/disjunctive absorption. *Journal of Logic, Language and Information*, 15(1-2):49-63, 2006.

4.3   In National Journals

[20] Reinhard Kahle. Os teoremas de incompletude de kurt gödel. *Boletim da Sociedade Portuguesa de Matemática*, 55, 2006.

[21] Luís Moniz Pereira. Gödel e a computabilidade. *Boletim da Sociedade Portuguesa de Matemática*, 9:77–90, October 2006. Invited paper, special issue commemorative of Kurt Gödel's birth centenary.

4.4   Book chapters

[22] Iara Almeida and José Júlio Alferes. An argumentation-based negotiation for distributed extended logic programs. In Katsumi Inoue, Ken Satoh, and Francesca Toni, editors, *Computational Logic in Multi-Agent Systems, Revised Selected and Invited Papers of CLIMA VII*, volume 4371 of *Lecture Notes in Aritificial Intelligence*, pages 191–210. Springer, 2006.

[23] Guillaume Bonfante, Reinhard Kahle, Jean-Yves Marion, and Isabel Oitavem. Towards an implicit characterization of nc^k. volume 4207 of *212-224*. Springer, 2006.

[24] Ludwig Krippahl. Integrating web resources to model protein structure and function. In Pedro Barahona, François Bry, Enrico Franconi, Nicola Henze, and Ulrike Sattler, editors, *Lecture Notes in Computer Science*, volume 4126, pages 184–196. Springer, 2006.

[25] J. Leite and L. Soares. Adding evolving abilities to a multi-agent system. In K. Inoue, K. Satoh, and F. Toni, editors, *Computational Logic in Multi-Agent Systems VII*, volume 4371 of *LNAI*, pages 246–265. Springer-Verlag, 2006.

4.5   In Proceedings of International Conferences

[25] Salvador Abreu and Vitor Nogueira. Towards structured contexts and modules. In Sandro Etalle and Miroslaw Truszczynski, editors, *Logic Programming, 22nd International Conference, ICLP 2006, Seattle, WA, USA, August 17-20, 2006, Proceedings*, volume 4079 of *Lecture Notes in Computer Science*, pages 436–438. Springer, 2006.

[26] José Júlio Alferes, Federico Banti, and Antonio Brogi. An eca logic programming language. In G. Semeraro F. Esposito, D. Malerba, editor, *Convegno Italiano di Logica Computazionale, CILC 2006*. Università di Bari, 2006.

[27] José Júlio Alferes, Federico Banti, and Antonio Brogi. Era: An event-condition-action logic programming language. In Michael Fisher, Wiebe van der Hoek, Boris Konev, and Alexei Lisitsa, editors, *Logics in Artificial Intelligence, 10th European Conference, JELIA 2006*, volume 4187 of *Lecture Notes in Computer Science*, pages 29–42. Springer, 2006.

[28] José Júlio Alferes and Gaston Tagni. Implementation of a complex event engine for the web. In Ling Liu and Opher Etzion, editors, *Event-Driven Architecture, Processing and Systems, IEEE Services Computing Workshops*, pages 65–72. IEEE Press, 2006.

[29] Iara Almeida and José Júlio Alferes. An argumentation-based negotiation for distributed extended logic programs. In K. Inoue, K. Satoh, and F. Toni, editors, *Pre-proceedings of the 7th International Workshop CLIMA VII*. Future University, Hakodate, Japan, 2006.

[30] Miguel Alves, Carlos Viegas Damásio, Wolfgang Nejdl, and Daniel Olmedilla. A distributed tabling algorithm for rule based policy systems. In *POLICY'06: Proceedings of the Seventh IEEE International Workshop on Policies for Distributed Systems and Networks (POLICY'06)*, pages 123–132, London, Ontario, Canadá, 2006. IEEE Computer Society.

[31] Francisco Azevedo. An attempt to dynamically break symmetries in the social golfers problem. In Francisco Azevedo, editor, *11th Annual ERCIM Workshop on Constraint Programming (CSCLP'2006)*, pages 101–115, 2006.

[32] Francisco Azevedo and Hau Nguyen Van. Extra constraints for the social golfers problem. In *13th International Conference on Logic for Programming Artificial Intelligence and Reasoning (LPAR 2006) Short Papers Proceedings*, 2006.

[33] Helena Barbas and Nuno Correia. Documenting instory - mobile storytelling in a cultural heritage environment. In Luciana Bordoni, Massimo Zancanaro, and Antonio Krueger, editors, *First European Workshop on Intelligent Technologies for Cultural Heritage Exploitation*, volume 1, pages 6–12. ITC-Irst, Trento, Italy, August 2006.

[34] Charalampos Bratsas, Evabgelos Kaimakamis, Panagiotis Bamidis, Paulo Quaresma, and Nicos Maglaveras. Semi automatic ontology based knowledge extractions and search for medical algorithms from web documents. In Gunther Eysenback, editor, *Proceedings of MedNet - 11th World Congress on the Internet in Medicine, Toronto, Canada*, pages 25–25, 2006.

[35] Marco Correia and Pedro Barahona. Overview of an open constraint library. In Francisco Azevedo, Pedro Barahona, F. Fages, and F. Rossi, editors, *Proceedings CSCLP 2006, Annual ERCIM Workshop on Constraint Solving and Constraint Logic Programming*, pages 159–168, Caparica, Portugal, June 2006.

[36] Carlos Viegas Damásio, Anastasia Analyti, Grigoris Antoniou, and Gerd Wagner. Open and closed world reasoning in the semantic web. In *Proceedings of the 11th International Conference on Information Processing and Management of Uncertainty in Knowledge-Based Systems (IPMU-06), special session Works on the Semantic Web*, pages 1850–1857, Paris, France, July 2006. Editions E.D.K. Participação por convite e sujeita a avaliação.

[37] Carlos Viegas Damásio, Anastasia Analyti, Grigoris Antoniou, and Gerd Wagner. Supporting open and closed world reasoning on the web. In José Júlio Alferes, J. Bailey, and U. Schwertel, editors, *Principles and Practice of Semantic Web Reasoning, 4th International Workshop, PPSWR 2006, Revised Selected Papers*, volume 4187 of *Lecture Notes in Computer Science*, pages 149–163, Budva, Montenegro, June 2006. Springer.

[38] Carlos Viegas Damásio, Jesús Medina, and Manuel Ojeda-Aciego. A tabulation procedure for first-order residuated logic programs. In *Proceedings of the 11th International Conference on Information Processing and Management of Uncertainty in Knowledge-Based Systems, (IPMU-06)*, pages 476–483, Paris, France, July 2006. Editions E.D.K.

[39] Carlos Viegas Damásio, Jesús Medina, and Manuel Ojeda-Aciego. A tabulation procedure for first-order residuated logic programs: soundness, completeness and optimisations. In *Proceedings of the IEEE Congress on Computational Intelligence (section Fuzzy Systems)*, pages 9576–9583, Vancouver, Canada, July 2006. IEEE Computer Society.

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[44] Cássia Trojahn dos Santos, Paulo Quaresma, Irene Rodrigues, and Renata Vieira. A multi-agent approach to question answering. In *PROPOR*, pages 131–139, 2006.

[45] Armando Fernandes and Susana Nascimento. Automatic water eddy detection in sst maps using random ellipse fitting and vectorial fields for image segmentation. In Ljupco Todorovski, Nada Lavrac, and Klaus Jantke, editors, *Discovery Science, Proceedings*, volume 4265 of *Lecture Notes in Artificial Intelligence*, pages 77–88, Barcelona, Spain, October 2006. Springer.

[46] Teresa Gonçalves, Cassiana Silva, Paulo Quaresma, and Renata Vieira. Analysing part-of-speech for portuguese text classification. In *CICLing*, pages 551–562, 2006.

[47] Rui Dias Jorge and Carlos Viegas Damásio. Diagnosis of power system protection. In Moonis Ali and Richard Dapoigny, editors, *Advances in Applied Artificial Intelligence, 19th International Conference on Industrial, Engineering and Other Applications of Applied Intelligent Systems, IEA/AIE 2006, Proceedings*, volume 4031 of *Lecture Notes in Computer Science*, pages 650–659, Annecy, France, June 2006. Springer. Nomeado para a competição dos melhores artigos.

[48] Ludwig Krippahl and Pedro Barahona. Chemera: Constraints in protein structural problems. In Alessandro Dal Palu, Agostino Dovier, and Sebastian Will, editors, *Proceedings of WCB06, Workshop on Constraint Based Methods for Bioinformatics*, pages 30–45, Nantes, France, September 2006.

[49] Ana Luísa Leal, Paulo Quaresma, and Rove Chishman. From syntactical analysis to textual segmentation. In *PROPOR*, pages 252–255, 2006.

[50] J. Leite and L. Soares. Evolving characters in role-playing games. In R. Trappl, editor, *Cybernetics and Systems 2006, 18th European Meeting on Cybernetics and Systems Research (EMCSR 2006)*, volume 2, pages 515–520. Austrian Society for Cybernetic Studies, 2006.

[51] João Alexandre Leite and M. Babini. Dynamic knowledge based user modeling for recommender systems. In A. Felfernig and M. Zanker, editors, *Procs of the ECAI 2006 Workshop on Recommender Systems, Riva del Garda, Italy*, pages 134–138, 2006.

[52] João Alexandre Leite and L. Soares. Enhancing a multi-agent system with evolving logic programs. In K. Inoue, K. Satoh, and F. Toni, editors, *Pre-Procs. of the 7th International Workshop on Computational Logic in Multi-Agent Systems, (CLIMA VII), Hakodate, Japan*, pages 207–222, 2006.

[53] Gonçalo Lopes and Luís Moniz Pereira. Prospective programming with acorda. In *Empirically Successful Computerized Reasoning (ESCoR'06) workshop at The 3rd International Joint Conference on Automated Reasoning (IJCAR'06)*, Seattle, USA, August 2006.

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5 Missions

Salvador Abreu

- Madrid, Spain, November 2006: Salvador Abreu and Vitor Nogueira
  Purpose: participation in the WFLP'06 conference.

José Júlio Alferes

- Munich, Germany, March 2006
  Purpose: Participation in the annual meeting of project Rewerse, and the meeting of
  the I5 working group on Evolution and Reactivity.
- Munich, Germany, May 2006
  Purpose: Participation in the review meeting of project.
- Budva, Montenegro, June 2006
  Purpose: Participation in the 4th Workshop on Principles and Practice of Semantic
  Web Reasoning – PPSWR'06, where he was Programme Chair. Participation in the
  European Conference on Semantic Web.
- Dresden, Germany, December 2006
  Purpose: Participation in a meeting of the project Rewerse.
- Bolzano, Italy, December 2006
  Purpose: Participation in a meeting and Students' workshop of the European Masters
  in Computational Logics.

Federico Banti

- Bari, Italy, June 2006
  Purpose: Participation in the CILC'056 conference
- Liverpool, UK, September 2006
  Purpose: Participation in the JELIA'06 conference

Pedro Barahona

- Munich, Germany, March 2006
  Purpose: Participation in the annual meeting of project Rewerse, and the meeting of
  the A2 working group on Bioinformatics.
- Jakarta, Indonesia, August 2006
  Purpose: Invited Lecture in the Summer School on Logical Foundations of Intelligent
  Systems.
- Nantes, France, September 2006
  Purpose: Participation in CP'2006, 12th International Conference on Principles and
  Practice of Constraint Programming and in its Sattelite Workshop on Constraint Based
  Methods for Bioinformatics.
- Dresden, Germany, December 2006
  Purpose: Participation with invited talk at "Scientific Workshop in honour of Professor
  Luís Moniz Pereira", on the occasion of his honoris causa doctorate from TU Dresden.

Helena Barbas

- Trento, Italy, August 2006
  Purpose: Participation in ECAI 2006, 17th European Conference on Artificial Intelligence.
- Stuttgart, Germany, May 2006
  Purpose: Participation in the International Seminar Sagas_net/MEDIA Plus Project.

- Stuttgart, Germany, May 2006
  Purpose: Participation in the Fmx/06 11th. International Conference on Animation, Effects, Real Time and Contents. Bristol, UK, April 2006
  Purpose: Participation in the Symposium Narrative, Artificial Intelligence and Games AISB06

Marco Correia

- Samos, Greece, July 2006
  Purpose: Participation in Association of Constraint Programming on Global Constraints
- Nantes, France, September 2006
  Purpose: Participation in CP'2006, 12th International Conference on Principles and Practice of Constraint Programming (accepted in the Doctoral Programme).

Jorge Cruz

- Nantes, September 2006
  Purpose: Participation in CP 2006, Twelfth International Conference on Principles and Practice of Constraint Programming.

Carlos Viegas Damásio

- Paris, France, July 2006
  Purpose: Presentation of two papers at the Eleventh International Conference on Information Processing and Management of Uncertainty in Knowledge-Based Systems (IPMU'2006)

- Munich, Germany, March 2006
  Purpose: Participation in the annual REWERSE meeting.

Pierangelo DellAcqua

- Bari, Italy, September 2006
  Purpose: Participation with paper in 16th International Symposium on Methodologies for Intelligent Systems.
- Setúbal, Portugal, August 2006
  Purpose: Participation with paper in 3rd Int.Conf. on Informatics in Control, Automation and Robotics, subarea Intelligent Control Systems and Optimization.

Armando Fernandes

- Barcelona, Spain, 7-10 October 2006
  Purpose: Participation in the Ninth International Conference on Discovery Science (DS-2006)

Rui Dias Jorge

- Annecy, France, June 2006
  Purpose: presentation of a paper at 19th International Conference on Industrial, Engineering and Other Applications of Applied Intelligent Systems, IEA/AIE 2006.

Reinhard Kahle

- Coimbra, January 2006
  Purpose: Organization and Participation at *Days in Logic '06*
- Luminy, France, February 2006
  Purpose: Talk and Participation at the Workshop *GeoCal '06* (on invitation)

- Coimbra, April 2006
  Purpose: Organization and Talk at the *Simpósio de Matemática: Centenário do nascimento de Kurt Gödel*

- Aveiro, May 2006
  Purpose: Talk at the Departamento de Matemática.

- Braga, June 2006
  Purpose: Talk at the *Colóquio de Matemática*

- Lisbon, June 2006
  Purpose: Talk and Participation at the *Encontro nacional da sociedade portuguesa de matemática, ENSPM '06*

- Lisbon, July 2006
  Purpose: Talk at the *Seminário de Lógica Matemática, UTL, IST*

- Ilmenau, Germany, July 2006
  Organization, Talk and Participation at the International Workshop *Proof, Computation, Complexity — PCC'06*

- Oaxaca, Mexico, August 2006
  Invited Talk and Participation at the *XIII Simposio Latinoamericano de Lógica Matemática*

- Szeged, Hungary, September 2006
  Talk and Participation at the International Conference *Computer Science Logic, CSL '06*

- Lisbon, October 2006
  Talk at the *First Lisbon Colloquium on the Unity of Science*

- Lisbon, November 2006
  Participation on the panel at the *Panel Discussion, Lancamento do Boletim da SPM sobre Kurt Gödel*

Ludwig Krippahl

- Alba di Canazei, University of Verona, Italy, January 2006
  Purpose: Participation in Second EuCheMS School on Protein Chemistry

- Munich, Germany, March 2006
  Purpose: Participation in the annual meeting of project Rewerse, and the meeting of the A2 working group on Bioinformatics.

João Leite

- Hakodate, Japan, May 2006
  Purpose: Participation in AAMAS'06, 5th International Conference on Autonomous Agents and Multi Agent Systems where a tutorial titled "Programming languages and Development Tools for MAS" was presented, and its satellite workshops DALT'06, PRO-MAS'06 and CLIMA'06, where three papers were presented.

- Vienna, Austria, April 2006
  Purpose: Participation in 18th European Meeting on Cybernetics and Systems Research (EMCSR'06).

- Riva del Garda, Italy, August 2006
  Purpose: Participation in 17th European Conference 9on Artificial Intelligence (ECAI'06) and satellite workshop on Recommender Systems where a paper was presented.

- Dagstuhl, Germany, June 2006
  Purpose: Participation in Dagstuhl Seminar 06261 on Foundations and Practice of Programming Multi-Agent Systems.

- Tokyo, Japan, May/June 2006
  Purpose: Research visit at the National Institute of Informatics, invited by Ken Satoh. Two invited lectures were presented, at NII, during this stay.
- Lisbon, Portugal, 2006
  Purpose: Invited speaker at the IV PROMAS Technical Forum.

Gonçalo Lopes

- Seattle, USA, August 2006
  Purpose: Participation with paper in Empirically Successful Computerized Reasoning workshop at The 3rd International Joint Conference on Automated Reasoning.

Susana Nascimento

- Oeiras, Portugal, 22-24 June 2006
  Purpose: Participation in the 2006 Summer School on Clustering organized by Professor Peter Bryant.
- Birkbeck College, University of London, London, UK, August 27th to September 2nd 2006
  Purpose: elaboration of the COPSRO project proposal with Professors Boris Mirkin and Luis Moniz Pereira.
- Birkbeck College, University of London, London, UK, 18-21 December
  Purpose: to work with Professor Boris Mirkin on algorithms and computations for both clustering and mapping the clusters to the ACM classification ontology, in the context of COPSRO project proposal.

Luís Moniz Pereira

- Jakarta, Indonesia, January/February 2006
  Purpose: Giving a course on Computational Logic Agents, in the context of Asia Link project VN/001.
- Munich, Germany, March 2006
  Purpose: Participation in the annual REWERSE project meeting.
- Lisbon, Portugal, April 2006
  Purpose: Participation with invited talk at International Meeting on Abduction and the Process of Scientific Discovery, Museu de Ciência da Universidade de Lisboa.
- Porto, Portugal, April 2006
  Purpose: Participation with invited talk at Novas Fronteiras da Ciência e do Conhecimento, Alfândega do Porto.
- Porto, Portugal, May 2006
  Purpose: Participation with invited talk at Dia Comemorativo dos 50 Anos da Inteligência Artificial", ISEP - Instituto Superior de Engenharia do Porto.
- Lisbon, Portugal, May 2006
  Purpose: Participation with invited talk at "Excelência - Centros de Inovação e Inteligência Artificial", Faculdade de Ciências e Tecnologia, Universidade Nova de Lisboa.
- Almada, Portugal, May 2006
  Purpose: Participation with invited talk at "Velhos e Novos Media", Fórum Municipal Romeu Correia.
- Lisbon, Portugal, July 2006
  Purpose: Participation in the coordination meeting of the European Master in Computational Logic.
- Lisbon, Portugal, October 2006
  Purpose: Participation with invited talk at First Lisbon Colloquium for the Philosophy of Science - The Unity of Science: Non Traditional Approaches, Teatro da Trindade.

- Lisbon, Portugal, November 2006
  Purpose: Participation with invited talk at "South Western Europe Regional ACM Programming Contest 2006, Faculdade de Ciências e Tecnologia, Universidade Nova de Lisboa.

- Dresden, Germany, December 2006
  Purpose: Participation in the ceremony of his honoris causa doctorate from TU Dresden.

- Dresden, Germany, December 2006
  Purpose: Participation with invited talk at "Scientific Workshop in honour of Professor Luís Moniz Pereira", on the occasion of his honoris causa doctorate from TU Dresden.

- Bolzano, Italy, December 2006
  Purpose: Participation in the coordination meeting of the European Master in Computational Logic.

Alexandre Pinto

- Munich, Germany, March 2006
  Purpose: Participation in the annual REWERSE project meeting.

Paulo Quaresma

- Itatiaia, Brazil, May 2006
  Purpose: Participation in Propor: Computational Processing of the Portuguese Language.

- Porto Alegre, Brazil, January 2006
  Purpose: Collaboration with UNISINOS and PUCRS, under project GRICES/CAPES DIRPI.

José Saias

- Ribeirão Preto, Brazil, October 2006
  Purpose: Participation in IBERAMIA – 10th Ibero-American Artificial Intelligence Conference.

Pedro Santana

- Annecy, France, June 2006
  Purpose: Participation with paper in The 19th Intl.Conf. on Industrial & Engineering Applications of Artificial Intelligence & Expert Systems.

Gaston Tagni

- Chicago, USA, September 2006
  Purpose: Participation in the IEEE Services Computing Workshops

Gregory Wheeler

- Pensacola, Florida. January 2006.
  Purpose: Invited Talk. "Remarks on some sub-P logics", presented at the *Institute for Human and Machine Cognition*.

- Blacksburg, Virginia. June 2006.
  Purpose: Participation in the *The First Symposium on Experimental Reasoning, Reliability, Objectivity and Rationality (ERROR 2006)*.

- Madrid. July 2006.
  Purpose: Participation in the *Second ISIPTA Workshop and Summer School*.

- Washington, D.C. December 2006.
  Purpose: Participation in Colloquium on Formal Epistemology, *Eastern Division Meeting of the American Philosophical Association*.

6 Visitors

Barry O' Sullivan , Cork Constraint Computing Centre, Ireland, 3 days, June 2006, Participation on CSCLP'06 and discussions on Constraint Programming

Bertram Fronhöfer , Technical University of Dresden, Germany, 4 days, July 2006. Meeting of the Coordinating Committee of the European MSc in Computational Logic.

Boudjenah Lotfi , University of Oran, Algeria, February/December 2006, with a research scholarship from his Government.

Daniel Schubert , Göttingen University, Germany, 1 week in July. Collaboration in the context of the Rewerse project.

Enrico Franconi , Free University of Bolzano, Italy, 4 days, July 2006. Meeting of the Coordinating Committee of the European MSc in Computational Logic.

Francesca Rossi , University of Padova, Italy, 3 days, June 2006, Participation on CSCLP'06 and discussions on Constraint Programming

François Fages , INRIA Roquencourt, France, 3 days, June 2006, Participation on CSCLP'06 and discussions on Constraint Programming.

Katja Lehmann , Technical University Dresden, Germany, 3 month. PhD. student participating in a cooperation programme within project Rewerse.

Márcia Moraes , PUCRS, S. Leopoldo, Rio Grande do Sul, Brasil, 2 weeks, April 2006. Project GRICES/CAPES. Development of specialized tools for natural language processing.

Matthias Baaz , Technical University of Vienna, Austria, 4 days, July 2006. Meeting of the Coordinating Committee of the European MSc in Computational Logic.

Mehdi Dastani , University of Utrecht, The Netherlands, 27 - 30 July. To participate in the MSc Jury of Vivek Nigam and prepare a joint project proposal.

Nguyen Hieu , Technical University of Hanoi, Vietnam, 6 months, September 2005/February 2006. Collaboration in the context of a European Asia Link project.

Nguyen Van Hau , Technical University of Hanoi, Vietnam, 6 months, April/October 2006. Collaboration in the context of European Asia Link project VN/001.

Nicolas Beldiceanu , 3 days, École des Mines, Nantes, France, June 2006, Participation on CSCLP'06 and discussions on Constraint Programming, namely on implementation of Globals constraints

Oliver Fritzen , Göttingen University, Germany, 1 week in July. Collaboration in the context of the Rewerse project.

Pierangelo DellAcqua , Linköping University, Sweden, 1 month, July 2006. Collaboration in joint research.

Renata Vieira , UNISINOS, S. Leopoldo, Rio Grande do Sul, Brasil, 2 weeks, April 2005. Project GRICES/CAPES. Development of specialized tools for natural language processing.

Thanh Tu Nguyen , Technical University of Hanoi, Vietnam, 6 months, May/October 2006. Collaboration in the context of European Asia Link project VN/001.

Uwe Assmann , Technical University Dresden, Germany, 1 week in September. Meeting between coordinator of workpackages of the project Rewerse.

Sergio Tessaris , Free University of Bolzano, Italy, 4 days, July 2006. Meeting of the Coordinating Committee of the European MSc in Computational Logic.

Steffen Hölldobler , Technical University of Dresden, Germany, 4 days, July 2006. Meeting of the Coordinating Committee of the European MSc in Computational Logic.

Susana Muñoz Hernández , Polytechnic University of Madrid, Spain, 4 days and 1 week in September, July 2006. Meeting of the Coordinating Committee of the European MSc in Computational Logic, and of the bilateral KRENI project funded by CRUP.

Wolfgang May , Göttingen University, Germany, 1 week in July and 1 week in September. Collaboration in the context of the Rewerse project.

Yohanes Stefanus , University of Indonesia, 2.5 months, March-May 2006. Collaboration in European Asian Link project VN/001, and teaching in European Master in Computational Logic.

7 CENTRIA evolution graphics in 2006

Research Projects

Organization of Events

Publications

Publications in Collaboration

Publications Distribution by Type

Publication Distribution by Collaboration Type

M.Sc. Thesis

Ph.D. Thesis