
UDLA Answer Sets Group

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TAG's meeting. August 2003.

ABOUT THE GROUP

- Universities: UDLA, BUAP.
- People: 2 professors, 2 Ph. D. Students, 3 Master Students, 3 Under Graduate Students.
- Founding: CONACyT 2002 – 2004.
- Related Groups: Geographical Information Systems (GIS), LEARNING.

PROJECTS / TOPICS

- Theory.
- Decision Support Systems (GIS)
- Supporting Collaboration in LEARNING SYSTEMS
- A-POL
- Updates

THEORY — ANSWER SET PROGRAMMING

Project participants:

- Mauricio Osorio Galindo –Ph. D.
- Juan Antonio Navarro Perez – M.Sc. Student
- Jose Arrazola Ramirez –Ph. D.

Recent publications:

- Mauricio Osorio Galindo, Juan Antonio Navarro Perez, Jose Arrazola. Applications of Intuitionistic Logic in Answer Set Programming. Journal of Theory and Practice of Logic Programming (Accepted in 2003).

- Juan Antonio Navarro. Properties of translations for logic programs. Accepted to appear at the Proceedings of the ESSLLI03 Student Session, 2003. (where you can find the paper on line).
- Mauricio Osorio, Jose Arrazola and Jose Juan Palacios. Towards a Framework for Answer Set Programming as Provability in Linear Logic. First IDEIA workshop (to be held in conjunction with the IBERAMIA 2002 conference). Sevilla, Spain, November 12th, 2002.
- Mauricio Osorio, Juan Antonio Navarro, Jose Arrazola. Logica Aplicada a Answer Set (abstract). Ponencia en area de Logica y Fundamentos del XXXV Congreso Nacional de la Sociedad Matematica Mexicana. Durango, del 6 al 11 de octubre 2002.
- Mauricio Osorio, Juan Antonio Navarro, Jose Arrazola. Consistent neg-extensions of superintuitionistic theories.

LOGIC COLLOQUIUM, Munster (Germany), August 3 - 9, 2002

- Juan Antonio Navarro. Answer Set Programming Through G3 Logic. Accepted in ESSLLI-2002 Student Session. Trento, Italy, 2002.
- Mauricio Osorio, Juan Antonio Navarro, Jose Arrazola. Debugging in A-Prolog: A logical approach Proceedings of ICLP 2002, LNCS 2401, pp 482-483, Springer-Verlag Copenhagen, Denmark, July/August 2002
- Mauricio Osorio, Juan Antonio Navarro, Jose Arrazola. Si-Logics for Nonmonotonic Reasoning. Workshop on Logic and Computation: Mexican International Conference on Artificial Intelligence. Merida, Yucatan, Mexico 2002. April 2002
- Mauricio Osorio, Juan Antonio Navarro, Jose Arrazola. A logical approach to A-Prolog. 9th Workshop on Logic,

Language, Information and Computation (WoLLIC'2002), pp 265-276. Rio de Janeiro, Brazil, July 30 to August 2, 2002
Volume 67 of Electronic Notes in Theoretical Computer Science ISBN: 044451290X

Results:

Our results in this line of research intend, mostly, to study properties and characteristics of answer sets in terms of non-classical logics, in particular intuitionistic and Gdel multivalued logics. This approach to study answer sets was initiated with a result from Pearce that offered a characterization of answer sets for disjunctive logic programs in terms of intuitionistic logic.

One of our results was to extend and correct this characterization in order to deal with nested logic programs.

Our proof is based, in fact, on another important result we

provided, that is a transformation of nested logic programs into standard disjunctive ones. We have also proved the invariance with respect to the background logic. We can use, instead of intuitionistic logic, any other intermediate logic and the result still holds.

Based on these results we proposed a general framework to study the answer set semantics in terms of, what we called, consistent neg-extensions. A particular logic that was found to be useful is G3, the 3-valued logic defined by Godel. Generalizing a result given by Lifschitz, Pearce and Valverde (2001) we have shown that this logic of G3 characterizes the notion of strong equivalence [esslli] between logic programs. A remarkable fact of this result is that it was proved without depending on the syntax of formulas, so it is not only valid in the context of nested logic programs but a little beyond (arbitrary propositional formulas). Other results deal with ideas on how to define, based again on G3, some sort of weak

answer set semantics with debugging purposes. We have been discussing on how to use this weak semantics to find undefined atoms and detect violated constraints within logic programs. Thus giving the logic programmer some pointers on where possible mistakes could be found. More recent results were focused on the study of properties of translations for logic programs. We have presented, in particular, a polynomial translation that can be used to reduce any propositional theory into the class of disjunctive logic programs programs. Some other interesting properties and attributes of translation in the context of answer sets were found. Examples are the property that theories can be extended by adding definitions and some relations between syntactical and semantical properties of translations.

ANSWER SET DECISION SUPPORT SYSTEMS IN GIS PROBLEMS

Objective: Making the A-Prolog approach widely applicable to GIS problems related to diagnostic and planning.

Particular Objectives

- Designing a methodology for developing Decision Support Systems in GIS problems (A situation related to the Popocatepetl problem).
- It should allow planning and diagnostic in GIS problems.
- Exploring the roll of Consistency Restoring Rules.
- Determining whether there is necessity of representing optimization aspects in GIS problems.

- If we need to represent optimization, we need to expand the power of currently available lp-solvers. We propose to use:
 - constraint satisfaction algorithms approach and/or
 - the relationship with partial-order programming (A-POL).

Related area: Geographical Information Systems (GIS)

Project participants:

- Mauricio Osorio Galindo –Ph. D.
- David Sol Martinez–Ph. D. (GIS researcher)
- Claudia Zepeda Cortes–Ph. D. Student
- Matilde Hernandez Salas – M.Sc. Student
- Luis Angel Montiel Moreno – Undergraduate Student
- Rocio Santillan Rodriguez – Undergraduate Student

Recent paper: Semantic Contents in ASP, submmited.

Abstract: We introduce the notion of Semantic Contents of a program. Using only the semantic contents of a program it is possible to obtain different semantics based on Answer Set Programming such as the standard definition of answer sets, W_s stable models, minimal generalized answer sets and a new notion similar to k -minimal stable models. One of our main theorems says that we can have compositionality in answer sets via its semantic contents. The theorem removes and makes abstraction of all details specific to answer set programming. Thus, we obtain a theorem that has its application in other nonmonotonic languages such as Partial Order Programming. Finally, we present future work about the use of Semantic Contents for planing and diagnostic in GIS.

Definition *Let P be a program (with a finite set of formulas), we define the semantic contents, denoted by $SC(P)$, as a set of pairs $\langle S, T \rangle$ satisfying the following properties:*

1. *T is a deductively closed consistent extension of P (abbreviated*

as dcc extension of P) w.r.t. \mathcal{L} ,

2. S is a set of formulas that $S \cup P \vdash T$ and

3. $\forall S' \subset S, S' \cup P \not\vdash T$.

The set S is called an abductive and the set T is called a scenario.

If SC is a semantic contents, then $SC_S := \{X : \langle X, Y \rangle \in SC\}$
and $SC_T := \{Y : \langle X, Y \rangle \in SC\}$.

Now we define an operator $+$ between semantic contents.

Definition Let SC_1 and SC_2 two semantic contents. Then $SC_1 + SC_2$ is a set of pairs of the form $\langle A \setminus K(SC_1, SC_2), T \rangle$ such that $T \in SC_T(SC_1, SC_2)$ and $\langle A, T \rangle \in SC_1$.

One main theorem says that we can have *compositionality* in answer sets via its semantic contents.

Theorem For every pair of programs P_1 and P_2 ,
 $SC(P_1 \cup P_2) = SC(P_1) + SC(P_2)$.

FINDING VARIANTS OF ANSWER SETS FROM SEMANTIC CONTENTS

We show how to obtain different semantics based on Answer sets such as:

- the standard definition of answer sets,
- minimal generalized answer sets,
- W_s stable models and
- a notion similar to k -minimal stable models.

Paper and program for compute partial answer sets (lwb):

<http://mailweb.udlap.mx/~sc098382/sc>

A LOGIC APPROACH TO SUPPORTING COLLABORATION IN LEARNING ENVIRONMENTS

Project participants:

- Mauricio Osorio Galindo –Ph. D.
- Gerardo Ayala San Martin –Ph. D.
- Maria Magdalena Ortiz de la Fuente – M.Sc. Student

Recent publications:

- Maria Magdalena Ortiz de la Fuente. An application of Answer Sets Programming for supporting collaboration in agent-based CSCL environments. Accepted to appear at the Proceedings of the ESSLLI03. Student Session, 2003. (where you can find the paper on line).

- Magdalena Ortiz, Gerardo Ayala, Mauricio Osorio.
Formalizing the Learner Model for CSCL Environments.
Accepted to appear at the Proceeding of the ENC03.

We introduce a new application of extended disjunctive logic programs in the area of CSCL environments. A logic representation of the learner model is proposed as a set of beliefs that an agent holds about the interests and capabilities of its user.

Based on these beliefs, the agent assures awareness and assists the collaboration among the learners in the community. It is an application of ASP, a formalism for nonmonotonic reasoning, which has proved to be suitable since it allows simple and clear modeling and the behavior of the system is appropriate. Here we present the main aspects of the formalized model and some general properties of it.

¡GRACIAS!

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