

A 25-YEAR PERSPECTIVE ON LOGIC PROGRAMMING

ACHIEVEMENTS OF THE ITALIAN ASSOCIATION FOR LOGIC PROGRAMMING, GULP

Agostino Dovier (Univ. of Udine)
Enrico Pontelli (New Mexico State Univ.)
35 authors
All GULP members

CILC10 — Rende, July 7th 2010

WHAT IS GULP?

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- ▶ **GULP** is the Italian Association for Logic Programming (Gruppo Utenti e ricercatori di Logic Programming)
- ▶ It is a non-profit organization founded in 1985 in Pisa
GULP is affiliated to ALP
- ▶ The constituent assembly of GULP was held in Pisa on June 18th, 1985 (about 90 people)
- ▶ **AIM:** to keep the interest in LP and related themes alive by promoting various initiatives both in research and education; an opportunity for young researchers to be introduced into an active and challenging research area in a *very informal* and *friendly* way

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THE CILC YEARS (2004–???)

A map of Italy with red arrows indicating travel routes from Bologna to various cities. A green speech bubble from Bologna says "gulp!". Cities listed include Treviso, Torino, Parma, Padova, Grado, Bologna, Genova, Pisa, L'Aquila, Roma, Vietri, Gizzeria, and Reggio Calabria. A list on the left includes Peniscola, San Sebastian, La Coruna, La Habana, Evora, and Madrid.

THE CILC YEARS (2004–???)

THE CILC YEARS (2004–???)

A map of Italy with red arrows indicating flight routes from Bologna. The routes connect Bologna to the following cities: Torino, Tremezzo, Parma, Padova, Grado, Genova, Pisa, L'Aquila, Roma, Bari, Vietri, Gizzeria, and Reggio Calabria. A green label 'Bologna gulf' is placed near the city of Bologna.

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M. Martelli



M. Gabbrielli



G. Rossi



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THE INITIAL STATE

- ▶ July 2008, Perugia. GULP assembly delegated us to organize the Book for the 25 years.
- ▶ First choice: kind of publication.
 - We asked first to Springer and they accepted
- ▶ Second choice: Book's structure
- ▶ Third choice: Chapter's authors
- ▶ Fourth choice: reviewers
- ▶ Fifth choice: Front page (and title).

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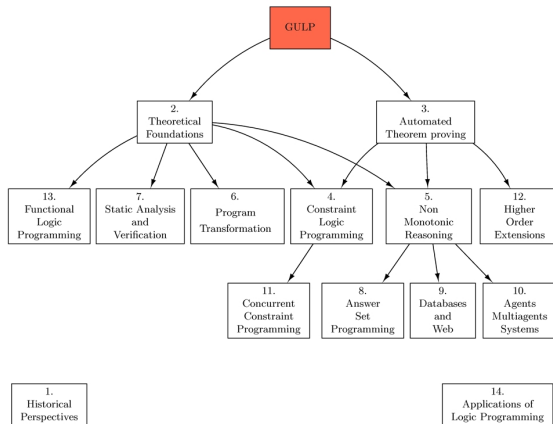
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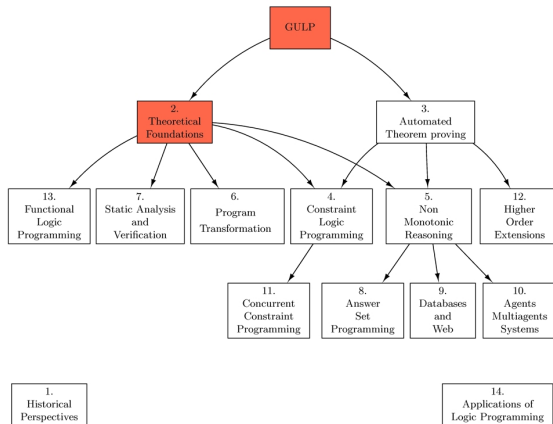
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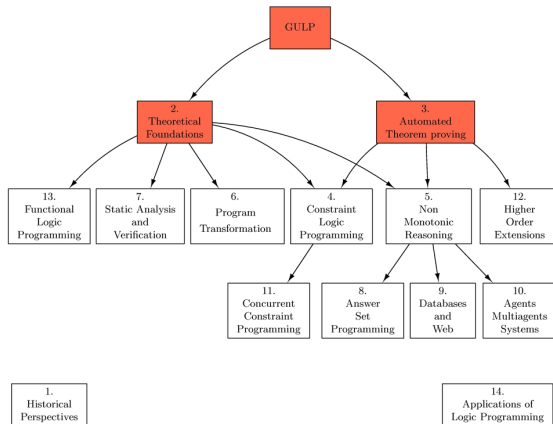
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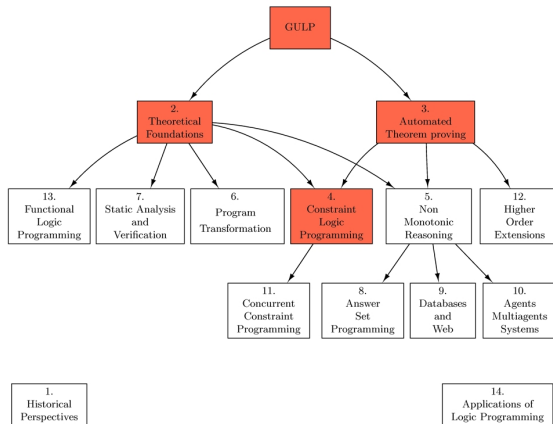
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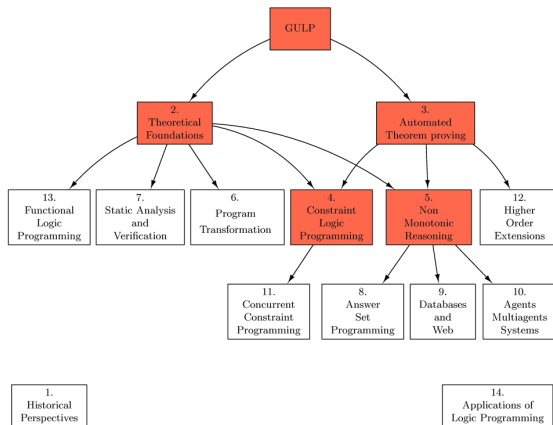
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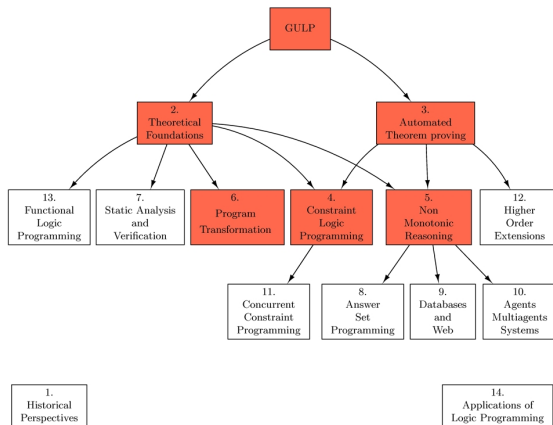
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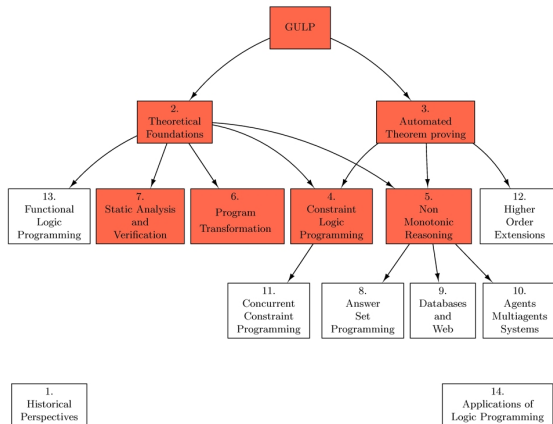
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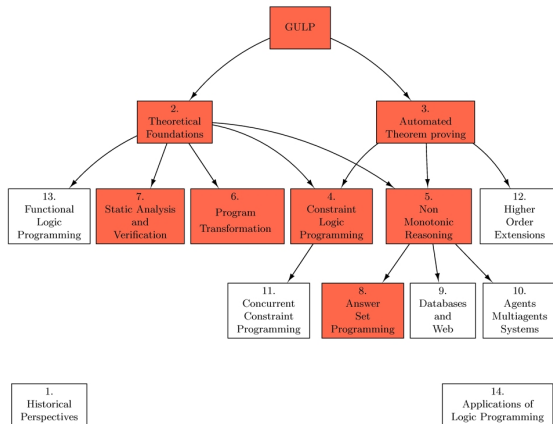
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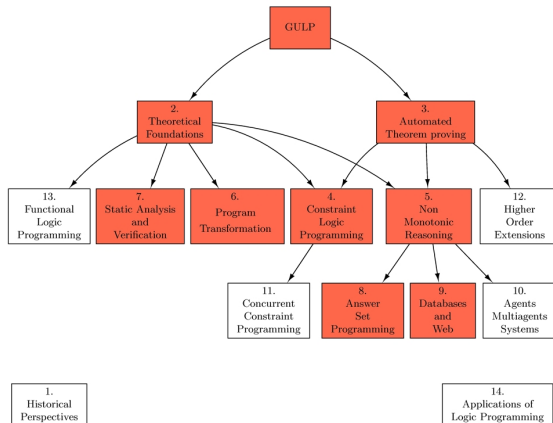
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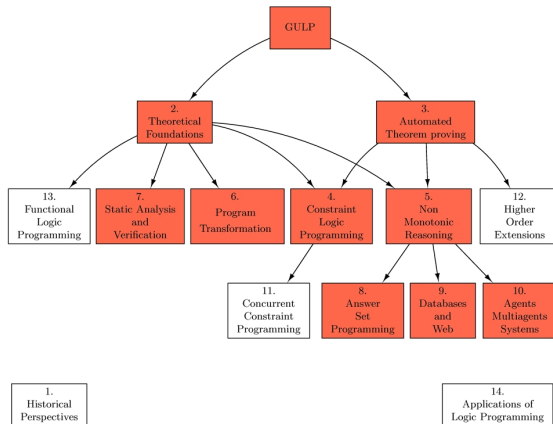
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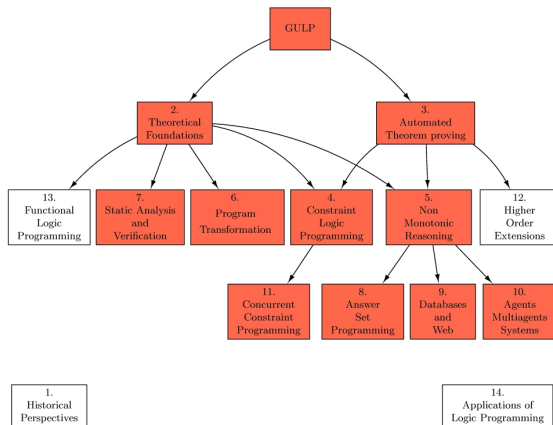
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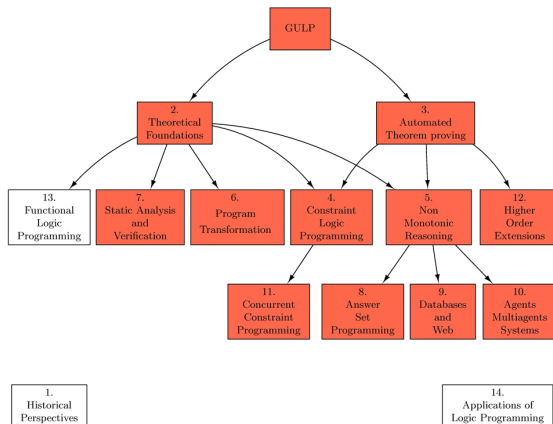
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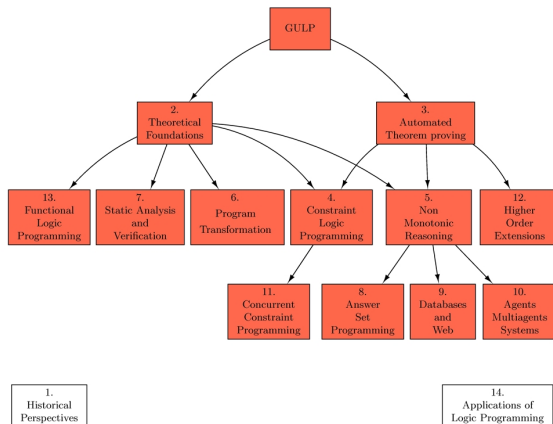
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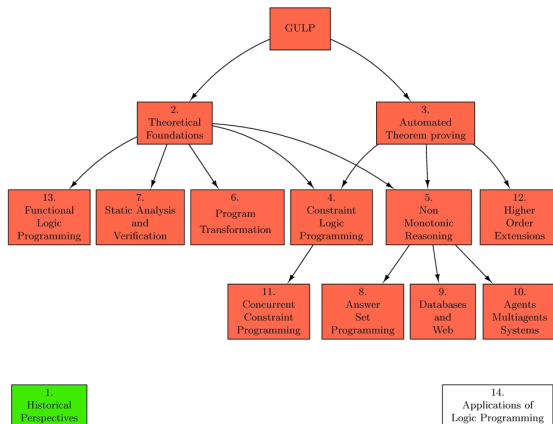
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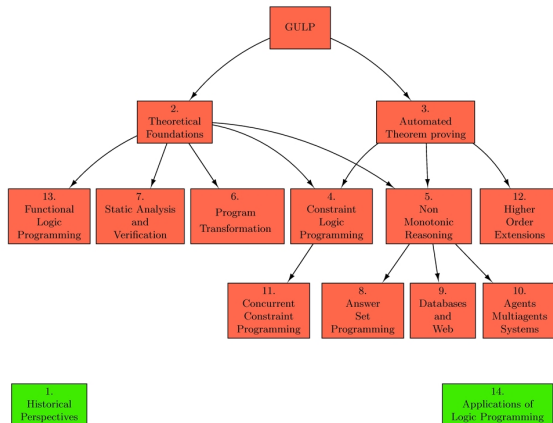
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THIRD CHOICE: CHAPTER AUTHORS

- Two invited authors per chapter (save for the 1st)
- World-wide experts of the area presented and related to GULP (or AGP)
- Since they have to cover 25 years, we decided to pair a younger researcher with a more established leader
- Possibly both of them (and at least the younger) must have a reputation of high reliability
- Invited authors can invite extra authors at their wish.
- A coverage of Italian universities related to GULP is preferable.
- ▶ We hope all the others will accept our sincere apologies

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1. LOGIC PROGRAMMING IN ITALY: A HISTORICAL PERSPECTIVE

GIANFRANCO ROSSI

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- ▶ Provides a historical perspective on the birth and development of GULP in the last 25 years.
- ▶ It is mainly concerned with what has been done in LP in Italy, but it also points out the many relationships and synergies that emerged and still exist between Italy and other countries all over the world.
- ▶ The three periods of GULP are identified and characterized in terms of activities the GULP supported and of the achievements obtained by its members.

2. THEORETICAL FOUNDATIONS AND SEMANTICS OF LOGIC PROGRAMMING

ANNALISA BOSSI AND MARIA CHIARA MEO

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- ▶ Overview of the studies on the (classical) semantics of (constraint) logic programs
- ▶ Theoretical foundations for modeling observable properties of logic programs in a compositional way.
- ▶ A uniform parametric framework is presented
- ▶ The parameter is the notion of observable which is dependent, e.g., on the selection rule
- ▶ results can be seen as a basis for Prolog transformation and analysis systems.

3. THEORY-SPECIFIC AUTOMATED REASONING

ANDREA FORMISANO AND EUGENIO G. OMODEO

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- ▶ Designing a large-scale computerized proof systems requires
 - an underlying logical calculus (e.g. Davis-Putnam propositional satisfiability checker) able to integrate
 - capabilities of reasoning into theories (satisfiability decision or semi-decision procedures)
- ▶ Integration among services speeds-up the proofs
- ▶ Interoperability among proof checkers and autonomous theorem provers is another key point of integration.
- ▶ Set Theory is used as unifying background, and a specific proof-checker based is used as an arena for experimentation.

4. CONSTRAINT LOGIC PROGRAMMING

MARCO GAVANELLI AND FRANCESCA ROSSI

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- ▶ CLP is one of the most successful branches of Logic Programming; it attracts the interest of theoreticians and practitioners, and it is currently used in many commercial applications.
- ▶ Since the original proposal, it has developed enormously: many languages and systems are now available either as open source programs or as commercial systems.
- ▶ Also, CLP has been one of the technologies able to recruit researchers from other communities to the declarative programming cause.
- ▶ Current CLP engines include technologies and results developed in other communities, which themselves discovered logic as an invaluable tool to model and solve real-life problems.

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5. KNOWLEDGE REPRESENTATION AND NON-MONOTONIC REASONING

LAURA GIORDANO AND FRANCESCA TONI

- ▶ Logic programming has been deployed to support non-monotonic reasoning since the late '80s.
- ▶ In Chapter 5 semantics, formalisms and computational mechanisms for logic programming for non-monotonic reasoning are reviewed.
- ▶ formalisms that have emerged from the cross fertilization between the two areas are presented
- ▶ Some applications in as diverse areas as reasoning about dynamic domains, security, diagnosis and legal reasoning are discussed

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6. THE TRANSFORMATIONAL APPROACH TO PROGRAM DEVELOPMENT

ALBERTO PETTOROSSO, MAURIZIO PROIETTI, AND VALERIO SENNI

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- ▶ Overview of the program transformation techniques proposed over the past twenty-five years in the context of logic programming.
- ▶ Focus on the approach based on
 - rules, and
 - strategies.
- ▶ A transformation methodology for the synthesis of logic programs from first-order specifications is presented
- ▶ Transformational techniques for verifying first-order properties of logic programs and their application to model checking for finite and infinite state concurrent systems are discussed.

7. STATIC ANALYSIS, ABSTRACT INTERPRETATION AND VERIFICATION IN (CONSTRAINT LOGIC) PROGRAMMING

GIORGIO DELZANNO, ROBERTO GIACOBAZZI, AND FRANCESCO RANZATO

- ▶ The authors survey some general principles and methodologies for program analysis and verification.
- ▶ In particular, the focus is on abstract interpretation and on model checking techniques,
- ▶ and on their applications to constraint logic programs.

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8. ANSWER SET PROGRAMMING

PIERO BONATTI, FRANCESCO CALIMERI, NICOLA LEONE, AND
FRANCESCO RICCA

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- ▶ Answer Set Programming (ASP)/Disjunctive Logic Programming under the stable model semantics (DLP) is a powerful formalism for Knowledge Representation and Reasoning.
- ▶ ASP has been the subject of intensive research studies, and, also thanks to the availability of some efficient ASP systems (e.g. DLV and CLINGO), has recently gained quite some popularity and is applied also in relevant industrial projects.

8. ANSWER SET PROGRAMMING

PIERO BONATTI, FRANCESCO CALIMERI, NICOLA LEONE, AND
FRANCESCO RICCA

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- ▶ The Italian logic programming community has been very active in this area, some ASP results achieved in Italy are widely recognized as milestones on the road to the current state of the art.
- ▶ After a formal definition of ASP, this chapter surveys the main contribution given by the Italian community to the ASP field in the last 25 years.

9. LOGIC PROGRAMMING LANGUAGES FOR DATABASES AND THE WEB

SERGIO GRECO AND FRANCESCA A. LISI

- ▶ This chapter contains a reference selection of Italian contributions in the intersection of Logic Programming (LP) with databases and the (Semantic) Web.
- ▶ The main contributions on deductive databases such as the coupling of Prolog systems and database systems, evaluation and optimization techniques, Datalog extensions for expressing nondeterministic and aggregate queries, and active rules and their relation to deductive rules. are discussed
- ▶ Solutions employing LP for querying the Web, manipulating Web pages, representing knowledge in the Semantic Web and learning Semantic Web ontologies and rules are presented.

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10. AGENTS, MULTI-AGENT SYSTEMS AND DECLARATIVE PROGRAMMING: WHAT, WHEN, WHERE, WHY, WHO, HOW?

MATTEO BALDONI, CRISTINA BAROGLIO, VIVIANA MASCARDI, ANDREA OMICINI, AND PAOLO TORRONI

- ▶ This chapter tackles the relation between declarative languages and multi-agent systems by following the dictates of the five Ws (and one H) that characterize investigations.
- ▶ *“What? What are declarative agents and multi-agent systems?”*
- ▶ *“When? When did research on them begin?”*
- ▶ *“Where? Where can it take place?”*
- ▶ *“Why? Why should it happen?”*
- ▶ *“Who? Who can be involved?”*
- ▶ *“How? How can it happen?”*

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MATTEO BALDONI, CRISTINA BAROGLIO, VIVIANA MASCARDI, ANDREA OMICINI, AND PAOLO TORRONI

- ▶ This chapter tackles the relation between declarative languages and multi-agent systems by following the dictates of the five Ws (and one H) that characterize investigations.
- ▶ *“What? What are declarative agents and multi-agent systems?”*
- ▶ *“When? When did research on them begin?”*
- ▶ *“Where? Where can it take place?”*
- ▶ *“Why? Why should it happen?”*
- ▶ *“Who? Who can be involved?”*
- ▶ *“How? How can it happen?”*

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11. CONCURRENT AND REACTIVE CONSTRAINT PROGRAMMING

MAURIZIO GABBRIELLI, CATUSCIA PALAMIDESSI, AND FRANK D.
VALENCIA

- ▶ The Italian Logic Programming community has given several contributions to the theory of Concurrent Constraint Programming.
- ▶ In particular, in the topics of semantics, verification, and timed extensions.
- ▶ The main lines of research and contributions of the community in this field are reviewed in this chapter.

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12. PROOF-THEORETIC AND HIGHER-ORDER EXTENSIONS OF LOGIC PROGRAMMING

ALBERTO MOMIGLIANO AND MARIO ORNAGHI

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- ▶ Proof-theoretic and higher-order extensions of Logic Programming are presented
- ▶ Horn clauses lacks of abstraction mechanisms such as higher-order programming, scoping constructs and forms of information hiding.
- ▶ Those extensions are based on the Deduction and Computation paradigm built LP around the notion of *focused uniform proofs* (Miller)
- ▶ The Italian contribution has been both foundational and applicative, in terms of language extensions, implementation techniques and usage of the new features to capture various computation models.
- ▶ The emphasis has now moved on logical frameworks, carrying with it a better understanding of the foundations of proof search.

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13. TRANSFORMATION AND DEBUGGING OF FUNCTIONAL LOGIC PROGRAMS

MARIA ALPUENTE, DEMIS BALLIS, AND MORENO FALASCHI

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- ▶ The Italian (AGP) contribution to functional-logic programming has been significant and influential in a number of areas of semantics, and semantics-based program manipulation techniques.
- ▶ In this chapter some selected topics are presented, with a particular regard to
 - debugging and
 - transformation techniques.
- ▶ The role of the narrowing strategy and some basic classical transformation techniques, namely folding and unfolding, are recalled.
- ▶ At the end, a bug-correction program synthesis methodology is described that attempts to correct the erroneous components of the wrong code.

14. 25 YEARS OF APPLICATIONS OF LOGIC PROGRAMMING IN ITALY

ALESSANDRO DAL PALÙ AND PAOLO TORRONI

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- ▶ A review of **practical** applications of Logic Programming appeared in Italy since 1985 is presented
- ▶ They are classified according to their area of application and some trends emerged in the latest developments are discussed.
- ▶ This survey shows that Logic Programming successfully evolved and quickly adapted to new challenges offered by a notable variety of application areas.

BOOK PLANNING

FOURTH CHOICE: REVIEWERS

- ▶ Book editors and most chapter author's also acted as reviewers
- ▶ Furthermore, the following friends helped us
 - Sergio Antoy
 - Sandro Etalle
 - Roberta Gori
 - Michela Milano
 - Angelo Montanari
 - Germán Vidal
 - Nicoletta Cocco
 - Camillo Fiorentini
 - Evelina Lamma
 - Alessandra Mileo
 - Carla Piazza
 - Alicia Villanueva García
- ▶ We really thank all of them

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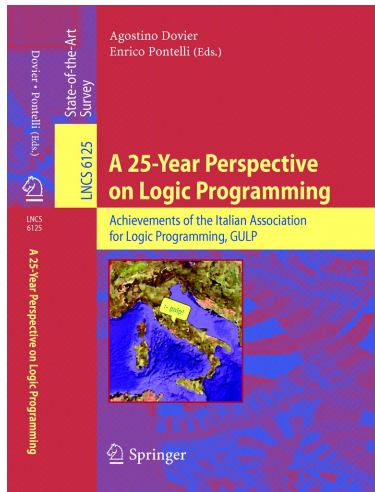
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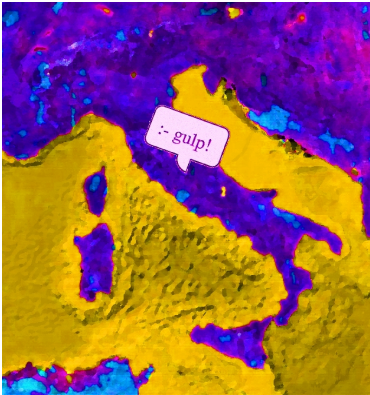
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FIFTH CHOICE: FRONT PAGE AND TITLE

- ▶ The former title was: Twenty-five years of Logic Programming in Italy
- ▶ During the final publishing stages, the publisher Alfred Hofmann suggested us to change it into
A 25-YEAR PERSPECTIVE ON LOGIC PROGRAMMING
Achievements of the Italian Association for Logic Programming, GULP
- ▶ We asked to the GULP EC. The majority of answers agreed with the publisher.

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Preface of the book, footnote 1 (written in March 2010):

*As a remark, Italy was the reigning football world
champion in 1985, as they are today.*

Actually, we wrote “at the time we are writing” but
Springer proofreaders changed the sentence.

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THE EDITORS

(IN L.A., WITH A TOP-CITED FRIEND)

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ALL BOOK AUTHORS

THANKS TO ALL OF THEM

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