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Research Interests

- **Natural Language Understanding (NLU) and Question Answering.** Translating natural language text to formal languages; Semantic parsing; Building natural language interfaces; Development and usage of Lambda Calculus algorithms in semantic parsing; NLU based question answering; Knowledge hunting and knowledge acquisition from natural language text; Combining NLU with deep reasoning; Answering Why, How, and What-If questions; and Solving combinatorial puzzles described in natural language.

- **Knowledge representation, reasoning and declarative problem solving.** Declarative problem solving and optimizations (with applications to planning, job-shop scheduling, tournament scheduling, supply chain planning, combinatorial auctions, product configuration, diagnosis, explanation generation and constraint satisfaction problems); Knowledge Representation and Non-monotonic Reasoning (with applications to common-sense reasoning, reasoning with defaults, reasoning with incomplete information, reasoning with priorities and preferences, and inheritance hierarchies); Logic Programming; Temporal Reasoning, Combining knowledge bases; and AI in general.

- **Bioinformatics.** AI and Database applications to Bioinformatics; Representation and reasoning about signal pathways, protein-protein interactions and gene networks; Learning causal connection between genes from micro-array data; and Knowledge extraction from Biological texts.

- **Actions, Goals and Autonomous agents.** Mobile robots; Robot control – formal characterization and automatic generation; Cognitive robotics; Representation and reasoning about actions (concurrent actions, complex actions, actions with causal effects, actions with non-deterministic effects, narratives, sensing actions, and actions with probabilistic effects), Multi agent actions, and Goal languages.

- **Active, deductive and incomplete databases and workflows.**

Semantics of active databases, Formulating correctness of active databases, specification of the purpose of active databases and automatic derivation of active rules from this specification, and modeling workflows as multiple co-operative agents.

Education

Doctor of Philosophy, Computer Science August 1991.

University of Maryland, College Park, Maryland.

Dissertation: *Issues in Knowledge Representation : Semantics and Knowledge Combination.*

Advisor: Prof. Jack Minker.

Master of Science, Computer Science May 1990.
University of Maryland, College Park, Maryland.

Bachelor of Technology with Honors, Computer Science and Engineering May 1987.
Indian Institute of Technology, Kharagpur, India.

Professional Experience

Professor: (August 2002 - present) Faculty of Computer Science and Engineering, School of Computing, Informatics and Decision Systems Engineering, Arizona State University.

Chair: (August 2014 - present) Graduate Programs in Computer Science, Arizona State University.

Chair: (March 2008 - May 2009) Department of Computer Science and Engineering, Arizona State University.

Associate Professor: (August 1999 - August 2002) Department of Computer Science and Engineering, Arizona State University.

Visiting Scientist: (June 99 - August 99) Department of Computer and Information Science, Linkoping University, Sweden.

Associate Professor: (August 1996 - August 1999) Department of Computer Science, University of Texas at El Paso.

Visiting Scientist: (June 98 - August 98) i2 Technologies, Dallas. Worked on planning and scheduling methods for supply chain planners.

Visiting Professor: (Dec 1996 - Jan 97) Department of Computer Science, University of New South Wales, Sydney, Australia.

Assistant Professor: (August 1991 - August 1996) Department of Computer Science, University of Texas at El Paso.

Graduate Research Fellow: (August 1990 - June 1991) University of Maryland, College Park. Research towards my dissertation.

Graduate Research Assistant: (May 1988 - June 1991) Department of Computer Science, University of Maryland, College Park. Dissertation work on semantics of knowledge representation languages and theory of combining knowledge bases. Also investigated the use of semantic constraints to constrain the search space in a parallel logic programming environment.

Teaching Assistant: (August 87 - May 88) Department of Computer Science, University of Maryland, College Park. Assisted courses in Computer Architecture, Compiler Design and Data structures.

Publications

Books

- [1] C. Baral. Knowledge representation, reasoning and declarative problem solving. Cambridge University Press, 2003, ISBN 0521818028.

Journal Articles

- [1] Saadat Anwar, Chitta Baral, and Katsumi Inoue. Encoding Petri Nets in Answer Set Programming for Simulation Based Reasoning. *Theory and Practice of Logic Programming* 13 (4-5), Online Supplement, 2013.
- [2] L. Tari, Nguyen Vo, Shanshan Liang, Jagruti Patel, Chitta Baral and James Cai. Identifying novel drug indications through automated reasoning Authors and Affiliations. In *PLoS ONE*, 2012.
- [3] Chitta Baral, Juraj Dzifcak, Marcos Alvarez Gonzalez and Aaron Gottesman. Typed answer set programming lambda calculus theories and correctness of inverse lambda algorithms with respect to them. *Theory and Practice of Logic Programming*. 12(4-5): 775-791, 2012.
- [4] J. Hakenberg, Dmitry Voronov, Vo H Nguyen, Shanshan Liang, Saadat Anwar, Robert Leaman, Luis N Tari and Chitta Baral. A SNPshot of PubMed to find associations between genetic variants, drugs, and diseases. *Journal of Biomedical Informatics*. 45(5): 842-850, 2012.
- [5] L. Tari, P. Tu, J. Hakenberg, Y. Chen, T. Son, G. Gonzalez and C. Baral. Parse Tree Database for information Extraction. *IEEE Transactions on Knowledge and Data Engineering*. Vol 24, Number 1, January 2012, pages 86-99.
- [6] J. Hakenberg, Ills Solt, Domonkos Tikk, Nguyen Ha Vo, Luis Tari, Quang Long Nguyen, Chitta Baral and Ulf Leser. Molecular Event Extraction from Link Grammar Parse Trees in the BioNLP'09 Shared Task. *Computational Intelligence* 27(4): 665-680 (2011).
- [7] Chitta Baral, Gregory Gelfond, Enrico Pontelli and Tran Cao Son. Logic programming for finding models in the logics of knowledge and its applications: A case study. *Theory and Practice of Logic Programming* 10(4-6): 675-690 (2010).
- [8] Luis Tari, Saadat Anwar, Shanshan Liang, James Cai and Chitta Baral. Discovering drug-drug interactions: a text-mining and reasoning approach based on properties of drug metabolism. *Bioinformatics* 26(18): (2010).
- [9] J. Hakenberg, Robert Leaman, Nguyen Vo, Siddhartha Jonnalagadda, Ryan Sullivan, Christopher Miller, Luis Tari, Chitta Baral and Graciela Gonzalez. Efficient Extraction of Protein-Protein Interactions from Full-Text Articles. *IEEE/ACM Trans. Comput. Biology Bioinform.* 7(3): 481-494 (2010).
- [10] Nam Tran and Chitta Baral. Hypothesizing about signaling networks. *Journal of Applied Logic* 7(3): 253 - 274 (2009).

- [11] Luis Tari, Chitta Baral and Seungchan Kim. Fuzzy c-means clustering with prior biological knowledge. *Journal of Biomedical Informatics* 42(1): 74-81 (2009).
- [12] Chitta Baral, Michael Gelfond and J. Nelson Rushton. Probabilistic reasoning with answer sets. *Theory and Practice of Logic Programming* 9(1): 57-144 (2009).
- [13] Richard B. Scherl, Tran Cao Son and Chitta Baral: State-Based Regression with Sensing and Knowledge. *Int. J. Software and Informatics* 3(1): 3-30 (2009).
- [14] Chitta Baral, Thomas Eiter, Marcus Bjreland and Mutsumi Nakamura. Maintenance goals of agents in a dynamic environment: Formulation and policy construction. *Artificial Intelligence* 172(12-13): 1429-1469 (2008).
- [15] N. Tran and C. Baral. Reasoning about non-immediate triggers in biochemical networks. *Annals of Mathematics and Artificial Intelligence*. Volume 2-4, 267-293 (2007).
- [16] Phan Huy Tu, Tran Cao Son and Chitta Baral. Reasoning and Planning with Sensing Actions, Incomplete Information, and Static Causal Laws using Answer Set Programming *Theory and Practice of Logic Programming*. 7(4): 377-450 (2007).
- [17] Tuan Le, Chitta Baral and Son Tran. A State-Based Regression Formulation for Domains with Sensing Actions and Incomplete Information. In *Logical Methods in Computer Science (Electronic journal)* Volume 2, Issue 4, 2006.
- [18] Xin Zhang, Seungchan Kim, Tie Wang and Chitta Baral. Joint learning of logic relationships for studying protein function using phylogenetic profiles and the Rosetta Stone method. *IEEE Transactions on Signal Processing*. Volume 54, Issue 6, Part 2, pages 2427-2435, 2006.
- [19] Tran Cao Son, Chitta Baral, Sheila McIlraith and Nam Tran. Planning with domain-dependent knowledge of different kinds – an answer set programming approach. *ACM Transactions on Computational Logic*. Volume 7, Number 4 (October 2006), pages 1-70.
- [20] Nam Tran, Chitta Baral, Vinay Nagaraj and Lokesh Joshi. Knowledge-Based Framework for Hypothesis Formation in Biochemical Networks: application to the p53 network. *Bioinformatics*, 21: ii213-ii219. (Supplement for the papers of ECCB’2005)
- [21] C. Baral and Y. Zhang. Knowledge updates: Semantics and complexity issues. *Artificial Intelligence*. 164(1-2): 209-243 (2005).
- [22] Graciela Gonzalez, Chitta Baral and Michael Gelfond. Alan: An Action Language for Modelling Multimedia Presentations Using Non- Markovian Domains. *Studia Logica*. 79(1): 115-134 (2005).
- [23] Chitta Baral and Nam Tran. Representation and reasoning about evolution of the world in the context of reasoning about actions. *Studia Logica*. 79(1): 33-46 (2005).
- [24] C. Baral, K. Chancellor, Nam Tran, M. Berens, A. Joy and Nhan Tran. A knowledge based approach for representing and reasoning about signal networks. *Bioinformatics*. vol 20, supplement 1, pages i15-i22, Supplement for the long papers of ISMB/ECCB’04, 2004.
- [25] R. Trejo, J. Galloway, C. Sachar, V. Kreinovich, C. Baral and L. Tuan. From planning to searching for the shortest plan: an optimal translation. *International journal of uncertainty, fuzziness and knowledge-based systems*. 9 (6): 827-837, 2001.

- [26] G. Trajcevski, C. Baral and J. Lobo: Formalizing and Reasoning About the Requirements Specifications of Workflow Systems. *IJCIS* 10(4): 483-507 (2001).
- [27] T. Son and C. Baral. Formalizing sensing actions – a transition function based approach. In *Artificial Intelligence*, 125, 1-2, 19-93, 2001.
- [28] C. Baral, V. Kreinovich and R. Trejo. Computational complexity of planning and approximate planning in presence of incompleteness. In *Artificial Intelligence*, 122, 241-267, 2000.
- [29] C. Baral. Abductive reasoning through filtering. In *Artificial Intelligence*, 120 (1), 1-28, 2000.
- [30] C. Baral, A. Gabaldon and A. Proveti. Value minimization in Circumscription. In *Artificial Intelligence*, 102/2, 163-186, July 1998.
- [31] C. Baral, A. Gabaldon and A. Proveti. Formalizing narratives using nested circumscription. In *Artificial Intelligence*, 104/1-2, 107-164, Sept 1998.
- [32] C. Baral and T. Son. Relating theories of actions and reactive control. In *Electronic Transactions on Artificial Intelligence*, vol 2, issue 3-4, 211-271, July - December 1998.
- [33] C. Baral, M. Gelfond and O. Kosheleva. Expanding queries to incomplete databases by interpolating general logic programs. In *Journal of Logic Programming*, vol 35, 1998, 195-230.
- [34] C. Baral, G. Gonzalez and T. Son. Conceptual modeling and querying in multi-media databases. In *Multimedia Tools and Applications*, 7, 37-66 (1998).
- [35] C. Baral and Michael Gelfond. Reasoning about effects of concurrent actions. In *Journal of Logic Programming*, Vol 31(1-3), May 97, 85-117.
- [36] C. Baral. Embedding Revision Programs in Logic Programming Situation Calculus. In *Journal of Logic Programming*, vol 30(1), Jan 97, 83-97.
- [37] C. Baral, M. Gelfond and A. Proveti. Representing Actions: Laws, Observations and Hypothesis. In *Journal of Logic Programming*, Vol 31(1-3), May 97, 201-243.
- [38] C. Baral. Relating Logic programming theories of actions and partial order planning. In *Annals of Math and AI*, Vol. 21 (1997) Nos. 2-4.
- [39] C. Baral. Varying Selection Function to Relate Conditional Logics and Preferential Models. In *Fundamenta Informaticae*, vol 21, No. 4 (1994), 307-320.
- [40] C. Baral and M. Gelfond. Logic Programming and Knowledge Representation. In *Journal of Logic Programming*, 19,20:73-148, 1994.
- [41] C. Baral, S. Kraus, J. Minker and V. S. Subrahmanian. Combining Default Logic Databases. In *International Journal of Intelligent and Co-operative Information Systems*, vol. 3, No. 3, 319-348, 1994.
- [42] C. Baral and V. S. Subrahmanian. Duality between Alternative Semantics of Logic Programs and Nonmonotonic Formalisms. In *Journal of Automated Reasoning*, 10:399-420, 1993.

- [43] C. Ramamoorthy, D. Cooke and C. Baral. Maintaining the Truth of Specifications in Evolutionary Software. In *International Journal of Tools for Artificial Intelligence*, vol 2, No 1 (1993) 15-31.
- [44] C. Baral and V. S. Subrahmanian. Stable and Extension Class Theory for Logic Programs and Default Logics. In *Journal of Automated Reasoning*, 8: 345-366, 1992.
- [45] C. Baral, J. Lobo and J. Minker. Generalized Disjunctive Well-founded Semantics for logic programs. In *Annals of Math and Artificial Intelligence*, 5 (1992) 89-132.
- [46] C. Baral, S. Kraus, J. Minker and V. S. Subrahmanian. Combining Knowledge Bases Consisting of First Order Theories. In *Computational Intelligence*, 8, 1, (1992), 45-71.
- [47] C. Baral, J. Minker and S. Kraus. Combining Multiple Knowledge Bases. In *IEEE Transactions on Knowledge and Data Engineering*, June 1991, volume 3, number 2, pages 208-221.

Book Chapters (refereed)

- [1] C. Baral, Michael Gelfond and Richard Watson. Reasoning about actual and hypothetical occurrences of concurrent and non-deterministic actions. In *Dynamic Worlds: From the frame problem to knowledge management*, pages 73-107, Edited by, Remo Pareschi and Bertram Fronhofer, Kluwer Academic Publishers, 1999.
- [2] C. Baral and M. Gelfond. Reasoning agents in dynamic domains. In *Logic based AI*, editor J. Minker, Kluwer Academic Publishers, pgs 257-279, 2000.
- [3] C. Baral and M. Gelfond. Logic Programming and Reasoning about Actions. In *Handbook of Temporal Reasoning in AI*, editors M. Fisher, D. Gabbay and L. Vila, Elsevier Publications, 2005. pages 389-428.
- [4] Enrico Pontelli, Tran Cao Son, Omar Elkhatib and Chitta Baral. A Framework for Composition and Inter-operation of Rules in the Semantic Web. In *Managing Web Service Quality: Measuring Outcomes and Effectiveness*, edited By: Khaled Khan, 2008.
- [5] M. Balduccini, C. Baral and Y. Lierler. Knowledge representation and Question Answering. In *Handbook of Knowledge Representation*, editors Vladimir Lifschitz, Frank van Harmelen and Bruce Porter, 2008.
- [6] Chitta Baral and Gregory Gelfond. On Representing Actions in Multi-agent Domains. *Logic Programming, Knowledge Representation, and Nonmonotonic Reasoning*. Springer. 2011: 213-232.
- [7] Chitta Baral, Marcos Alvarez Gonzalez and Aaron Gottesman. The Inverse Lambda Calculus Algorithm for Typed First Order Logic Lambda Calculus and Its Application to Translating English to FOL. *Correct Reasoning*, pages 40-56, 2012.
- [8] Enrico Pontelli, Tran Cao Son, Chitta Baral and Gregory Gelfond. Answer Set Programming and Planning with Knowledge and World Altering Actions in Multiple Agent Domains. *Correct Reasoning*, pages 509-526, 2012.
- [9] Tran Cao Son, Enrico Pontelli and Chitta Baral. A Non-monotonic Goal Specification Language for Planning with Preferences. *Advances in Knowledge Representation, Logic Programming, and Abstract Argumentation*, pages 202-217, 2015.

Edited Books/Proceedings/Special Issues

- [1] Chitta Baral, Giuseppe De Giacomo and Thomas Eiter. Principles of Knowledge Representation and Reasoning: Proceedings of the Fourteenth International Conference, KR 2014, Vienna, Austria, July 20-24, 2014. AAAI Press 2014, ISBN 978-1-57735-657-8.
- [2] Chitta Baral and Peter Schueller. Proceedings of the 1st Workshop on Natural Language Processing and Automated Reasoning co-located with 12th International Conference on Logic Programming and Nonmonotonic Reasoning (LPNMR 2013), A Corunna, Spain, September 15th, 2013. CEUR Workshop Proceedings 1044, CEUR-WS.org. 2013.
- [3] Adrien Coulet, Nigam H. Shah, Lawrence Hunter, Chitta Baral and Russ B. Altman. Proceedings of the PSB 2010 workshop on Extraction of Genotype-Phenotype-Drug Relationships from Text: From Entity Recognition to Bioinformatics Application. 2010.
- [4] Chitta Baral, Gerd Brewka and John Schlipf. Logic Programming and Nonmonotonic Reasoning, 9th International Conference, LPNMR 2007, Tempe, AZ, May 14-17, 2007, Proceedings, Springer 2007.
- [5] Chitta Baral Proceedings of AAAI 2006 Spring Symposium on Formalizing and Compiling Background Knowledge and its Applications to Knowledge Representation and Question Answering. AAAI, 2006.
- [6] Chitta Baral, Gianluigi Greco, Nicola Leone and Giorgio Terracina. Logic Programming and Nonmonotonic Reasoning, 8th International Conference, LPNMR 2005, Diamante, Italy, September 5-8, 2005, Proceedings Springer 2005.
- [7] C. Baral, A. Proveti and T. Son. Introduction to the special issue on Programming with Answer Sets. TPLP 3(4-5): 387-391 (2003).
- [8] C. Baral and S. McIlraith. Proceedings of the Third International Cognitive Robotics Workshop. July 28, 2002.
- [9] C. Baral and M. Truszczynski. Proceedings of 8th International Workshop on Non-monotonic reasoning. April 9-11, 2000.
- [10] C. Baral and H. Mohanty. CIT'99: Trends in Information Technology, (Proceedings of the International Conference on Information Technology), 1999. Tata-McGrawHill Publishers. ISBN 0-07-463747-9.
- [11] C. Baral and R. Goldman. Proceedings of the AAAI 97 Workshop on Robots, Softbots and Imambots: Theories of action, planning and control.
- [12] C. Baral, V. Kreinovich and V. Lifschitz. Special issue on Logic programming, nonmonotonic reasoning and reasoning about actions. Annals of Math and AI. Volume 21 (2-4), 1997.
- [13] C. Baral. Theories of action, planning and robot control: Bridging the gap. Papers from the 1996 Workshop. AAAI, August 1996. ISBN 1577350219.
- [14] C. Baral, M. Gelfond, J. Lobo and A. Rajasekar. Proceedings of the Workshop on Logic Programming with Incomplete Information. October 1993.

Conference and Workshop Papers (refereed)

- [1] Chitta Baral and Tran Cao Son. Add Another Blue Stack of the Same Height!: ASP Based Planning and Plan Failure Analysis. In Proceedings of LPNMR 2015. pages 127-133.
- [2] Arindam Mitra and Chitta Baral. Learning to automatically solve logic grid puzzles. EMNLP 2015. pages 1023-1033.
- [3] Arpit Sharma, Somak Aditya, Vo Nguyen and Chitta Baral. Towards Addressing the Winograd Schema Challenge - Building and Using a Semantic Parser and a Knowledge Hunting Module. In Proceedings of IJCAI 2015. pages 1319-1325.
- [4] Vo Nguyen, Arindam Mitra and Chitta Baral. The NL2KR platform for building Natural Language Translation Systems. ACL 2015. Volume 1, pages 899-908.
- [5] Somak Aditya, Chitta Baral, Nguyen Ha Vo, Joohyung Lee, Jieping Ye, Zaw Naung, Barry Lumpkin, Jenny Hastings, Richard Scherl, Dawn M. Sweet and Daniela Inclezan. Recognizing Social Constructs from Textual Conversation. NAACL HLT 2015. pages 1293-1298.
- [6] Arpit Sharma, Nguyen H. Vo, Somak Aditya and Chitta Baral. Identifying Various Kinds of Event Mentions in K-Parser Output. In the 3rd Workshop on EVENTS: Definition, Detection, Coreference, and Representation held at NAACL HLT 2015.
- [7] Tran Cao Son, Enrico Pontelli, Chitta Baral and Gregory Gelfond. Exploring the KD45n property of a Kripke model after the execution of an action sequence. In Proceedings of AAAI 2015. pages 1604-1610.
- [8] Chitta Baral, Gregory Gelfond, Enrico Pontelli and Tran Cao Son. Multi-Agent Action Modeling through Action Sequences and Perspective Fluents. In CommonSense 2015, AAAI Spring Symposium 2015.
- [9] Somak Aditya, Yiannis Aloimonos, Chitta Baral, Cornelia Fermuller and Yezhou Yang. Visual common-sense for scene understanding using perception, semantic parsing and reasoning. In Common-sense 2015, AAAI 2015 Spring Symposium.
- [10] Arpit Sharma, Nguyen H. Vo , Shruti Gaur and Chitta Baral. An Approach to Solve Winograd Schema Challenge Using Automatically Extracted Commonsense Knowledge. In Common-sense 2015, AAAI 2015 Spring Symposium. (Short paper)
- [11] Shruti Gaur, Nguyen H. Vo, Kazuaki Kashihara and Chitta Baral. Translating Simple Legal Text to Formal Representations. Eighth International Workshop on Juris-informatics (JURISIN 2014). 2014.
- [12] Saadat Anwar and Chitta Baral. Pathway Specification and Comparative Queries: A High Level Language with Petri Net Semantics. AAAI 2014: 981-988.
- [13] Tran Cao Son, Enrico Pontelli, Chitta Baral and Gregory Gelfond. Finitary S5-Theories. JELIA 2014: 239-252.
- [14] Chitta Baral, Gregory Gelfond, Enrico Pontelli and Tran Cao Son. Reasoning about the Beliefs of Agents in Multi-agent Domains in the Presence of State Constraints: The Action Language mAL. CLIMA 2013: 290-306. 2013.

- [15] Chitta Baral, Juraj Dzifcak, Kanchan Kumbhare and Nguyen Ha Vo. The NL2KR System. NLPAR at LPNMR 2013: 37-47. 2013.
- [16] Saadat Anwar, Chitta Baral and Katsumi Inoue. Encoding Higher Level Extensions of Petri Nets in Answer Set Programming. LPNMR 2013: 116-121.
- [17] Chitta Baral and Nguyen Ha Vo. Event-Object Reasoning with Curated Knowledge Bases: Deriving Missing Information. LPNMR 2013: 161-167.
- [18] Chitta Baral, Nguyen Ha Vo and Shanshan Liang. Answering Why and How questions with respect to a frame based knowledge base: a preliminary report. ICLP (Technical Communications) 2012: 26-36.
- [19] Chitta Baral and Shanshan Liang. From Knowledge Represented in Frame-Based Languages to Declarative Representation and Reasoning via ASP. KR 2012.
- [20] Chitta Baral and Juraj Dzifcak. Solving Puzzles Described in English by Automated Translation to Answer Set Programming and Learning How to Do that Translation. KR 2012.
- [21] Chitta Baral and Juraj Dzifcak. Solving puzzles described in English by automated translation to answer set programming and learning how to do that translation. AAAI Fall Symposium on Advances in Cognitive Systems. 2011.
- [22] Chitta Baral, Shanshan Liang and Vo Nguyen. Towards deep reasoning with respect to natural language text in scientific domains. Proceedings of Deep Knowledge Representation Challenge Workshop, 2011.
- [23] Chitta Baral, Juraj Dzifcak, Marcos Gonzalez and Jiayu Zhou. Using Inverse Lambda and Generalization to Translate English to Formal Languages. Proceedings of International Conference on Computational Semantics (IWCS) 2011, Oxford.
- [24] Chitta Baral: Logic Programming and Uncertainty. 2011. (Invited paper.) Fifth International Conference on Scalable Uncertainty Management. 2011. SUM 2011: 22-37.
- [25] Chitta Baral, Gregory Gelfond, Tran Cao Son and Enrico Pontelli. Using answer set programming to model multi-agent scenarios involving agents' knowledge about other's knowledge. AAMAS 2010: 259-266.
- [26] Luis Tari, Saadat Anwar, Shanshan Liang, J. Hakenberg and Chitta Baral. Synthesis of Pharmacokinetic Pathways through Knowledge Acquisition and Automated Reasoning. Pacific Symposium on Biocomputing 2010: 465-476.
- [27] Luis Tari, Phan Huy Tu, J. Hakenberg, Yi Chen, Tran Cao Son, Graciela Gonzalez and Chitta Baral. GenerIE: Information extraction using database queries. ICDE 2010: 1121-1124.
- [28] Juraj Dzifcak, Matthias Scheutz, Chitta Baral and Paul W. Schermerhorn. What to do and how to do it: Translating natural language directives into temporal and dynamic logic representation for goal management and action execution. International Conference in Robotics and Automation (ICRA) 2009: 4163-4168.
- [29] Chitta Baral, Tran Cao Son and Enrico Pontelli. Modeling Multi-agent Domains in an Action Languages: An Empirical Study. LPNMR 2009: 409-415.

- [30] Luis Tari, Jorg Hakenberg, Graciela Gonzalez and Chitta Baral. Querying Parse Tree Database of Medline Text to Synthesize User-Specific Biomolecular Networks Pacific Symposium on Biocomputing 2009.
- [31] S. Ahmed, H. Davulcu and C. Baral. Extracting Protein-Protein Interactions from MEDLINE Using Syntactic Roles, IEEE International Conference on Bioinformatics and Biomedicine (BIBM), pp. 473-479, 2008.
- [32] Richard B. Scherl, Tran Cao Son and Chitta Baral. State-Based Regression with Sensing and Knowledge. PRICAI 2008: 345-357.
- [33] Chitta Baral and Jicheng Zhao. Non-monotonic Temporal Logics that Facilitate Elaboration Tolerant Revision of Goals. AAI 2008: 406-411.
- [34] Chitta Baral, Juraj Dzifcak and Tran Cao Son. Using Answer Set Programming and Lambda Calculus to Characterize Natural Language Sentences with Normatives and Exceptions. AAI 2008: 818-823.
- [35] Chitta Baral, Juraj Dzifcak and Luis Tari. Towards Overcoming the Knowledge Acquisition Bottleneck in Answer Set Prolog Applications: Embracing Natural Language Inputs. ICLP 2007: 1-21.
- [36] C. Baral, G. Gonzalez, A. Gitter, C. Teegarden and A. Zeigler. CBioC: beyond a prototype for collaborative annotation of molecular interactions from the literature. In Computational Systems Bioinformatics Conference. 2007.
- [37] G. Gonzalez, L. Tari, A. Gitter, R. Leaman, S. Nikkila, R. Wendt, A. Zeigler and C. Baral. Integrating Knowledge from Biomedical Literature. In Second BioCreative Challenge Evaluation Workshop. 2007. Madrid, Spain: CNIO.
- [38] Chitta Baral and Jicheng Zhao. Non-monotonic Temporal Logics for Goal Specification. In Proc. of IJCAI 2007. pages 236-242.
- [39] Graciela Gonzalez, Juan C. Uribe, Luis Tari, Colleen Brophy and Chitta Baral. Mining Gene-Disease Relationships from Biomedical Literature: Weighting Protein-protein Interactions and Connectivity. Pacific Symposium on Biocomputing, 12: 28-39 (2007).
- [40] Chitta Baral, Juraj Dzifcak, Nam Tran and Jicheng Zhao. Reasoning about Actions in Biophysical Systems. AAI 2006 Workshop on Cognitive Robotics.
- [41] Enrico Pontelli, Chitta Baral and Tran Son. A Framework for Composition and Interoperation of Rules in the Semantic Web. In Proceedings of Rules and Rule Markup languages for the Semantic Web (RuleML 2006), pages 39-50.
- [42] Chitta Baral and Jicheng Zhao. Goal specification, non-determinism and quantifying over policies. In Proceedings of AAI'06, pages 231-237.
- [43] Chitta Baral, Juraj Dzifcak and Hiro Takahashi. Macros, Macro calls and use of ensembles in modular answer set programming. In Proceedings of International Conference on Logic Programming (ICLP'2006). 376-390.
- [44] Nam Tran, Chitta Baral, Vinay Nagaraj and Lokesh Joshi. Knowledge-Based Framework for Hypothesis Formation in Biochemical Networks: application to the p53 network. Proc. of the European Conference on Computational Biology (ECCB'2005), Bioinformatics, 21: ii213-ii219. (A preliminary version in the DILS'05 workshop.)

- [45] Lian Yu, Syed Toufeeq Ahmed, Graciela Gonzalez, Brandon Logsdon, Mutsumi Nakamura, Shawn Nikkila, Kalpesh Shah, Luis Tari, Ryan Wendt, Amanda Zeigler and Chitta Baral. Genomic information retrieval through selective extraction and tagging by the ASU-BioAI Group. Proceedings of the 2005 TREC Genomics track.
- [46] Luis Tari and Chitta Baral. Using AnsProlog with Link Grammar and WordNet for QA with deep reasoning. Proc. of AAAI'05 workshop on Inference for Textual Question Answering.
- [47] Chita Baral, Gregory Gelfond, Michael Gelfond and Richard Scherl. Textual Inference by combining multiple logic programming paradigms. Proc. of AAAI'05 workshop on Inference for Textual Question Answering.
- [48] Nam Tran and Chitta Baral. Issues in reasoning about cellular interactions: necessity of event ordering knowledge. Proc. of AAAI'05, 676-681.
- [49] Chitta Baral and Michael Gelfond. Reasoning about intended actions. Proc. of AAAI'05, 689-694.
- [50] Chitta Baral, Thomas Eiter and Jicheng Zhao. Using SAT and Logic Programming to Design Polynomial-Time Algorithms for Planning in Non-deterministic Domains. Proc. of AAAI'05, 575-583.
- [51] Carron Shankland, Nam Tran, Chitta Baral and Walter Kolch. Reasoning about the ERK signal transduction pathway using BioSigNet-RR. In Computational Methods in Systems Biology (CMSB'05) 2005. 3-5 April 2005, Edinburgh, Scotland.
- [52] Xin Zhang, Chitta Baral and Seungchan Kim. An algorithm to learn causal connection between genes from steady state data: simulation and its application to melanoma dataset. Proc. of 10th Conference on Artificial Intelligence in Medicine (AIME 05) 23 - 27 July 2005 Aberdeen, Scotland. Pages 524-534.
- [53] Nam Tran, Chitta Baral, Vinay Nagaraj and Lokesh Joshi. Knowledge-Based Integrative Framework for Hypothesis Formation in Biochemical Networks. Proc. of the 2nd International Workshop on Data Integration in the Life Sciences, San Diego (DILS'05), July 20-22, 2005. Pages 121-136.
- [54] Chitta Baral, Prabhdeep Singh, Ravi Bhimavarapu, Hasan Davulcu, Huan Liu, Seungchan Kim, Mike Bittner and I.V. Ramakrishnan. BioLog: A Browser Based Collaboration and Resource Navigation Assistant for BioMedical Researchers. Proc. of the 2nd International Workshop on Data Integration in the Life Sciences (DILS'05), San Diego, July 20-22, 2005 Pages 19-30.
- [55] Chitta Baral, Hasan Davulcu, Mutsumi Nakamura, Prabhdeep Singh, Lian Yu and Luis Tari. Collaborative Curation of Data from Bio-medical Texts and Abstracts and its integration. Proc. the 2nd International Workshop on Data Integration in the Life Sciences (DILS'05), San Diego, July 2022, 2005. Pages 309-312. (poster paper).
- [56] Syed Toufeeq Ahmed, Deepthi Chidambaram, Hasan Davulcu and Chitta Baral. IntEx: A Syntactic Role Driven Protein-Protein Interaction Extractor for Bio-Medical Text. Proc. of BioLINK SIG: Linking Literature, Information and Knowledge for Biology, a Joint Meeting of The ISMB BioLINK Special Interest Group on Text Data Mining and The ACL

Workshop on Linking Biological Literature, Ontologies and Databases: Mining Biological Semantics (Biolink'2005), Detroit, Michigan, June 24, 2005.

- [57] L. Tari, C. Baral and Partha Dasgupta. Understanding the global properties of functionally related gene networks using the gene ontology. In Proceedings of Pacific Symposium on Biocomputing 2005. (PSB'05), pages 209-220.
- [58] Lei Yu, Chitta Baral, Seungchan Kim, Jessica Rennert, Dominique B Hoelzinger, Michael E Berens and Huan Liu. Discriminative Gene Selection for Brain Tumor Migration. Poster in Pacific Symposium on Biocomputing 2005.
- [59] C. Baral, Le-Chi Tuan, Xin Zhang and Tran Son. Regression With Respect to Sensing Actions and Partial States. In Proceedings of AAAI'04, pages 556-561.
- [60] C. Baral and Jicheng Zhao. Goal specification in presence of non-deterministic actions. In Proceedings of ECAI'04, pages 273-277.
- [61] C. Baral and Nam Tran. Encoding probabilistic causal models in probabilistic action language PAL. In Proceedings of AAAI'04, pages 305-310.
- [62] Tran Son, Chitta Baral and Le-Chi Tuan. Adding Time and Intervals to Procedural and Hierarchical Control Specifications. In Proceedings of AAAI'04, pages 92-97.
- [63] N. Tran and C. Baral. Reasoning about Triggered Actions in AnsProlog and its Application to Molecular Interactions in Cells. In Proceedings of KR'2004, pages 554-564.
- [64] C. Baral and T. Eiter. A Polynomial time algorithm for constructing k-maintainable policies. In Proceedings of ICAPS'2004, pages 111-121.
- [65] C. Baral, M. Gelfond and N. Rushton. Probabilistic reasoning with answer sets. In Proceedings of LPNMR7, 2004. pages 21-33.
- [66] T. Son, P. Huy and C. Baral. Planning with Sensing Actions and Incomplete Information using Logic Programming. In Proceedings of LPNMR7, 2004. pages 261-274.
- [67] C. Baral and Matt Barry. Goal specification using temporal logic in presence of non-deterministic actions. In Proc. Nonmonotonic Reasoning, Action, and Change (NRAC'03).
- [68] Chitta Baral and Nam Tran. Representation and reasoning about evolution of the world in the context of reasoning about actions. In Proc. Nonmonotonic Reasoning, Action, and Change (NRAC'03).
- [69] Chitta Baral and Nam Tran. Encoding probabilistic causal models in probabilistic action language PAL. In Proc. Nonmonotonic Reasoning, Action, and Change (NRAC'03).
- [70] C. Baral, K. Chancellor, Nam Tran and Nhan Tran. Representing and reasoning about signal networks: an illustration using NF κ B dependent signal pathways. In Proceedings of Computational Systems Bioinformatics (CSB2003), 2003, poster paper, pages 623-628.
- [71] Chitta Baral, Le-Chi Tuan and Tran Cao Son. Golog+HTN^{TI}: Adding time and intervals to procedural and hierarchical control knowledge. Proc. of the Sixth International Symposium on Logical Formalizations of Commonsense Reasoning, 2003 AAAI Spring Symposia Series, Stanford, USA.

- [72] G. Gonzalez, C. Baral and P. Cooper. Modeling Multimedia Displays Using Action Based Temporal Logic. In Proc. of VDB 2002, pages 141-155, 2002.
- [73] C. Baral, N. Tran and L. Tuan. Reasoning about actions in a probabilistic setting. In Proc. of AAI'2002, pages 507-512, 2002.
- [74] C. Baral, T. Son and L. Tuan. A transition function based characterization of actions with delayed and continuous effects. In Proc. of KR'02, pages 291-302, 2002.
- [75] C. Baral and Y. Zhang. The Complexity of Model Checking for Knowledge Update. In Proc. of KR'02, pages 82-93, 2002.
- [76] C. Baral, L. Tuan and T. Son. Using Smodels to reason about actions in presence of resources: applications to planning and scheduling. In Proc. of International Conference on Information Technology (CIT'01), pages 3-8, 2001.
- [77] C. Baral and C. Uyan. Declarative specification and solution of combinatorial auctions using logic programming. In Proc. of Int'l conference on Logic programming and non-monotonic reasoning (LPNMR01), pages 186-199, 2001.
- [78] Tran Cao Son, Chitta Baral and Sheila McIlraith. Planning with domain-dependent knowledge of different kinds – an answer set programming approach In Proc. of Int'l conference on Logic programming and non-monotonic reasoning (LPNMR01), pages 226-239, 2001.
- [79] C. Baral, V. Kreinovich and R. Trejo. Computational Complexity of Planning with Temporal Goals. In Proc. of IJCAI 2001, pages 509-514, 2001.
- [80] C. Baral and Y. Zhang. On the Semantics of Knowledge Update. In Proc. of IJCAI 2001, pages 97-102, 2001.
- [81] C. Baral and L. Tuan. Reasoning about actions in a probabilistic setting. In Proceedings of commonsense 2001.
- [82] L. Tuan and C. Baral. Effect of knowledge representation on model based planning : experiments using logic programming encodings. In *Proceedings of AAI Spring symposium on Answer Set Programming: Towards Efficient and Scalable Knowledge Representation and Reasoning 2001*, pages 110-115.
- [83] T. Son, C. Baral and S. McIlraith. Extending Answer Set Planning with Sequence, Conditional, Loop, Non-Deterministic Choice, and Procedure Constructs. In *Proceedings of AAI Spring symposium on Answer Set Programming: Towards Efficient and Scalable Knowledge Representation and Reasoning 2001*, pages 202-209.
- [84] Goce Trajcevski, Chitta Baral and Jorge Lobo. Formalizing (and Reasoning About) the Specifications of Workflows. In *Proceedings of the Fifth IFCIS International conference on Cooperative Information Systems (CoopIS'2000)*. (Awarded one of the best paper award.)
- [85] C. Baral, L. Tuan, R. Trejo and V. Kreinovich. Computational Complexity of Planning Based on Partial Information About The System's Present and Past States. In *Proc. of First International Conference on Computational Logic (KR track) CL'2000*, pages 882-896.

- [86] M. Nakamura and C. Baral. Invariance, Maintenance and other declarative objectives of triggers – a formal characterization of active databases. In *Proc. of First International Conference on Computational Logic (DOOD track) CL'2000*, pages 1210-1224.
- [87] M. Nakamura, C. Baral and M. Bjärelund. Maintainability: a weaker stabilizability like notion for high level control. In *AAAI 2000*, pages 62-67.
- [88] R. Trejo, V. Kreinovich and C. Baral. Towards Feasible Approach to Plan Checking Under Probabilistic Uncertainty: Interval Methods. In *AAAI 2000*, pages 545-550.
- [89] C. Baral, S. McIlraith and T. Son. Formulating diagnostic problem solving using an action language with narratives and sensing. In *Proceedings of KR 2000*, pages 311-322, Morgan Kaufmann.
- [90] C. Baral and T. Son. Extending ConGolog to allow partial ordering. In *Intelligent Agents VI – Agent Theories Architectures and Languages (Proc. of ATAL-99)*, ed. N. Jennings and Y. Lesperance, Springer, pages 188-204. (*Best paper award.*)
- [91] C. Baral and G. Gonzalez. Specifying Generic Multimedia 3D Visualizations and Temporal Presentations from Database Queries. In proceedings of IEEE ICMCS' 99 (IEEE International Conference on Multimedia Computing and Systems), vol 1, pages 550-555.
- [92] C. Baral, V. Kreinovich and R. Trejo. Planning and Approximate Planning in presence of incompleteness. In proceedings of *IJCAI 99*, pages 948-953.
- [93] C. Baral and T. Son. Formalizing sensing actions – a transition function based approach. In proceedings of *AAAI 98 Fall Symposium on Cognitive Robotics*, October 98.
- [94] C. Baral, G. Gonzalez and A. Nandigam. SQL+D:extended display capabilities for multimedia database queries. In proceedings of *6th ACM Multi-media conference*, September 98, 109-114.
- [95] C. Baral, L. Floriano, A. Hardesty, D. Morales, M. Nogueira and T. Son. From theory to practice: The UTEP robot in AAAI 96 and AAAI 97 robot contests. In *proceedings of the second international conference on autonomous agents (Agents 98)*, 32-38.
- [96] C. Baral, G. Gonzalez and T. Son. Design and Implementation of Display Specification for Multi-media Answers. In proceedings of 1998 International Conference on Data Engineering (ICDE 98), 558-565.
- [97] C. Baral and J. Lobo. Formal Characterizations of Active Databases: Part II In proceedings of *International Conference on Deductive and Object-oriented database systems (DOOD) 1997*, pgs 247-264 (LNCS 1341).
- [98] C. Baral and J. Lobo. Formalizing workflows as cooperative agents In proceedings of ILPS 97 (International logic programming symposium) workshop on (Trans)Actions and Change in Logic Programming and Deductive Databases (DYNAMICS 97).
- [99] C. Baral and T. Son. Approximate reasoning about actions in presence of sensing and incomplete information. In *proceedings of International Logic Programming Symposium (ILPS) 97*, pages 387-401.
- [100] C. Baral and J. Lobo. Defeasible Specifications in Action Theories. In proceedings of *IJCAI 1997*, 1441-1446, 1997.

- [101] C. Baral and T. Son. Regular and special sensing in robot control - relation with action theories. In proceedings of the AAAI 97 Workshop on Robots, Softbots, and immobots - Theories of Action, Planning and Control.
- [102] C. Baral, T. Son and G. Gonzalez. Issues in querying multi-media databases. In proceedings of 2nd international workshop on multimedia information systems, 1996.
- [103] C. Baral and J. Lobo. Formal Characterization of Active Databases. In proceedings of the International Workshop on Logic in Databases, 1996 (LID'96), pages 175-195, LNCS 1154.
- [104] C. Baral, A. Gabaldon and A. Proveti. Value minimization in Circumscription. In KR 96, pages 474-481.
- [105] C. Baral and T. Son. Relating reasoning about actions and reactive control. In proceedings of the workshop on *Reasoning about actions, planning and robot control: bridging the gap*, held Aug 2-3 during AAAI 96, Portland, OR, USA.
- [106] C. Baral, L. Floriano, A. Gabaldon, D. Morales, T. Son and R. Watson. A reactive mobile robot based on a formal theory of action. In proceedings of AAAI 96 as a robot competition abstract, page 1350. *Our entry was placed third in the competition.*
- [107] C. Baral, A. Gabaldon and A. Proveti. Formalizing Narratives using Nested Circumscription. In proceedings of AAAI 96, Aug 4-8, Portland, OR, USA, pages 652-657.
- [108] G. Mendez, J. Lobo, J. Llopis and C. Baral. Temporal logic and reasoning about actions. Presented in Common-sense 96.
- [109] C. Baral, A. Gabaldon and A. Proveti. Formalizing Narratives using Nested Abnormality Theories. Presented in Common-sense 96.
- [110] C. Baral. A systematic approach to reason about actions, planning and Robot Control. Proceedings of 33rd Annual Allerton Conference on Communication, Control and Computing, October 4-6, 1995. (Invited non-refereed paper)
- [111] C. Baral and Michael Gelfond. Reasoning about actual and hypothetical occurrences of concurrent and non-deterministic actions. In IJCAI 1995 Workshop on Nonmonotonic reasoning, action and change, August 19-25, Montreal, Canada.
- [112] C. Baral. Reasoning about actions: Non-deterministic effects, Constraints, and Qualification. In proceedings of IJCAI 1995, 2017-2023, August 1995.
- [113] C. Baral, M. Gelfond and A. Proveti. Representing Actions-I: (Laws, Observation and Hypothesis) In Proceedings of AAAI 1995 Spring Symposium, March 27-29.
- [114] C. Baral. Rule based updates on simple knowledge bases. In *Proc. of AAAI 94*, 136-141, 1994.
- [115] C. Baral, M. Gelfond and O. Kosheleva. Approximating general logic programs. In *Proceedings of International Symposium in Logic Programming 93*, Vancouver, BC, pages 181-198, November 1993.
- [116] C. Baral and Michael Gelfond. Representing Concurrent actions in Extended Logic Programs. In *Proceedings of IJCAI 93*, pages 866-873, August 1993.

- [117] C. Baral. L_3 : A logic programming language with multiple default negations. In *Proc. of Fifth International Symposium on AI*. Cancun, Mexico, December 1992.
- [118] C. Baral. Generalized Negation As Failure and Semantics of Normal Disjunctive Logic Programs. In the *Proceedings of International Conference on Logic Programming and Automated Reasoning*, St. Petersburg, 1992. In *Lecture notes in AI- 624*, edited by A. Voronkov, pages 309-319.
- [119] C. Baral. Classification of iterative fixpoint semantics for logic programs. In *Second International Symposium on Artificial Intelligence and Mathematics*, Fort Lauderdale, Florida, January 1992.
- [120] C. Baral, S. Kraus, J. Minker and V. S. Subrahmanian. Combining Knowledge Bases Consisting of First Order Theories. In the *Proceedings of Sixth International Symposium on Methodologies for Intelligent Systems*, Charlotte, NC, 1991. In *Lecture Notes in Artificial Intelligence*. No 542. Z.W. Ras and M. Zemankova, Eds. Springer-Verlag. Charlotte, N.C. Oct (1991). 92-101.
- [121] C. Baral, J. Lobo and J. Minker. WF^3 : A Semantics for Normal Disjunctive Logic Programs. In the *Proceedings of Sixth International Symposium on Methodologies for Intelligent Systems*, Charlotte, NC, 1991. In *Lecture Notes in Artificial Intelligence*. No 542. Z.W. Ras and M. Zemankova, Eds. Springer-Verlag. Charlotte, N.C. Oct (1991). 459-468.
- [122] C. Baral, S. Kraus, J. Minker and V. S. Subrahmanian. Combining and Updating Knowledge Bases Consisting of Default Theories. In the proceedings of *Bar-Ilan Symposium on the Foundations of Artificial Intelligence*, Israel, 1991.
- [123] C. Baral and V. S. Subrahmanian. Duality between Alternative Semantics of Logic Programs and Nonmonotonic Formalisms. In the proceedings of *International Workshop on Logic Programming and Nonmonotonic Reasoning*, Washington DC, 1991, ed. Nerode, Marek and Subrahmanian, MIT press, pages 69-86.
- [124] C. Baral and V. S. Subrahmanian. Stable and Extension Class Theory for Logic Programs and Default Logics. Presented in the *Third International Workshop on Nonmonotonic Reasoning*, South Lake Tahoe, California, May 31, 1990.
- [125] C. Baral, J. Lobo and J. Minker. Generalized disjunctive well-founded semantics for logic programs: Declarative semantics. In M. Zemankova, Z. W. Ras and M. L. Emrich, editors, *Proc. of Fifth International Symposium on Methodologies for Intelligent Systems*, pages 465–473, Knoxville, TN, 1990. North-Holland.
- [126] C. Baral, J. Lobo and J. Minker. Generalized disjunctive well-founded semantics for logic programs: Procedural semantics. In M. Zemankova, Z. W. Ras and M. L. Emrich, editors, *Proc. of Fifth International Symposium on Methodologies for Intelligent Systems*, pages 456–464, Knoxville, TN, 1990. North-Holland.
- [127] C. Baral, J. Lobo and J. Minker. Generalized Well-Founded Semantics for Logic Programs. In M. E. Stickel, editor, *Proc. of Tenth International Conference on Automated Deduction*, pages 102–116, Kaiserslautern, FRG, July, 1990. Springer-Verlag.

- [128] C. Baral, S. Kraus and J. Minker. Communicating between Multiple Knowledge Based Systems. Presented in the *International Working Conference on Cooperating Knowledge Based Systems*, University of Keele, England, October 1990.
- [129] A. Roy, V. Haldar and C. Baral. Identification of Geometric Features from Hierarchical Coding of Images. Presented in the *Second International Conference on Advances in Pattern Recognition and Digital Techniques*, Calcutta, India, Jan 6-9, 1986.

Courses Taught

- Taught undergraduate courses on Automata and Languages (Fall 91 and Fall 92), Computer Architecture (Fall 92, Fall 93, Fall 94, Fall 95, Fall 96), Operating Systems (Spring 92, Spring 93, Spring 94, Spring 95), Database Systems (Fall 97, Fall 98, Spring 01), Design and analysis of Algorithms (Spring 00), Building and Programming Mobile Robots (Spring 96, Spring 97, Spring 98, Spring 99, Fall 00), Introduction to theoretical Computer Science (Spring 02, Fall 02, Spring 04, Spring 08, Spring 13, Spring 14, Spring 15), Computing Ethics (Spring 2009), Computer Organization & Assembly Language Programming (Spring 2012), Introduction to Computer Science & Engineering (Fall 09), Artificial Intelligence (Fall 1991, Fall 2010, Fall 2011, Fall 2012, Fall 2013, Fall 2014).
- Taught graduate courses on Database Theory (Spring 92, Spring 93, Spring 94, Spring 95, Spring 96, Spring 97, Spring 98), Object Oriented and Distributed Databases (Fall 93, Fall 94), Cognitive Robotics (Fall 95), Knowledge Representation (Summer 92), Autonomous Agents (Fall 97, Fall 01, Fall 04, Fall 07, Spring 11), Web authoring and multi-media databases (Fall 96), Multimedia Systems (Fall 98), Artificial Intelligence (Fall 99, Spring 01, Fall 03, Spring 05, Spring 07), Computational Molecular Biology (Spring 03), Application of AI to molecular biology (Fall 03, Spring 06), Computational Pharmacogenomics (Fall 06), Text analysis with applications to biomedicine and archaeology (Fall 08 - with Joerg Hakenberg), Multi-agent Systems (Spring 09), Topics in Natural Language Processing (Fall 08, Fall 10), Biological Networks (Fall 09 - with Joerg Hakenberg), and Natural Language Understanding and Question Answering (Spring 12, Spring 13, Spring 14).

Honors

- Invited Speaker LPNMR 2011.
- Invited Speaker KR 2010.
- Invited Speaker AAAI'05.
- Our entry in Biocreative II.5 in 2009 was the best in the normalization task and was also the best in the protein-protein interaction extraction task. There were 15 participants and greater than 100 submissions. (Based on the above we were invited to write about our entry in the IEEE Transactions on Computational Biology.)
- Our entry in Biocreative II in 2007 was number 4 in the protein-protein interaction extraction task. There were 20 participants.

- ASU Computer Science and Engineering Department “Researcher of the Year Award” for 2006.
- Awarded one of the best paper award at the Fifth IFCIS International conference on Cooperative Information Systems (CoopIS’2000) for the paper ‘Formalizing (and Reasoning About) the Specifications of Workflows’ with Jorge Lobo and Goce Trajcevski.
- Best paper award at the ATAL 99 (Agent theories, architectures and languages) for the paper ‘Extending Congolog with partial order’ with Tran Son.
- Team advisor of the robot team entry from UTEP that won the first place in the ‘Home vacuuming’ part of the AAAI 97 robot contest.
- Team advisor of the robot team entry from UTEP that won the third place in ‘Office Navigation’ part of the AAAI 96 robot contest.
- Invited Speaker at the 33rd Annual Allerton Conference on Communication, Control and Computing, October 4-6, 1995.
- Received the NSF RIA (1992) and CAREER (1995) awards.
- Received a Graduate Research Fellowship (1990) award from the graduate school of University of Maryland, College Park, MD 20742.
- Awarded the J. N. Tata scholarship (1987) for higher studies.
- Awarded the R. D. Sethna scholarship (1987) for higher studies.
- Received the “Best B. Tech thesis” award in Computer Science and Engineering in 1987 at the Indian Institute of Technology, Kharagpur, India, for the thesis titled : “Natural Language Interface for a Relational Database” (co-author A. Patel).
- Won the joint first prize in undergraduate IEEE student paper writing contest (1985) for the papers
 - C. Baral and A. G. Ray. An Efficient Recursive Algorithm for Constructing Quadrees.
 - C. Baral. Alternative efficient structures for linear quadrees and Octrees.

Grants and Contracts

- PI, Research in Knowledge Representation and Common Sense Reasoning.
NSF RIA (Research Initiation Award) grant IRI-9211662 of \$89,956 for the period 7/92 to 12/95.
- PI, A Systematic Approach to Reasoning about Actions and Change.
NSF CAREER award (IRI-9501577) of \$135,000 for the period 9/95 to 9/99.

- Co-PI (till Aug 98), PI (Aug 98 - May 99), The University of Texas at El Paso Network Resources and Training Site.
NASA, \$2,499,822 for 9/1/1995 - 8/31/2000.
- PI, Implementation of spatial data management at Ft. Bliss – support for student S. Sahu.
US Army Constr Engg Research, Ltd \$4,273 for 6/01/96-8/31/96.
- PI, An undergraduate laboratory for building and programming intelligent mobile robots.
NSF ILI award of \$40,000 for the period of 7/1/97 - 6/30/99.
As required by the NSF ILI program UTEP matches the award by another \$40,000.
- Co-PI, AI technologies for space applications.
United Space Alliance, Houston, \$57,660 for the period 6/1/97 to 8/31/98.
- PI, A Systematic approach to reasoning about actions – Transfer to ASU. NSF. \$62,027 for the period of 8/31/99 - 8/31/00.
- PI, Reasoning and planning with sensing actions and their applications. NSF. \$331,714 for the period of 4/1/2000 - 3/31/2005.
- PI, Agent development and control verification using dual characterizations. NASA. \$175,000 for the period of 3/1/2001 – 3/31/2004.
- PI, Answering complex questions and performing deep reasoning in advance question answering systems, AQUAINT program, ARDA, \$808,019 for the period of 5/3/04-10/31/06. (includes external sub-contract of \$469,007; hence ASU portion is \$339,012.)
- PI, Knowledge representation, reasoning, and problem solving in a cellular domain, NSF, \$399,000 for the period of 8/1/04-7/31/07.
- PI, Integrating knowledge based reasoning, common sense reasoning and natural language semantics in a QA system, DTO. About \$400,000 for the period of 10/1/06-9/30/07. (includes external sub-contract of half that amount.)
- Co-PI, Compiling AnsProlog to first-order theories an approach to integrate AnsProlog knowledge bases with first-order knowledge bases, DTO. About \$100,000 for the period of 10/1/06-9/30/07. (Shared with PI Joohyung Lee.)
- PI, Generalized Text Extraction form Life Science and Biomedicine Abstracts: empowering the CBioC Mass Collaborative Curation and Reasoning Systems. Science Foundation of Arizona, \$126,136 for the period of 03/01/07 - 08/28/08. (Co-PIs: Graciela Gonzalez, Yi Chen and Lokesh Joshi)
- PI, Developing a state of the art biological interaction extraction system. Science Foundation Arizona, \$99,000 for the period of 06/01/08 - 05/31/09.
- PI (ASU part), Human-Robot Interaction in Littoral and Urban Military Domains: Human-Unmanned Systems Interactions. MURI award from ONR of \$1 million for the period 7/1/2007-

6/30/2012. (PI of the overall grant of \$2.5 million is Matthias Sheutz of Indiana University and the ASU part is shared with Subbarao Kambhampati, Pat Langley and Mike McBeath. Pat Langley was the lead in assembling the team and wrote big parts of the proposal. Other team members include Stanley Peters from Stanford.)

- PI, Integrating Machine Learning and Knowledge Representation for Discovery of Social Goals of groups. IARPA. \$1,000,000 for 08/24/09-10/23/11.
- PI, EAGER: Enabling collaboration in the creation of scientific databases from the published literature. NSF. \$179,927 for the period of 09/01/09 - 08/31/12.
- Participant: Computational Analysis of Gene Expression Pattern Images (R01) NHGRI (NIH). (PI : Sudhir Kumar). My budget was for half month. 2011-2014.
- PI, Natural Language Interaction With Systems and Agents: Acquiring Knowledge, Understanding Text, Reasoning and Responding. ONR, \$324,763. 01/01/2013-12/31/2015.
- PI, A Foundational Model for Postdoctoral Programs in Computer Science & Engineering at Large Universities, Sub Award for PostDoc Best Practices, CRA, \$892,350. 04/01/2014-03/31/2017.
- Co-PI, DataNet Federation Consortium SubAward to ASU, Sub-award from UNC (originally from NSF), \$108,000. 09/01/2013-08/31/2016.

Student mentoring and advising

Doctoral Students¹

Tran Son graduated in Spring 2000. Professor at the New Mexico state University.
(Best doctoral dissertation of the University of Texas at El Paso award, 2000.)

Graciela Gonzalez graduated in Fall 2000. Associate Professor at the Arizona State University.

Raul Trejo graduated in Spring, 2001. (Was also co-advised by Vladik Kreinovich of UT El Paso.) Assistant Professor, ITESM, Mexico City.
(Best doctoral dissertation of the University of Texas at El Paso award, 2001.)

Le-Chi Tuan graduated in December 2004. Research Scientist at GCAS, Inc.

Nam Tran defended his Ph.D dissertation (at ASU) in October 2006. Works at GE Research.

Xin Zhang defended her Ph.D dissertation (at ASU) in 2008. Works at Cisco.

Luis Tari defended her Ph.D dissertation (at ASU) in 2010. Works at GE Research.

¹The first three students are the 2nd, 3rd and 4th student to obtain a Ph.D from the computer science department at the University of Texas at El Paso. The first four students that graduated from this program are in academia as faculty. I had a major role to play in establishing this program at UT El Paso.

Jicheng Zhao defended her Ph.D dissertation (at ASU) in 2011. Works for Baidu in China.

James R. Leaman defended his Ph.D dissertation (at ASU) in 2012. (Co-advised by Graciela Gonzalez). Works at NIH.

Saadat Anwar defended his Ph.D dissertation (at ASU) in 2013. Works at ASU.

Vo Nguyen defended his Ph.D dissertation (at ASU) in 2015.

Current Ph.D Students: *Gregory Gelfond*, *Shruti Gaur*, *Arpit Sharma*, *Somak Aditya*, *Arindam Mitra* and *Kazuaki Kashihara*.

Masters Students

Advised or mentored thesis/project of the following students (A. Gabaldon², Y. Gelfond, S. Hota, D. Bhattacharya, R. Vijayrangam, G. Gonzalez, P. Madden, D. Morales, A. Nandigam, B. Ayuluri, B. Rachamreddy, S. Sahu, M. Hampton, D. Schirmer, and A. Hardesty at UTEP; and S. Culver, Luis Tari, Piyun Chang, Deepthi Chidambaram³, Hiro Takahashi, Dmitry Voronkov, Matthew Greene, Marcos Alvarez Gonzalez, Barry Lumpkin, Kanchan Kumbhare, Tejas Budukh, Meghna Pollimera, Matthew Hunsaker, and Arpit Sharma⁴ at ASU.

Undergraduate and High School Students

Alfredo Gabaldon and Patrick Kahl started working with me when they were undergraduates and went on to do their M.S and Ph.D.

Guray Alsac worked with me as an undergraduate researcher and was supported by an NSF REU supplement. He joined Ph.D at University of Massachusetts, Amherst.

Anthony Gitter worked in our group as an undergraduate, received an NSF graduate fellowship based on his work in our group and finished his Ph.D at CMU.

Undergraduate students that worked with me and our group: Craig Teegarden, Amanda Ziegler, Ryan Wendt, Shawn Nikkila, Jenny Hastings, Saswati Sahoo, Matthew Greene, Barry Lumpkin, Kirk Morales Amy Baldwin, Jacob Jorgensen, Ismael Mercado, Garth Bjerk, Sam Rawal (current), Sajid Anwar, Joseph North.

Amy Baldwin received the Google Anita Borg Memorial Scholarship in 2014.

Barry Lumpkin was awarded an honorable mention in the CRA outstanding research awards for 2010.

High School students that worked with me and our group: Misha Koshelev (went to Harvard for undergraduate and then finished MD-PhD from Baylor.), Sidharth Kulkarni.

²He finished his Ph.D from the University of Toronto.

³co-advised by Hasan Davulcu

⁴For his MS thesis titled "Solving Winograd Schema Challenge : Using Semantic Parsing, Automatic Knowledge Acquisition and Logical Reasoning" he was awarded the best Masters Student in Computer Science award for 2014-2015.

External Students

- Opponent of Joakim Gustafsson, Linkoping University, Sweden.
- Examiner for Mikhail Prokopenko, Macquarie University NSW 2109, Australia.
- External Ph.D committee member of Esra Erdem, University of Texas at Austin.
- External Ph.D committee member of Yuting Zhao, Hong Kong University of Science and Technology.
- External Ph.D committee member of Rajdeep Niyogi, Indian Institute of Technology, Kharagpur, India.
- External Ph.D committee member of Marcello Balduccini, Texas Tech University.

Professional Activities

- Associate Editor, Artificial Intelligence, January 2015 - present.
- Associate Editor, JAIR (Journal of AI Research) : March 2007 - February 2010
- Area Editor (Knowledge representation, non-monotonic reasoning and answer sets), ACM Transactions on Computational Logic. 2005-present
- Editorial Advisor of the journal “Theory and Practice of Logic Programming”. 4/15/2005-present
- Program committee member of AAI 2007, AAI 2006, AAI 2005.
- Steering committee member of International Workshops on Nonmonotonic Reasoning. 2005.
- Co-Program Chair, LPNMR’05.
- General Chair, CIT’04.
- Senior program committee of AAI 2008, AAI 2004.
- Program committee member of IJCAI 2003.
- Co-Editor, Special issue of *Theory and practice of Logic Programming* on answer set programming to appear in 2003.
- Co-Program Chair of CogRob’2002.
- Senior program committee of AAI 2002.

- Organizing Committee, AAAI Spring symposium on Answer set programming, 2001.
- Co-Program Chair of NM'2000 (8th International Workshop on Non-monotonic reasoning).
- Program Chair of CIT 99 (Second International Conference on Information Technology).
- Organizing Committee, CogRob'2000 (2nd International Cognitive Robotics Workshop).
- Program Committee of AAAI 97, AAAI 98, AAAI 99, AAAI 2000, IJCAI'2003; AAAI 98 Fall Symposium on Cognitive robotics; CIT98; LPNMR 99; CLIMA-00 (Workshop on Computational Logic in Multi-agent systems); KR 2008; PADL 2008.
- Overseas Secretary, Orissa Information Technology Society: 1998-2001.
- Co-Editor, Special issue of *Annals of Math and AI*, Vol. 21 (1997) Nos. 2-4.
- Co-Chair, AAAI 97 Workshop on "ROBOTS, SOFTBOTS, IMMOBOTS: Theories of Action, Planning and Control".
- Chair, AAAI 96 Workshop on "Reasoning about actions, planning algorithms and control architectures : Bridging the gap."
- Member of program committee and main organizer of Workshop on *Logic Programming with Incomplete Information*, held together with 1993 International Symposium on Logic Programming, Vancouver, BC, Canada.
- Member, Program Committee of the *ICLP'95 Workshop on Abduction in Deductive Databases and Knowledge-based Systems* Kanagawa, Japan.
- Panelist, 1995 Spring Symposium on Extending theories of actions.
- Refereed articles for AI Journal, Journal of AI Research, Journal of Automated Reasoning, Journal of Logic Programming, Journal of Logic and Computation, Annals of Math and AI, Journal of Experimental and Theoretical AI, Journal of Intelligent Information Systems, ACM transactions on Database Systems, IEEE Transactions on Knowledge and Data Engineering, and various conferences on Databases, Artificial Intelligence, Logic Programming and Knowledge Representation.
- Refereed articles for conferences such as: ICLP90, VLDB90, NACL90, DOOD91, AAAI93, IJCAI93, ICLP93, LPNMR93, ILPS94, ISMIS94, ICLP95 and LPNMR95.

Invited Lectures

- "Semantics of Nonmonotonic Formalisms", Department of Computer Science, New Mexico State University, Las Cruces, USA (Dec 1991).
- "A language for reasoning about actions and change", Department of Law and Philosophy, University of Bologna, Italy (Jan 1994).

- “Abductive Logic Programming”, Department of Computer Science, University of Modena, Italy (Jan 1994).
- “Logical Basis of Disjunctive Databases”, Department of Computer Science, University of Milan, Italy (Jan 1994).
- “Knowledge Representation in Artificial Intelligence”, Xaviers School of Business Management, Bhubaneswar, India (Jan 1994).
- “Rule Based Updates in Simple Knowledge Bases”, Department of Computer Science, University of Nebraska, Lincoln, USA (April 1994).
- “Reasoning about Situations”, Department of Computer Science, University of Texas at Austin, USA (August 1994).
- “Reasoning about Actions and Change”, Department of Electrical Engineering and Computer Science, University of Illinois at Chicago, USA (October 20, 1994).
- “A systematic approach to reason about actions, planning and Robot Control”. Invited Speaker at the 33rd Annual Allerton Conference on Communication, Control and Computing, October 4-6, 1995.
- “Reasoning about actions and its relation to robot control and database updates”, Department of Computer Science, University of Corona, La Cornua, Spain (June 1996).
- “Reasoning about actions and its relation to robot control and database updates”, Department of Computer Science, Griffith University, Brisbane, Australia (Jan 17, 1997).
- “From action theories to agents – a formal approach to agents”, Seminar at IRST, Trento, Italy, Aug 18, 1997.
- “From action theories to agents – a formal approach to agents”, Invited Lecture at the Symposium on logical approaches to agent modeling and design, held as part of the ESSLLI’97 (Ninth European Summer School in Logic, Language and Information), Aix-en-Provence, France, August 20, 1997.
- “From action theories to agents – a formal approach to agents”, TRAIL seminar at Imperial College, London, Aug 26, 1997.
- “From action theories to agents”, University of Toronto, Feb 6, 1998.
- “Representing actions: Laws, Observations and Hypothesis”, York University, Toronto, Feb 7, 1998.
- “From action theories to agents”, Linköping University, Sweden, Sept 18, 1998.
- “Knowledge representation, reasoning and declarative problem solving”, International Con-

ference on Information Technology, Bhubaneswar, Dec 22nd, 2000.

- Invited to speak at the Joint German/Austrian Conference on Artificial Intelligence (KI-2001), Vienna, Sept 2001. (Could not go because of the September 11 incident.)
- Knowledge representation, reasoning and declarative problem solving with answer sets. Dagstuhl seminar. Germany Sept'02.
- Several talks at the Vienna U of Technology Vienna May'03.
- From high-level goals to policies: a polynomial time algorithm for k-maintainable goals. NASA JPL. Jan'04.
- From high-level goals to policies: a polynomial time algorithm for k-maintainable goals. University of Texas at Austin. Feb'04.
- From high-level goals to policies: a polynomial time algorithm for k-maintainable goals. Fundación Universidad de las Américas, Puebla, Mexico. Nov 2004.
- From Knowledge to Intelligence - Building Blocks and Applications. AAAI conference invited talk. Pittsburgh, PA July 2005.
- CBioC and Biosignet: BioAI research in my group. New Mexico State University, Las Cruces. March 2006.
- Using the Probabilistic Logic Programming Language P-log for Causal and Counterfactual Reasoning. Texas Tech University, Lubbock. March06.
- CBioC: a tool for mass collaborative curation. NLM, NIH, Bethesda, MD. May 2006. (self-invited talk.)
- Towards Overcoming the Knowledge Acquisition Bottleneck in Answer Set Prolog Applications: Embracing Natural Language Inputs. ICLP 2007 conference invited talk. Porto, Portugal, September 11th 2007.
- Combining probabilistic and logical reasoning. Invited talk at Univ of Nova de Lisboa, Lisbon, Portugal, September 13th 2007.
- A knowledge based approach for representing, reasoning and hypothesizing about biochemical networks. Invited talk at the 2007 International Workshop on Abduction and Induction in Artificial Intelligence (AIAI07), Aix-en-Provence, France, September 15th 2007.
- Action, Change and Evolution: reasoning and acting in a dynamic world. Invited talk at the University of Maryland, College Park on November 12th 2007.
- Reasoning about Actions and Change: From Single Agent Actions to Multi-Agent Actions. Invited talk at KR 2010.

- Lessons from Efforts to Automatically Translate English to Knowledge Representation Languages. Invited talk at LPNMR 2011: 12
- Manual and automatic knowledge representation in Answer Set Programming. Invited talk at CPSAT, Kobe, Japan. May 2012.
- Lessons from Efforts to Automatically Translate English to Knowledge Representation Languages. Invited talk at NII (National Institute of Informatics), Tokyo, Japan. May 2012.
- Invited Panelist at the NIH workshop on Natural language processing: State of the Art, Future Directions and Applications for Enhancing Clinical Decision Making. April 23-24, 2012.
- Invited Participant, NSF Workshop on Research Challenges and Opportunities in Knowledge Representation. February 2013.
- Explanation Producing Combination of NLP and Logical Reasoning through Translation of Text to KR Formalisms. Invited Presentation at NII Shonan Meeting Seminar 057. Japan. November 2014.

Tutorials and Short Courses

- “From Actions Theories to Updates, Transactions, Triggers and Agents”, A joint tutorial at DOOD 97 (Montreux, Switzerland) with J. Lobo, Dec 10, 1997.
- “From action theories to agents – planning control strategies for reactive agents”, A joint tutorial at AAI 98 (Madison, Wisconsin) with F. Kabanza. (65 registered participants)
- “A logical approach to building agents, active databases and workflows: representing and reasoning about actions”, A two week course to be given at ESSLLI 99 (11th summer school in logic, language and information) with Jorge Lobo and Richard Scherl. (35 registered participants)
- A short course at the Vienna U of Technology, Vienna May’03. 184.186 - 2.0 VU Theorie der Wissensrepräsentation (Theory of Knowledge Representation)
- Two weeks course in Vienna. Summer 2010.

University Service and Outreach Activities – Highlights

- Member of Deans advisory committee on research 2010-11.
- Recruiting Committee Chair, Dept. of CSE, Arizona State University, Fall 2004 - Spring 2005; Fall 2006-Spring 2008; 2011-12 (for the search on Personalized Learning and Language Processing); 2012-13 (for the search on Human Centered Robotics)
- Executive Committee, Dept. of CSE, Arizona State University, Fall 2004, Fall 2006-Spring 2007.

- Personnel Committee, Dept. of CSE, Arizona State University, 2000- 2001; 2002- Spring 2005 (Chair during Fall 2003); Fall 2009-Spring 2011; Fall 2012-Spring 2014 (Chair during Fall 2013).
- CEAS Senate representative, member of graduate admission committee, member of TA and financial aid committee, 2001-2004.
- Faculty mentor for one summer intern at Intel as part of the Embedded Systems Initiative.
- Chair of the graduate admissions committee, and member of graduate program committee, Dept. of CSE, Arizona State University, August 1999 – May 2001.
- Graduate Advisor and in charge of the graduate program in Computer Science at UTEP from Fall 94 till Spring 99.
- Instrumental in developing a Ph.D program for Computer science students at UTEP.
- Developed – through students – the first Web pages for the university and the local area (the city of El Paso and Juarez), in 1993 and wrote op-ed articles in the El Paso Times newspaper to increase local awareness about the WWW.
- Held several robot building workshops and robot demonstrations for El Paso area school teachers and students.
- Have been featured (together with my students) many times in the El Paso newspapers, TV stations, and the university alumni magazine.

Community Service Activities and Awards – Highlights

- Distinguished Odia Award (2014) by the Odisha Society of the Americas.
<http://www.odishasociety.org/winners-of-osa-awards-2014/>
- Living Legend Award (2012) by OdishaDiary.
<http://www.orissadiary.com/CurrentNews.asp?id=37757>
- Instrumental in the establishment of the National Institute of Science Education and Research (NISER), Bhubaneswar, India. Some articles and pointers that mention my role on this are as follows.
 - http://www.telegraphindia.com/1051109/asp/jamshedpur/story_5454814.asp
 - http://www.orissasociety.org/media/newsletters/january06/osanl_january200610.html
 - <http://www.orissadiary.com/CurrentNews.asp?id=2803>
 - <http://iiser.blogspot.com/>
 - <http://bit.ly/niser-history>
 - <http://nis.orissalinks.com/>
 - <http://www.nis.orissalinks.com/vol1/>
 - <https://bdsays.wordpress.com/2005/11/09/a-history-of-bias/>

- <http://www.odishasociety.org/media/newsletters/january06/utkarsa-january06.pdf>
- Helped in the establishment of Xavier University Bhubaneswar, India. This is the first and only Jesuit university in India. Some articles that mention my role on this are as follows.
 - <http://www.tathya.in/new/print.aspx?sno=7155>
 - <http://www.orissadiary.com/CurrentNews.asp?id=36808>
- As member of the Higher Education Task Force helped develop vision document for higher education for the state of Odisha, India. Some pointers on this are as follows.
 - <https://sites.google.com/site/orissavision2020/>
 - <http://www.slideserve.com/nasnan/the-stanford-declaration>
 - <http://slideplayer.com/slide/5918808/>

Community Service Writings in Newspapers

- [1] C. Baral. March 5, 1995.
Cyberspace: City should tech it out. Guest Column in El Paso Times.
- [2] C. Baral. July 01, 2006.
Bias Against Bhubaneswar. Article in the editorial page of Indian Express and New Indian Express. <http://www.indianexpress.com/story/7592.html>
- [3] C. Baral. July 11, 2006.
For IIT upgrade, an alternative roadmap Article in the op-ed page of Indian Express and New Indian Express. <http://www.indianexpress.com/story/8266.html>
- [4] C. Baral. November 17, 2006.
The gold that keeps Orissa poor. Article in the editorial page of Indian Express and New Indian Express. <http://www.indianexpress.com/story/16768.html>
- [5] C. Baral. December 21, 2006.
Higher Education Lower Development. Article in the editorial page of Indian Express and New Indian Express. <http://www.indianexpress.com/story/18992.html>
- [6] C. Baral. January 19, 2007.
Central university as development pill. Article in the editorial page of Indian Express. <http://www.indianexpress.com/story/21273.html>