

Annual Merit Report for 2006

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1 Research

1.1 Summary

In 2006 I started a new research project, called Evergreen which began before I came to Northeastern, with my PhD dissertation in 1977. It was an adventure to explore what happened in the last 30 years since I wrote my dissertation. Slowly but surely the fields of SAT (Satisfiability) solvers and CSP (Constraint Satisfaction Problem) solvers rediscovered the concept of non-chronological backtracking that I invented and formalized in my dissertation and related papers. I quickly put those papers on my publications website and informed the community. They kindly put my 1977 paper on the main website of the SAT community: SATLive!.

Non-chronological backtracking turns out to be a pivotal feature of all state-of-the-art SAT and CSP solvers. The idea is quite simple: when the solver runs into a conflict, add a new “short” clause that prevents this conflict from happening in the future. Then you may restart the search process anywhere you like.

A 1995 PhD dissertation at the University of Michigan claims to have invented this and I am in email discussion with the student and his professor who happen to be the General Chairs of the conference to which we submitted our paper.

But not all my results from 30 years ago were put into solvers. The work on P-optimal approximation was left out and therefore we implemented our own MAX-CSP solver (of which a SAT or CSP solver is a special case). We wrote a paper and submitted it in January to SAT 2007 (<http://www.ccs.neu.edu/home/lieber/s/sat07-sub.pdf>).

The Evergreen project explores the space of constraint satisfaction with a focus on biological applications. Evergreen is supported by a 4 year grant from Novartis (NIBR).

Indeed, my sabbatical at Novartis restarted my interest in CSP solvers. I worked in the department of Genome & Proteome Sciences (manager: Mark Boguski) and developed good connections to several of his researchers. Mark, a member of the National Academy of Sciences, agreed to become an adjunct professor of our college. With my PhD student Christine Hang I visit Novartis weekly and work with Novartis researchers on systems biology problems (using CSP in biology).

In addition, I continue my research on modularity mechanisms in software development, with special focus on aspect-oriented software development. We actually apply now the best software development ideas we and others developed during the last 30 years to CSP solvers.

1.2 Technical Report

“Functional Visitors Revisited”, with Bryan Chadwick and Therapon Skotiniotis, 2006, May, NU-CCIS-06-03.

1.3 Conference Paper

Demeter Interfaces: Adaptive Programming without Surprises, with Therapon Skotiniotis and Jeffrey Palm, European Conference on Object-Oriented Programming, 2006, Springer Verlag Lecture Notes, pages 477-500.

Top tier conference.

1.4 Conference Paper submbitted

This paper was submitted in January 2007 but most of the work was done in 2006.

Superresolution and P-Optimality in Boolean MAX-CSP Solvers, with Ahmed Abdelmegeed and Christine Hang and Daniel Rinehart, submitted to SAT 2007.

1.5 Invited Talks, Colloquia, etc.

ETH Zurich, Switzerland, March 2006.

1.6 Grants

Novartis gift \$ 200 000 over 4 years.

1.7 Grant Proposals

I wrote one proposal to Novartis which got funded. I hope that more will develop from this relationship. After the SAT 2007 paper is accepted, I will write a proposal on CSP/Biology.

1.8 Conferences Attended

AOSD 2006, Bonn, Germany

Computational Biology Conference, Basel, Switzerland, March 2006,

(I sent Theo to Nantes to present our ECOOP paper in July 2006).

2 Teaching

2.1 Courses

- Advanced Software Development, CSG 260, Fall 2006, 6 students.
The course applied advanced software development to CSP solvers. The course resulted in a conference paper submission and a technical report (MAX-CSP paper).
- Software Design and Development, CSU 670, Fall 2006, 30 students.
The course was completely reorganized. The project was designing and implementing a CSP solver.

2.2 My Ph.D. Students

Therapon Skotiniotis is finishing his thesis proposal. He is expected to graduate in 2007.

Christine Hang, second year PhD student. Co-author of MAX-CSP paper. Christine also has a desk at Novartis and access to their researchers and research resources.

Ahmed Abdelmegeed, first year PhD student. Co-author of MAX-CSP paper.

Bryan Chadwick: second year PhD student. He is working on functional visitors (TR published).

Pengcheng Wu, part-time PhD student. Slow progress because of full-time job. He is revising his thesis proposal.

Jeff Palm is a third year PhD student. He took a leave of absence for fall 2006 and spring 2007.

Yuantai Du: first year, part-time PhD student on leave. I am his mentor but there was minimal activity.

2.3 External Ph.D. Committees

I was a member of the PhD committee of Mark Grechanik at the University of Texas at Austin and Christopher Dutchyn at the University of British Columbia.

3 Service

3.1 College Committees

In the fall I became a member of the Graduate Committee (Master's committee). We evaluated the spring 2007 applications.

Member of sabbatical leave committee. Ken Baclawski did most of the work.

3.2 Professional Service

Steering committee of Aspect-Oriented Software Association.

PC member for ECOOP 2006, 2007, SC 2006, 2007, AOSD 2006, Generative Programming and Component Engineering 2006. For each PC I evaluated about 12 papers.

Workshop PCs: I was also on the PC for FOAL 2006 and FOAL 2007 workshops. 3 papers each. Workshop on Generic Programming 2006. 5 papers.

Editorial board of LNCS Transactions on Aspect-Oriented Software Development.

Tenure letters for a few universities.

Proposal evaluations for Canada (Gregor Kiczales) and Switzerland (Oscar Nierstrasz).

3.3 Other Service

I maintain the popular Demeter website that offers information about Aspect-Oriented Programming, including our software packages: DemeterJ, DJ, DAJ and the AP Library.