

THE 11TH GAME PROGRAMMING WORKSHOP IN JAPAN 2006
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Introduction

From November 10th to 12th the Japanese Game Programming Workshop was held for the 11th time. This year there were 74 participants from all over Japan. It is also tradition to have at least one invited speaker from overseas and this time Yngvi Björnsson from the University of Reykjavik and Mark Winands from the University of Maastricht were the foreign guests. The third invited speaker was Kunihito Hoki, who had shocked the computer shogi world this year by winning the Computer Shogi World Championships with his first year entry BONANZA.

Other than the invited talks, there were 19 presentations in 6 sessions over three days. There also was a poster session with 12 posters. The recent trend in the workshop has been that the vast majority of presentations was about shogi, but the number of shogi presentations was the lowest in recent years (6). This was only one more than the number of presentations on Go (5). It was encouraging to see that this year's workshop had a well-balanced program including presentations on different puzzles, Hex, general search and the use of games in education.

Session 1: Shogi (1)

One of the problems in shogi is to incorporate long standard move sequences including multiple sacrifices (particularly of pawns) into the general search. *Jun Nagashima* from the Japanese Advanced Institute of Science and Technology (JAIST) presented a method to recognize the possibility of one such a standard move sequence (the edge attack) and extend the search accordingly.

Nobosuke Sasaki of the University of Hiroshima used TD-Learning to learn the piece values of Chu-shogi (a shogi variant with a bigger board and more pieces). This is a first step into analyzing the evolution of the rules of different games.

Tomoki Murata of JAIST presented a method to extract standard tactical move sequences including sacrifices in shogi from a large corpus of game records. By hashing the 3-move tactical sequences it was possible to use this information efficiently in the search.

Invited talk 1: Tools for Debugging Large Game Trees

Yngvi Björnsson presented a tool for helping game programmers with analyzing the information in large game trees. He has designed a tool that only requires the programmer to add some simple statements for logging the search. A game-tree viewer can then be used to navigate through the tree and it is possible to formulate queries for collecting statistics or look for abnormalities. During the workshop he promised that a beta version would be available by the end of the year.

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Session 2: Puzzles and search (1)

Mark Winands from the University of Maastricht explained how to use Monte-Carlo sampling to initialize proof numbers in proof-number search. Using this method significantly improved the average solution time of a set of Tsume Go problems.

Hiroki Shirai of the Tokyo University of Agriculture and Technology presented a method to solve and compose problems of the *Slither Link* puzzle using constraint satisfaction techniques.

Chikari Igarashi, also from the Tokyo University of Agriculture and Technology presented a method to solve a pentomino-like dissection/put-together puzzle.

Shunsuke Soeda talked about a new method for combining proof-number search with λ -search called df-pn driven dual λ -search. This method was tested in the game of *Simpei* and showed significant improvement over the previously proposed proof-number search with λ -search methods.

Session 3: Shogi (2)

In many shogi programs a progress value is used to measure how far the game has proceeded. This value is then used to change the weight of evaluation function features that are more important in the endgame than in the opening and vice versa. *Shogi Takeuchi* of the University of Tokyo proposed a method to automatically tune the progress value based on game records.

Another method often used in shogi programs is realization probability search. This method divides moves into different categories and decides the search depth based on the category of a move. *Makoto Miwa* presented a method to extend move categorization from single moves to move sequences and also explained how to assign search depths to these categories.

In the final presentation of this session, I explained how to use bitboards in shogi. Despite the fact that the 81 square shogi board cannot be efficiently represented as a bitboard, it was shown that the bitboard representation can also be an advantage in games with board sizes that are not a power of 2.

Invited talk 2: Optimal control of minimax search results to learn positional evaluation

Probably the most anticipated talk of the workshop was the presentation by *Kunihito Hoki* of Tohoku University, who would reveal the secrets of computer shogi world champion *Bonanza* for the first time to a large audience. One of the problems in the middle game in shogi is to make a program play good piece formations. Bad formations can lead to long term strategical disadvantages that can often be easily exploited by top players. In *Bonanza* this evaluation is done by using more than 10,000 piece relation vectors. To learn the values for such a large number of vectors, the Lagrange method of undetermined multipliers was used in combination with a large connection of about 60,000 game records. It took three months to tune the values, but *Bonanza* has been particularly praised by professional shogi players for its natural use of pieces.

Invited talk 3: MIA: A World Champion LOA Program

The final invited speaker of this workshop was *Mark Winands* of the University of Maastricht, who explained the methods behind MIA, the world champion in Lines of Action. The search methods applied in MIA include PVS, two-deep transposition tables, forward pruning, move ordering, quiescence search and realization probability search. Also, a complex evaluation function is used with features for concentration, centralization, centre-of-mass position, quads, mobility, walls, connectedness, uniformity, player to move and feature caching. In 2003, MIA was finally able to decide a long time rivalry with Yngvi Björnsson's program YL in its favour. Since then, MIA has been the best LOA program in the world.

Session 4: Go (1)

The first presentation on Go was by *Youhei Nii* from the Kyushu University of Technology. He presented a tool to analyze capturing races in Go using combinatorial game theory.

Teigo Nakamura, also from the Kyushu University of Technology, then explained the importance of not only deciding the winner of a capturing race, but also the amount of territory involved. He presented an evaluation method for establishing this territory score.

Session 5: Go (2)

Youhei Yano of the University of Electro-Communications then presented a method to determine the maximum number of strings that can be put on a 19×19 Go board. 3 days of calculation showed that the value lies between 277 and 281. Before the workshop started, 40 days of calculation by Miyashiro Ryuhei from the Tokyo University of Agriculture and Technology using a different method determined that the maximum number of strings is 277.

Solving the problem of determining the maximum number of strings is a time-consuming task. *Yuichi Hiruta* of the Tokyo University of Agriculture and Technology explained some ideas to solve the same problem much faster.

Katsuyoshi Takahashi of the Future University Hakodate presented some first results on cognitive experiments with Go players using eye camera data. The performance of professional players, amateurs and beginners in memory tasks was analyzed.

Session 6: Miscellaneous

Takanobu Umetsu talked about the (in his opinion) rather sad state-of-the-art in using games for educational purposes. He presented a system that can use card games for learning tasks and can also automatically generate new games to fit new learning tasks.

Ken Mishima of the University of Electro-Communications explained a new proof method for Hex, which extends and simplifies earlier proof methods proposed by Noshita. A winning strategy for an 8×8 board with the first move at 63 and a proof-tree for a 9×9 board with the first move at 55 was presented.

The final presentation of this year's workshop was by *Kazutomo Shibahara* of the University of Agriculture and Technology. This presentation was about solving the game of *Utsurigi*. The game was further analyzed by comparing the results for different board sizes.

Conclusion

Thanks to Hitoshi Matsubara and Takeshi Ito, the GPW was (as always) very well organized and conducted in a relaxed atmosphere from start to finish (the fact that the venue is a hot spa in the famous Hakone district helps!). Apart from the presentations, there was also an informal computer shogi event on the two evenings of the workshop. This year there were 14 participants, including 6 of the 8 programs that qualified for the finals of the computer shogi world championships in May this year. The tournament was won by GEKISASHI (World Champion 2005) with BONANZA (World Champion 2006) being the runner-up.

The Game Programming Workshop is probably the biggest gathering of game researchers in the world and because of this it is a little unfortunate that the presentations are in Japanese. This year I was impressed with the high level of the presentations. In my opinion, there were actually quite a number of poster sessions that would have deserved presentation time in the main event. For me, every year the GPW provides so much opportunities for exchanging ideas that it drives my research for months after the event. I would almost go as far as to say that it is a perfect reason to learn Japanese!