COMPUTER GAMES WORKSHOP AT ECAI 2012

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From August 29 to August 31, the European Conference on Artificial Intelligence was held in Montpellier, France. In the two days preceding, 44 workshops were additionally proposed. On the first day (Monday, August 27) the Computer Games Workshop was held, co-chaired by Tristan Cazenave, Jean Méhat and Mark Winands at Montpellier University. This workshop turned out to be the most popular one. A total of 17 papers were submitted: 11 were accepted, 1 was withdrawn and 5 were rejected. Moreover, 33 participants registered for the event. We will briefly report on the accepted papers below.

In the first talk, Tristan Cazenave presented the paper *Beam Nested Rollout Policy Adaptation,* co-authored by Fabien Teytaud. In his talk he discussed the Nested Rollout Policy Adaptation algorithm, which is a search algorithm known to be efficient for combinatorial problems. However, one problem is that the algorithm can converge to a local optimum and get stuck in it. The researchers proposed a modification that limits this behaviour. Next, they performed experiments on the Traveling Salesman Problem With Time Windows and Morpion-Solitaire.

In the next talk, *A New Self-Acquired Knowledge Process for Monte Carlo Tree Search,* written by André Fabbri, Frédéric Armetta, Éric Duchêne and Salima Hassas, a new approach, called BHRF (Background History Reply Forest) was proposed to extract knowledge from the search tree in order to improve the quality of the playouts. The experimental results in Go were quite promising.

Subsequently, the paper *Detecting Cheating Activities in Online Duplicate Bridge Game Tournaments* written by Sylvain Lagrue and Karim Tabia, was presented. The presentation focused on online duplicate Bridge tournaments where the same deals are played by several players. The authors argued that anomaly-based approaches, which are widely used in several application domains such as computer security, are appropriate for detecting potential cheating activities. They provide preliminary experimental evaluations showed the effectiveness of the proposed approaches.

After the coffee break Abdallah Saffidine presented joint research with Marc Lanctot, Joel Veness, and Chris Archibald. Their paper *Sparse Sampling for Adversarial Games* introduced Monte Carlo *-Minimax Search (MCMS), a Monte-Carlo search algorithm for finite, turned-based, stochastic, two-player, zero-sum games of perfect information. Through a combination of sparse sampling and classical pruning techniques, MCMS allows deep plans to be constructed. Unlike other popular tree search techniques, MCMS is suitable for densely stochastic games, i.e., games where one would never expect to sample the same state twice. The authors gave a basis for the theoretical properties of the algorithm and evaluate its performance in three games: Pig (Pig Out), EinStein Würfelt Nicht!, and Can't Stop.

Pim Nijssen presented the paper *An Overview of Search Techniques in Multi-Player Games.* He tested together with Mark Winands the performance of the minimax-based search techniques max^n, paranoid search and Best-Reply Search. Furthermore, they investigated how the tree structure of each of the minimax-based techniques can be applied in MCTS. The test set consisted of four different multi-player games: Chinese Checkers, Focus, Rolit and Blokus. Based on the experimental results, they concluded that Best-Reply Search is generally the best minimax-based search technique. Monte-Carlo Tree Search performed best with the max^n tree structure.

Unfortunately, the authors of the paper *Heuristics and Fishing in Scrabble* could not attend the workshop. In the paper Alejandro González Romero, René Alquézar, Arturo Ramírez Flores and Francisco González Acuña discussed Computer Scrabble. They explained an alternative method which uses a heuristic function that involves probability calculations to evaluate moves. The paper presented improvements on this heuristic function and tackles the problem of finding the best move for every initial 7-letter rack.

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In the last talk of the session, *Monte-Carlo Tree Search for the Simultaneous Move Game Tron,* Mark Winands presented the B.Sc. research, of his student Niek den Teuling. In the talk the performance of MCTS in Tron, which is a two-player simultaneous move game, was discussed. Based on their experiments, they concluded that Progressive Bias, altered expansion phase and play-out cut-off all increased the overall playing strength, but that the results differ per board. Moreover, MCTS-Solver appears to be a reliable replacement for MCTS in the game of Tron, and is preferred over MCTS due to its ability to search the state space for a proven win. The MCTS program was still outperformed by the best program A1K0N, which uses a sophisticated evaluation function, indicating that there is quite some room for improvement.

After lunch Ji Ruan presented the paper *Model Checking Games in GDL-II*, a joint collaboration with Michael Thielscher. First he discussed the game description language GDL. It is a logic-based formalism for representing the rules of arbitrary games in general game playing. A recent language extension called GDL-II allows the description of stochastic games with any number of players, which may have imperfect, asymmetric information. The researchers applied model checking to address the problem of verifying that games specified in GDL-II satisfy appropriate temporal and knowledge conditions. In the talk a systematic translation of a GDL-II description to a model checking tool was presented, and the feasibility by two case studies was shown.

The next presentation was entitled *A General Multi-Agent Modal Logic K Framework for Game Tree Search,* a paper written by Abdallah Saffidine and Tristan Cazenave. An application of Multi-Agent Modal Logic K (MMLK) to model dynamic strategy game properties was presented. Moreover, several search algorithms to decide the model checking problem in MMLK were provided. In the framework, the researchers distinguish between the solution concept of interest, which is represented by a class of formulas in MMLK, and the search algorithm proper. The solution concept defines the shape of the game tree to be explored and the search algorithm determines how the game tree is explored. As a result, several formulas classes and several of search algorithms can represent more than a dozen classical game tree search algorithms for single-agent search, two-player games, and multi-player games. They expressed the following algorithms: depth-first search, Minimax, Monte-Carlo Tree Search, Proof-Number Search, Lambda Search, Paranoid Search, Best-Reply Search.

Yuichiro Sato discussed *An Analysis of Voting Algorithm in Games,* joint research with Alessandro Cincotti, and Hiroyuki Iida. In the talk he discussed multiple-choice systems in the domain of games, e.g., 3-Hirn and consultation algorithm. However, he argued that little is known about the reasons why these systems work well. The researchers introduced a mathematical representation of multiple-choice systems to determine the necessary and sufficient condition of successful decision making on voting algorithm. They derived reasonable explanations for 3-Hirn and consultation algorithm in this context.

In the last presentation *A Bayesian Tactician*, Gabriel Synnaeve presented research performed together with Pierre Bessière. He described a generative Bayesian model of tactical attacks in strategy games, which can be used both to predict attacks and to take tactical decisions. This model is designed to easily integrate and merge information from other (probabilistic) estimations and heuristics. In particular, it handles uncertainty in enemy units' positions as well as their probable tech tree. They claimed that learning, being supervised or through reinforcement, adapts to skewed data sources. Their approach was evaluated on StarCraft. The parameters were learned on a new (freely available) dataset of game states, deterministically re-created from replays, and the whole model was evaluated for prediction in realistic conditions. The research resulted in the tactical decision-making component of a competitive StarCraft AI.

The workshop was enjoyed by all participants. The workshop proceedings are online available for free at: http://www2.lirmm.fr/ecai2012/images/stories/ecai_doc/pdf/workshop/W33_ComputerGames.pdf