ECAI COMPUTER GAMES WORKSHOP 2014

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From August 20 to August 22, the 21st European Conference on Artificial Intelligence was held in Prague, Czech Republic. In the two days preceding, 13 workshops were additionally held. On the first day (Monday, August 18) the Computer Games Workshop was held, chaired by Tristan Cazenave, Mark Winands, and Yngvi Björnsson at the Czech Technical University in Prague. A total of 20 papers were submitted: 12 papers were accepted for oral presentation and 8 were rejected. Moreover, 26 participants registered for the event. We briefly report on the accepted papers below.

In the first talk *Belief-Driven Pathfinding Through Personalized Map Abstraction,* Davide Aversa and Stavros Vasso investigated the case of belief-driven pathfinding (BDP) according to which characters maintain a personalized account of a dynamic changing game world. BDP is concerned with maintaining and revising a set of beliefs that persists over time as a character navigates to subsequent target destinations. This allows for a differentiation among characters with different observations in the game and can provide better believability. In the talk BPCA* was introduced, a practical BDP approach that is based on (i) decomposing the map into regions, (ii) personalized beliefs per character about the connectivity of regions, and (iii) the use of a regular pathfinding component as a service. The authors evaluated BPCA* in terms of computational effort and precision with regard to a regular solver over several benchmark maps. Their results motivate a simple belief revision strategy that induces small overhead and amortizes effort spent toward precision.

Subsequently, Hendrik Baier presented joint research with Mark Winands. Their paper *Monte-Carlo Tree Search and Minimax Hybrids with Heuristic Evaluation Functions* discussed three different approaches to employ minimax search with static evaluation functions in MCTS: (i) to choose moves in the play-out phase of MCTS (ii) as a replacement for the play-out phase and (iii) as a node prior to bias move selection. The MCTS-minimax hybrids were tested and compared to their counterparts using evaluation functions without minimax in the domains of Othello, Breakthrough, and Catch the Lion. Results showed that introducing minimax search is effective for heuristic node priors in Othello and Catch the Lion. The MCTS-minimax hybrids were also found to work well in combination with each other.

The next talk, *On the Complexity of General Game Playing,* written by Édouard Bonnet and Abdallah Saffidine, discussed the computational complexity of reasoning in General Game Playing (GGP) using various combinations of multiple features of the Game Description Language (GDL). Their analysis offers a complexity landscape for GGP with fragments ranging from NP to EXPSPACE in the single- agent case, and from PSPACE to 2-EXPTIME in the multi-agent case.

After the coffee break the paper *Coordinating Dialogue Systems and Stories through Behavior Composition*, written by Stefano Cianciulli, Daniele Riccardelli, and Stavros Vassos, was presented. The paper exploited behaviour composition in AI as a formal tool to facilitate interactive storytelling in video games. This is motivated by (i) the familiarity of transition systems in video game development, and (ii) the fact that behaviour composition extends the spectrum of approaches for non-linear storylines by introducing a new paradigm based on planning for a target desired process instead of a goal state. Moreover, the approach provides support for the debugging of deadlocks in stories at design level. The authors described the behaviour composition framework, and showed the details for an interactive dialogue system scenario in order to illustrate how interactive storytelling can be phrased in terms of it. They also reported on a simple architecture for implementing a demo game over the scenario using existing behaviour composition tools.

Next, Nicolas Jouandeau discussed *Small and Large MCTS Playouts applied to Chinese Dark Chess Stochastic Game,* joint research with Tristan Cazenave. He presented various changes applied to MCTS to deal with the stochastic game Chinese Dark Chess. The authors experimented with group nodes and chance nodes using various configurations: with different play-out policies, with different play-out lengths, with true or estimated wins. Results show that extending the play-out length is useful to create more informed play-outs,

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the usage of evaluation function can increase or decrease player's effectiveness through modifying the number of draw possibilities.

In the last talk of the session, *SHPE: HTN Planning for Video Games,* written by Alexandre Menif, Éric Jacopin, and Tristan Cazenave, described SHPE (Simple Hierarchical Planning Engine). It is a hierarchical task network planning system designed to generate dynamic behaviours for real-time video games. SHPE is based on a combination of domain compilation and procedural task application/decomposition techniques in order to compute plans in a very short time-frame. The planner was able to return relevant plans in less than three milliseconds for several problem instances of the *SimpleFPS* planning domain.

After lunch Mark Winands presented the paper *Minimizing Simple and Cumulative Regret in Monte-Carlo Tree Search*, a joint collaboration with Tom Pepels, Tristan Cazenave, and Marc Lanctot. In the talk a new MCTS variant, called Hybrid MCTS (H-MCTS) was introduced that minimizes cumulative and simple regret in different parts of the tree. H-MCTS uses SHOT, a recursive version of Sequential Halving, to minimize simple regret near the root, and UCT to minimize cumulative regret when descending further down the tree. The results showed genuine performance increase in Amazons, AtariGo, and Breakthrough.

The next presentation was entitled *Monte-Carlo Tree Search for the Game of "7 Wonders"*, written by Denis Robilliard, Cyril Fonlupt, and Fabien Teytaud. The authors studied MCTS on a more complex game, the game of "7 Wonders". This card game gathers together several known challenging properties, such as imperfect information, multi-player, and chance. It also includes an inter-player trading system that induces a combinatorial search to decide which decisions are legal. Moreover, it is difficult to hand-craft an efficient evaluation function since the card values are heavily dependent upon the stage of the game and upon the other player decisions. The authors argued that MCTS is a solution for this game and discussed how to apply it.

Before the last coffee break, Antonín Komenda gave the talk *On Robustness of CMAB Algorithms: Experimental Approach*, co-authored by Alexander Shleyfman and Carmel Domshlak. They experimentally analyzed robustness of two state-of-the-art algorithms Naive Monte Carlo (NMC) and Linear Side-Information (LSI) for online planning with combinatorial actions of the turn-based variant of the strategy game μRTS. The results showed that LSI is stronger with smaller budgets and shorter look-ahead.

In the first talk of the last session, *Fast Instantiation of GGP Game Descriptions Using Prolog with*, by Jean-Noël Vittaut and Jean Méhat, presented a method to instantiate game descriptions used in GGP with the tabling engine of a Prolog interpreter. Instantiation is a crucial step for speeding up the interpretation of the game descriptions and increasing the playing strength of general game players. Their method allows dealing with almost all of the game descriptions present on the GGP servers in a time that is compatible with the common time settings of the GGP competition. It instantiates descriptions more rapidly than previous published methods.

Next, *Job-Level Algorithms for Connect6 Opening Position Analysis*, by Ting-Han Wei, I-Chen Wu, Chao-Chin Liang, Bing-Tsung Chiang, Wen-Jie Tseng, Shi-Jim Yen, and Chang-Shing Lee, was presented. They investigated job-level (JL) algorithms to analyse opening positions for Connect6. They first proposed four heuristic metrics when using JL-PNS to estimate move quality. Next, they proposed a JL Upper Confidence Tree (JL-UCT) algorithm and heuristic metrics, one of which is the number of nodes in each candidate move's subtree. In order to compare these metrics objectively, they introduced two kinds of measurement methods to analyze the suitability of these metrics when choosing best moves for a set of benchmark positions. The results show that for both metrics this node count heuristic metric for JL-UCT outperforms all the others, including the four for JL-PNS.

In the last presentation Hanting Xie presented joint research with Daniel Kudenko, Sam Devlin, and Peter Cowling. Their paper *Predicting Player Disengagement in Online Games* introduced a pure data driven method to foresee whether a player will quit the game given their previous activity within the game, by constructing decision trees from historical gameplay data of previous players. The method was assessed on two popular commercial online games: *I Am Playr* and *Lyroke*. The former is a football game while the latter is a music game. The results indicated that the decision tree built by their method is valuable to predict the players' disengagement and that its human-readable form allow us to search out further reasons about what in-game events made them quit.

The workshop was enjoyed by all participants. The workshop proceedings will be published with Springer in their Communications in Computer and Information Science series.