

Game AI Research

Michael Buro



GAMES Group
University of Alberta

Game-playing, **A**nalytical methods,
Minimax search and **E**mpirical **S**tudies

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Outline

GAMES Group

My Research Interests and Projects

GAMES Group



Jonathan



Martin



Michael



Rob



Mike



Duane



Vadim



Ryan

30+ grad students

Abstract Games and Puzzles

- ▶ 15-Puzzle
- ▶ Go
- ▶ Checkers
- ▶ Poker
- ▶ Skat

- ▶ Heuristic search
- ▶ Combinatorial game theory
- ▶ Opponent Modeling
- ▶ Acting under uncertainty
- ▶ Endgame/pattern databases
- ▶ Evaluation function learning
- ▶ Multiplayer games ...

Video Games

- ▶ Role-playing Games
- ▶ Sports Games
- ▶ First Person Shooters
- ▶ RTS (StarCraft, ORTS)

- ▶ Multi-agent pathfinding
- ▶ Single-agent and adversarial planning
- ▶ Threat modeling
- ▶ Strategy visualization
- ▶ Scripting ...

My Research Interests

- ▶ Heuristic Search
- ▶ Adversarial Planning
- ▶ Abstraction
- ▶ Imperfect Information Games

Applications:

- ▶ Real-Time Strategy Games (StarCraft)
- ▶ Cardgames (Skat)
- ▶ Boardgames, Synthetic Games

Skat

The screenshot displays a Skat game interface on a wooden table background. At the top, two players are identified: EricStoner on the left and MrHoward on the right, each with a small portrait icon. EricStoner's hand consists of seven cards, all with a red patterned back. MrHoward's hand consists of seven cards, including the Ace of Diamonds, King of Diamonds, Ace of Hearts, and King of Hearts. In the center, a fan of cards is laid out, showing the 9 of Hearts, 10 of Hearts, 7 of Spades, 10 of Spades, King of Spades, Ace of Spades, 9 of Clubs, 10 of Clubs, King of Clubs, and Ace of Clubs. At the bottom, a red game log bar contains the following elements: a 'Sortieren' button with a card icon, a 'Letzter Stich' button with a card icon, a small green spade icon, the name 'EdFelson' with a portrait icon, a text box stating 'EricStoner legte Herz-Acht und EdFelson bekam den Stich', and a 'Restzeit' button with a clock icon.

EricStoner

MrHoward

Sortieren

Letzter Stich

EdFelson

Restzeit

EricStoner legte Herz-Acht und EdFelson bekam den Stich

Skat

Popular trick-based card game for 3 players

Similar to Contract Bridge

But:

- ▶ 1 vs. 2 players in cardplay phase (changing coalitions)
- ▶ Short card deck (32 cards)
- ▶ Simpler numerical bidding system
- ▶ Card points important, not number of tricks
- ▶ Declarer allowed to pick up and discard cards
- ▶ No dummy players

Project Goal: Defeat the best human players

Skat

- ▶ Search in Imperfect Information Games
- ▶ Dealing with more than 2 players
- ▶ Card inference and playing conventions
- ▶ Opponent and partner modeling
- ▶ Not much time (3 seconds per move on average)

Our program Kermit is playing at human expert level.



Jeff Long Tim Furtak Kermit

Weekly meetings: Fridays 11:00-12:00, Ath 337

Weekly Skat Session: Fridays 14:00-15:30, SUB Food Court

Thesis Topics related to Skat

1. Implement and test human playing conventions
2. Use Monte Carlo search for card inference
3. Learn strategy abstractions from games
4. Develop signalling mechanisms to improve defender cooperation
5. Design, implement, and test state-action evaluators for card play.

RTS Game AI



StarCraft I



ORTS

Real-time-Strategy (RTS) games are popular, fast-paced video games

Testbed for research on real-time AI, planning, and abstraction

Annual competitions! (we ended up 2nd out of 13 in August)

RTS Game AI

- ▶ Current RTS game AI systems have little reasoning, learning, and planning abilities
- ▶ Large number of **simultaneous micro actions**
- ▶ Fast-paced
- ▶ **Imperfect information**
- ▶ RTS games are feature-rich and can be **tailored** to particular research questions

We will be hosting the **third StarCraft AI competition** in August 2012. Join the team. We want to win this time!



Dave Churchill

Meetings: Tuesdays 12:30-13:30, Ath 337

Thesis Topics related to RTS Games

1. Multi-agent pathfinding based on triangulations
2. Combat simulation: design and test unit targeting and motion strategies.
3. Learn high- and low-level strategies from replays and mimic them in your StarCraft bot.
4. Design, implement, and test efficient and accurate state value predictors and incorporate them in look-ahead search.
5. Opponent modelling in RTS games: how to exploit weaker players?

Want to Participate in Exciting Game AI Research?

Visit me (Ath 337)

Walk into our research meetings

Send email: mburo@ualberta.ca

**Highly motivated, independent, and still looking for a
W2012 grad course?**

Talk to me about a 605 individual study course!

Interested in learning a great card game?

“Field research”: SUB (food court) Fridays at 2pm.

(Group meeting times: google michael buro)