# Games Research at U of A

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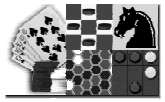
## Outline

- The **GAMES Group** at U of A
  - Classic Games Research
  - Commercial Games Research
- **ORTS**: An Open RTS Game Environment
  - RTS Games
  - Issues: Client Hacks & Weak A.I.
  - Project Roadmap, Current State
  - Demo



## GAMES Group at U of A

**G**ame-playing, **A**nalytical Methods,
**M**inimax search, and **E**mperical Studies

- **Classic Games**
  - Early A.I. test domain
    - Heuristic Search
    - Evaluation Functions
    - Opponent Modeling ...
  - Making computers strong(er)
  - **Goal: World-champion level**
- **Commercial Games**
  - Addressing A.I. problems game developers face
    - Pathfinding
    - Learning
    - Believable behaviour
    - Low/high level A.I. ...
  - **Goals: smart NPC or opponent behaviour - efficient algorithms**

## Classic Games Research

- Minimax Search Enhancements
- Evaluation Function Learning
- Imperfect Information
- Opponent Modeling
- Single Agent Search
- **Chinook** - Checkers World-champion
- **Logistello** - super-human Othello program
- **IS Shogi** - computer Shogi World-champion
- **OptiBot** - an "optimal" Poker program

## Commercial Games Research

- Tackling A.I. issues games developers face
  - **Efficient Pathfinding**
    - What topology? incremental, real-time
    - How to find paths for formations?
  - **Learning in Sports Games**
    - Finding/Avoiding "Sweet Spots"
    - Increasing replay value
  - **Scripting Languages** for role playing games
  - **A.I. for RTS Games**

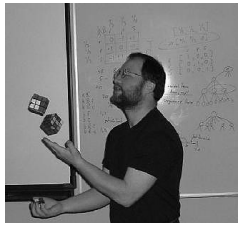
## Ties to Computer Games Companies

- Currently Electronic Arts and Bioware
- Get **source code access** to current titles: E.g.
  - FIFA Soccer
  - Baldur's Gate
  - Neverwinter Nights
- Run **experiments** with state-of-the-art game engines
- **Interact** with game developers
- Solve problems that matter
- **Internships**

## People








## Real-Time Strategy (RTS) Games

- Players build and command armies
- Real-time object motion usually on 2.5D battlefield
- Imperfect information ("Fog of War")
- Resources
- Technology tree

**+ Fancy graphics = Million sellers**
WarCraft, StarCraft, AoE, AoM, Homeworld ...

# A Typical RTS Game

StarCraft (tm)

# RTS Game Wish Lists

**Player Perspective:**

- Smarter unit level AI
- Better computer opponents/allies
- Multiple-view GUIs
- Hack-free game environment

**CS Perspective:**

- Better AI (low- and high-level)
- AI interfaces
- Man/Machine + Machine/Machine competitions

# ORTS - An Open RTS Game Environment

- Test domain for real-time AI research
- **Abstract** RTS game
- **Hack-free** server-side simulation
  - Only server maintains entire game state
  - Local player views are sent to clients
  - Clients send actions back to server
- Portable: C++ & SDL
- **Free software** - GPL

# Server-Side Simulation Issues

- Downstream data: **~ C * #visible objects**
  (10 KB/sec 4x250 objects @ 5 fps)
- Upstream data: **~ D * #own objects**
  ( ~1 KB/sec)
- **Bottlenecks:** CPU + network latency
- Need dedicated server
- Can the server be trusted?

## Server-Side Simulation Benefits

- All unit commands are generated in clients
  - Command for each unit in every frame
  - No fixed unit behaviour! Micro actions are sent
- **Users can roll their own client software**
  - GUIs with multiple views, resolutions etc.
  - Low-level unit behavior (a la Quake's AimBots)
- **Client hacks pointless**

## Project Roadmap

- **First:**
  - Finish server code, optimize it
  - Implement platform independent GUI
  - Client software, AI plugins for low-level unit behavior
  - "Advanced" RTS competitions (humans+AI plugins)
- **Then:**
  - AI arms race commences
  - Machine RTS game competitions
- **Ultimate Goal:**
  - High-level AI replaces human general

## Current State

- StarCraft-like terrain features almost complete
- Efficient object **motion** + **collision test**
- Not so efficient **tile-based view** computation
- Incremental / compressed data transmission
- Performance
  - worst case: all objects visible
  - on P3/1GHz: ~15 fps  1200 moving objects

## Current Projects

- Summer Students:
  - optimize server/client code
  - implement GUI
- Thesis Topics:
  - Learning low-level behavior
  - Heuristic search, abstraction, and planning
  - Scripting in RTS games

Demo