CS 6V81-05
Battle of Botcraft: Fighting Bots in Online Games with Human Observational Proofs

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Outline

1. Background
   - Game Bots
   - Game Playing Characterization

2. HOP System
   - Client-side Exporter
   - Server-side Analyzer
   - Performance and Scalability

3. Experiments
   - Setup
   - Results
   - Other Bots

4. Limitations
What is a Bot

A **Bot** is an exploit. It is an automated program used for gaining an unfair advantage during online gameplay.
What are HIPs

Human Interactive Proofs

1. Cumbersome for system traffic
2. Obtrusive to players
Mass Multiplayer Online Games
Affected Games

- World of Warcraft
- Ultima Online
- Diablo II
- Second Life
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4 Limitations
Early bots used small server farms. Sophistication came early with homebrewed clients.

- Client patches made to break bots
The Arms Race

- Bot coded for new client patch begets another patch by the game
- Emergence of pixel reading configurable bots
Advanced Bots

1. Use pixel scanning
2. Construct macros for automation
Simple Bots are Simple

MMOGs provide a large variety of possible interactions for players to perform, therefore their actions should include such variety. Bots have no need for this variety to be efficient.
High Level Behavioral Differences

**Human**
- Burst pattern with strong locality

**Bot**
- Repetitive, simple tasks
Bots do not optically perceive output data. Instead of being bounded by mechanical physics they glean some information from memory (i.e. Health or location coords)
Meet Glider Bot

Glider Bot is a WoW bot that runs concurrently with the client with admin privileges to circumvent Warden. Fights monsters and picks up items based on pre-configured locations and monster names based on current character level. 40 hours of collection
Meet The Humans

30 individuals
ranging in age from 18-45+
and skill level from none-10+ years
55 hours of collection
Input Parameters

- Keystroke
- Point
- Pause
- Click
- Point-and-Click
- Drag-and-Drop
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HOP Client

- Small, Standalone external program
- However, would ideally be incorporated into the integral executable or existing anti-cheat system
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Figure 7: Overview of the HOP system
Neural Network

Figure 8: A Cascade Neural Network
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The nature of MMOGs dictate that the HOP system be lightweight and have minimal impact upon either game client or server.
Performance

16 bytes per user input

- client side bandwidth consumption negligible
- exporter presence is imperceptible to end-user
Scalability

- designed for thousands of simultaneous users
- Valgrind estimates neural network memory consumption at 37Kbytes
- Single-threaded multi-client model
1 user input = 16 bytes
1 block = 4 inputs = 64 bytes
16 outputs = 2 bytes of bit array

**Total: aprox. 66 bytes per user**
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95 hours of logged gaming
over 3 million raw user inputs
Bot Data

- 40 hours of logged gaming
- 10 bot instances
- 7 areas of varying terrain
- levels 1-30
- 50% warrior/50% mage
## Human Data

- 55 hours of logged gaming
- 30 people
- level 1-30
- 60% melee/40% caster
### Test Sets

- 20 partitions
- each partition has a separate training set
- training set consist of either 9 bots and 30 humans or 10 bots and 27 humans
- test set is the remaining 1 bot or 3 humans
Keystroke Intervals

Figure 1: Keystroke Inter-arrival Time Distribution

(a) Bot

(b) Human
Keystroke Duration

Figure 2: Keystroke Duration Distribution
Point-and-Click Displacement

![Graphs showing speed vs. displacement for bots and humans.](image)

Figure 3: Average Speed vs. Displacement for Point-and-Click
Drag-and-Drop Duration

Figure 4: Drag-and-Drop Duration Distribution
Figure 5: Point-and-Click and Drag-and-Drop Movement Efficiency Distribution
Figure 6: Average Velocity for Point-and-Click
True Positives and True Negatives

![Graph showing True Positive and True Negative rates for different numbers of nodes and actions.](image-url)
Decision Times

Figure 10: Decision Time Distribution
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HOP for Diablo 2

1. without retraining the neural network
2. MMBot instead of Glider
   - coded using AutoIt and does not ready from memory
Diablo 2 Results

- 20 hours of recorded game time
- True Positive = .864
- True Negative = 1.0
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1. small group size
   - hardware variation
   - more bots
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2. allows for evasion
Questions