Lecture Notes for

Managing and Mining Multiplayer Online Games

Summer Semester 2017

Chapter 5: Game Analytics

http://www.dbs.ifi.lmu.de/cms/VO_Managing_Massive_Multiplayer_Online_Games

Overview

- What is Game Analytics?
- Responsibilities:
  - Fraud Detection
  - Game Balancing
- Reasons for Fraud in Computer Games
- Types of fraud
- Measures against fraud
- Monitoring player behavior
- Typical balancing tasks

Design Goals

Factors influencing sustainability of player experience:

- Games should be challenging, but not frustrating
- Games should guarantee a fair competition
- Game accomplishments should be persistent
- Games should allow/encourage social interaction
- Achievements should be visible for other players

  (Rankings, Title, Items, …)
- Games should be expanded and modified regularly
- Games must adapt to growing player skill

Game Analytics

Data Mining and statistical analysis of observed player behavior to gain knowledge about the manner in which a game is being played:

- Creating a game does not make you it's best player.
  How is a game played most effectively?
- Thousands of players cannot be monitored manually.
- How much time do players spend with the game?
  What aspect of the game occupies players most of the time?
- Game difficulty is relative to player skill:
  - *Who is playing, and what motivates players?*
  - *How capable are players with respect to different skills?*

Mining Game Data

Objectives:

1. **Fraud Detection**

Fraud influences a MMMO's long term success:

- micro-Transactions are no longer necessary
- wrecks other player's game experience

2. **Evaluating Game Balance**

- controlling difficulty level and player progress
- balancing power for different kinds of factions, classes, avatars…
- analysis of player resources necessary for success:
  time, skill and money.

E-Sports Analytics

How can players improve:

- How good do I play?
- How can I improve my performance?
- Which tactics and counter tactics exist?
- Which units are actually the best?
- What is the best team composition?
- What is the superior skilling?

How strong are E-Sports team:

- How well will my team score?
- Which new players should I recruit?
- How is my pool developing?
- How do I scout talents?

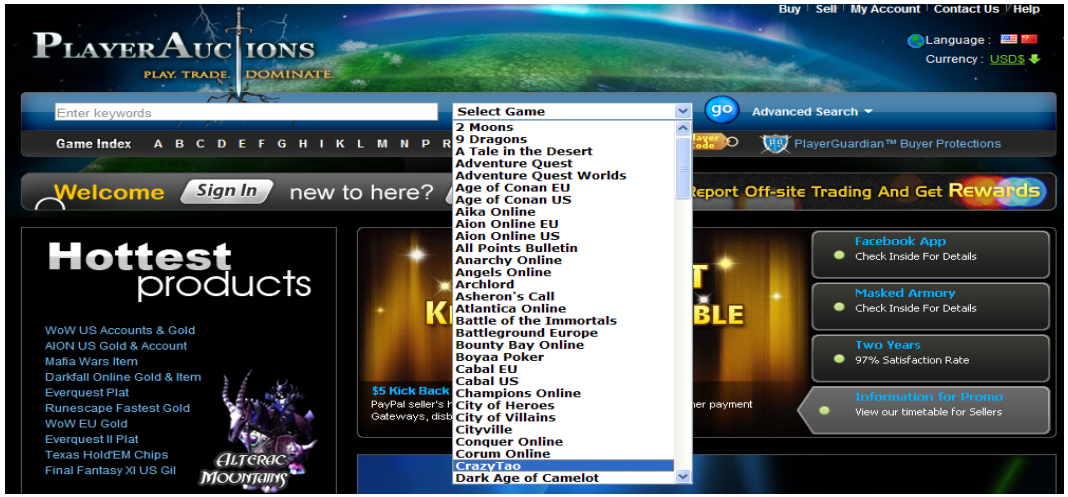
Why are Players committing fraud?

- ***Economic reasons***

  In-game currencies, goods or whole accounts have a real equivalent value: Poker Bots, Gold Farming, Account Trading, Item Trading, …

Example: Portals for trading game goods exist (playerauctions.com)

- More than 1 B USD accumulated player-to-player commercial value
- On average 25,000 daily transactions (ca. 20 pro Minute)
- More than 700 Massively Multi-Player Online Games are supported
- More than 30 MM completed transactions



Why are Players committing fraud?

- ***Saving time***

  example: AFK Bots (autonomous programs to control the game for completing lowly jobs (gathering, …) in player absence
- ***Prestige***

  in social games success is coupled with a standing.

  example: arena title,
- ***Fun***

  beating other players is fun, even if it is realized through unfair practices.

Any motivation is problematic

- Game operators directly loose money (micro transactions)
- Games loose sustainability and players loose interest
  (unfair competition, no performance comparability)

Technical ways to cheat

- ***Exploits:*** taking advantage of mistakes in game - design and programming
- ***Client Modifications (Hacks)***
  - Information Hack: player gets more information than intended. (e.g. Map-Hacks, Wall-Hacks, …)
  - circumventing game-physics or other rules (e.g. Teleportation Hack)
- ***Modifying other system components***
  - manipulation the network by manipulating latency, protocol headers or time-stamps(e.g. Protocol Hacks)
  - manipulating device drivers (e.g. Wall-Hacks with transparent textures)
- ***Botting***
  - control of an avatar to save time (Farm Bots)
  - control of an avatar to increase game power (Poker Bots)
- ***Macros, scripts, programmable I/O-devices***
  - partly automating control of an avatar to simplify complex actions (Gaming Macros)
  - programs that optimize user input (Aim Bot)

Other Possible Frauds

- ***Win-Trading***
  losing deliberatly to speed up the opponents progress

- ***Account Kidnapping:***
  takeover of a player account for a limited time:
  - selling the victims virtual possessions and in game money
  - obstructing the opponent during deciding game stages

- ***Illicit trade with virtual goods***
  - often in combination with account kidnapping
  - trade may counteract the game operators intention
    (If weak players control very successful avatars, it undermines the sustainability of fairly acquired successes)
  - trade may cut out the game operators commission

Countermeasures: Prevention

Cheat/Fraud Prevention

- important operations are calculated server side
- use of checksum methods on client programs
- clients receive software, that checks for fraudulent behavior (e.g. Punkbuster, Warden, …)

Advantage:

- prevents fraud before it affects other players

Disadvantages:

- control software has access to the whole computer (greatly endangers privacy)
- server side computations cost expensive resources and cut down the in game response time (waiting for an RTT)
- client computer are always under player control (virtual machines, Roots Kits, Code and DLL Insertion, …)

Countermeasure: Detection

Cheat/Fraud Detection:

- server side surveillance of players
- recognition of suspicious or fraudulent behavior
- sanctioning players for infractions
  (temporary expulsion from the game/Ban)

Advantages:

- fraud is detected server side
  - $\Rightarrow$ fraudsters are unable to analyze the detector
  - $\Rightarrow$ no breach of privacy

flexible approach, capable of detecting new kinds of fraud without adjustment

Disadvantage:

- reactive approach
  (fraud must occur, before being sanction-able)

Monitoring player behavior

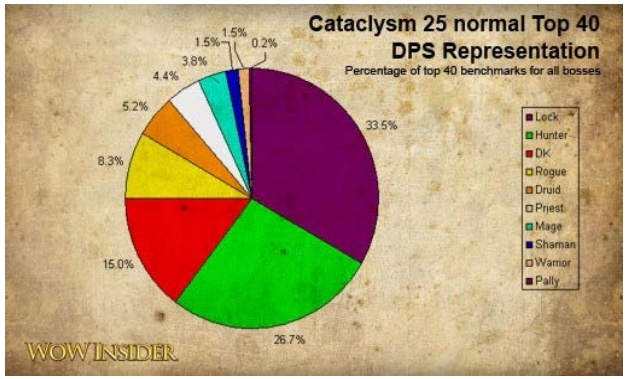
Challenges and Problems with Player surveillance:

- A chain of events is necessary for analysis.
  (saving the course of play is crucial)
- Reviewing every player action constitutes a very large calculation effort.
- Reviews should be as unspecific as possible, so variations and new possibilities can be detected without additional effort.
- Sanctioning fraud is a question of the operators' goals.
  (Not every minor cheat/exploit should lead to a ban)

Monitoring Game Balance

Game Balance describes:

- the difficulty level of the game
  (challenging, but not frustrating)
- the fairness of the game
  (Do all players have a fair chance for victory?)
- influence of skill, money and time
  (Should top players invest less or more money? How much time can/must be invested into the game?)



How are games balanced:

- defining design-goals
- establish mechanics to implement the goals
- examine how players react to the implementation

Monitoring Game Balance

Problems with Beta-Tests:

- The more is seen during the beta-test, the less “fresh content” is left for the actual game. (Spoiler)
- Beta-Tests are usually too small to include all group compositions, circumstances and possible tactics.
- New content should be released regularly
  => limited time frame for tests

⇒ Beta Tests require game analytics to be as comprehensive and effective as possible.

⇒ Control over current events and hot fixing problems are daily tasks of most MMORPGs.

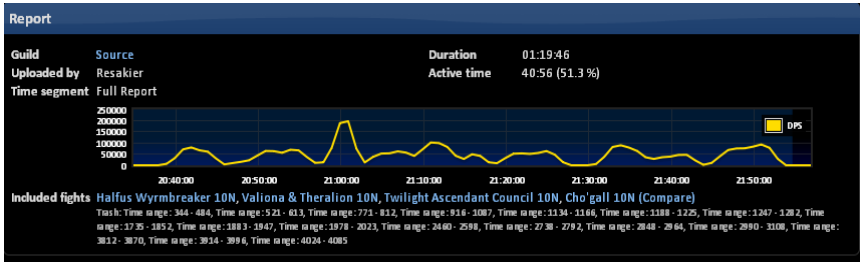
Characteristic game balance tasks

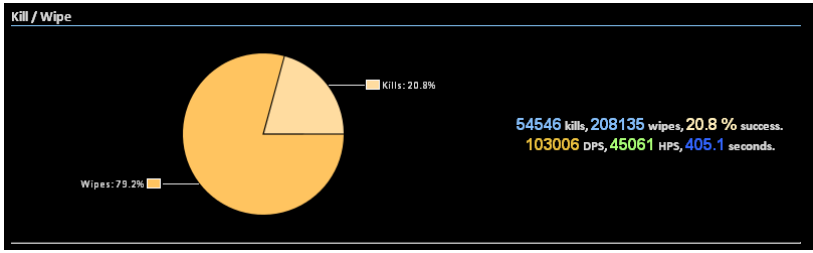
- **Predicting playing strength and match making**
  - Which teams should compete against each other?
    => dependent on playing strength and attendance of players
  - How are new teams ranked?
  - How should the player ranking be modified after the game?
- **Analysis of character classes and units**
  - Is the choice of faction or class a deciding factor for success?
  - What are the reasons behind this observation?
    => dependent on game-situations and player skill

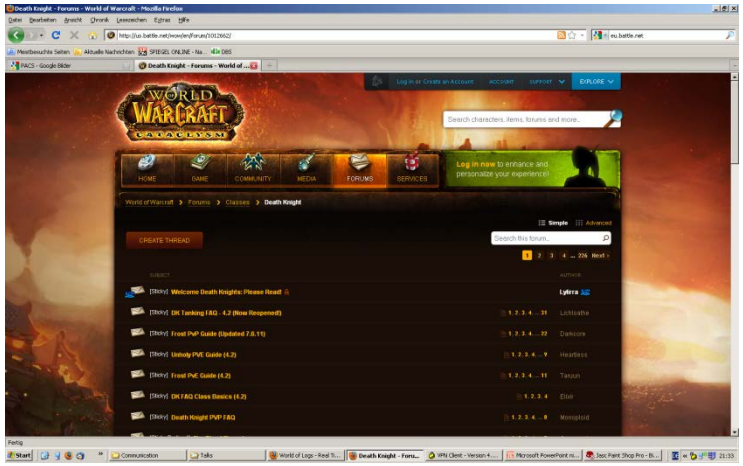
- **What kinds of players are there?**
  - Which players are most profitable?
  - What are specific player groups' needs?
  - Which kind of players are necessary for sustainable success of the game?

Important aspects for Game Balance

- Event Detection in data streams
- Monitoring of encounter-results
- Estimating play strength, to remove data bias
- Identification and description of characteristic strategies
  => *the more diverse, the more interesting is an encounter*
- Analysis of social media (e.g. Forum) and specifically including player opinions







Steps of an Analysis (Game Analytics)

1. Extraction of relevant data occurrences (Players, events, …)

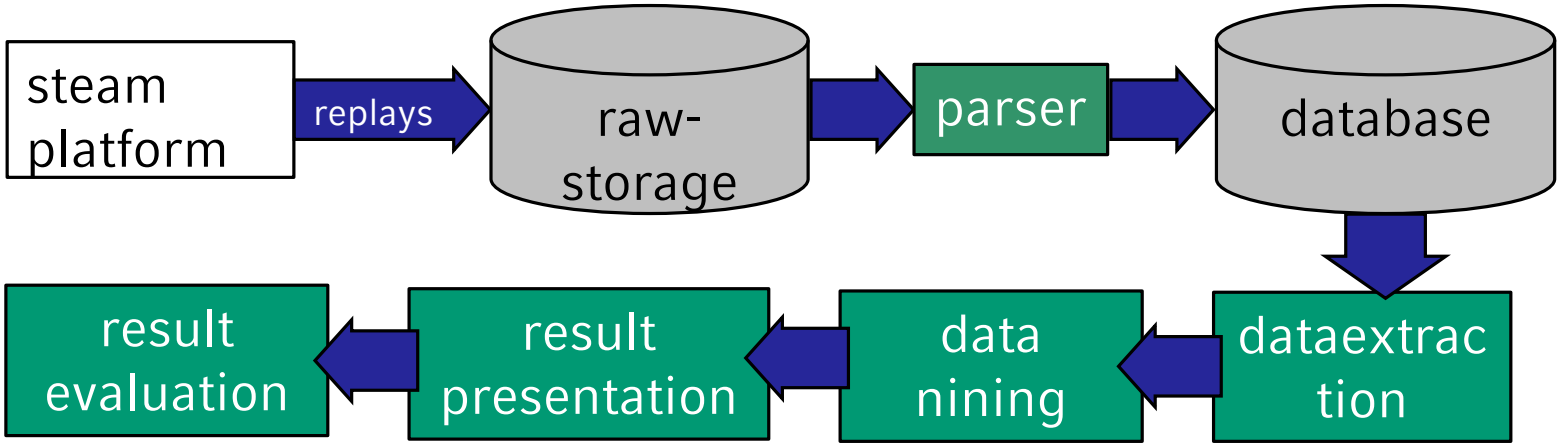
2. Modelling player behavior

3. Application of data mining algorithms
   1. Clustering
   2. Outlier Detection
   3. Classification

4. Analysis of found patterns

5. Development of measures to reach design-goals

Example: Analysis of DOTA2



- specifying results: When does one team win with 80% probability?
- data acquisition and processing
- generating knowledge: model for predicting the most likely winner upon receiving the situation
- evaluation: How good is the model? Is the result useful?

Learning goals

- What is game analytics?
- Fraud in computer games
- Motivations for fraud
- Methods of fraud
- Game Balance
- Balancing responsibilities

Bibliography

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