Introduction

IMGD 2905
Breakout Work

• What is data analysis for game development?
• Where does this data come from?
• What can game analysis do for game development?

• Icebreaker, Groupwork, Questions

https://web.cs.wpi.edu/~imgd2905/d20/breakout/breakout-1.html
What is data analysis for game development?
What is data analysis for game development?

• Using **game data** to inform the **game development** process

• Where does this data come from?

What is data analysis for game development?

• Using game data to inform the game development process

• Where does this data come from?

→ Players, actually playing game
  – Quantitative (instrumented)
  – Qualitative (subjective evaluation)
  – (But often lots more of the former!)
What can game analysis do for game development?
What can game analysis do for game development?

• **Improve level design** – e.g., see where players are getting stuck

• **Focus development on critical content** – e.g., see what game modes or characters are not used

• **Balance gameplay** – e.g., tune parameters for more competitive and fun combat

• **Broaden appeal** – e.g., hear if content/story is engaging or repulsing

• **Note**: game data often informs *players*, too
  – Analytics not dissimilar
Why is data analysis for game development needed?
Why is data analysis for game development needed?

• **Challenge**
  – Games gotten larger and more complex
    • Number of reachable states, characters
      → Game balance harder to achieve
  – Need for metrics to make sense of player behavior has increased

• **Opportunity**
  – New technologies enable aggregation, access and analysis
IMGD 2905 – Doing Data Analysis for Game Development

- **Data analysis pipeline** – get data from games, through analysis, to stakeholders
- **Summary statistics** – central tendencies of data
- **Visualization of data** – how to display analysis, illustrate messages
- **Statistical tests** – quantitatively determine relationships (e.g., correlation)
  - Probability needed as foundation (also used for game rules)
- **Regression** – model relationships
- **More advanced topics** (e.g., ML, Data management ...)

For this class:
- Described in lecture
- Read about in book
- Applied in projects and homework
Foundations for Data Analysis @ WPI

• Statistics classes
  – MA 2610 Applied Statistics for Life Sciences
  – MA 2611 Applied Statistics I
  – MA 2612 Applied Statistics II
• Probability classes
  – MA 2621 Probability for Applications
• Data Science (minor and major)
  – DS 1010 Introduction to Data Science
  – DS 2010 Modeling and Data Analysis
  – DS 3010 Computational Data Intelligence
  – DS 4433/CS4433 Big Data Management and Analytics
• Data Mining
  – CS 4445 Data Mining and Knowledge Discovery in Databases
• Other
  – CS 1004 Introduction to Programming for Non-Majors
  – CS 3431 Database Systems I

Note – other Stats and Probability classes are primarily geared for Math majors
Outline

• Overview (done)
• Game Analytics Pipeline (next)
• Game Data Analysis Examples
## Sources of Game Data

### Quantitative (Objective)
- Internal Testing
  - Developers
  - QA
- External Testing
  - Usability testing
  - Beta tests
  - Long-term play data

### Qualitative (Subjective)
- Surveys
- Reviews
- Online communities
- Postmortems

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**How to get from data to dissemination?**

→ *Game analytics pipeline*
Game Analytics Pipeline – Example

- **Collect-o-Bot**
- **Track-o-Bot**
- **JSON**
- **Python**
- **Excel**
- **PowerPoint**
- **Word**

**Analysis**

**Project 3!**
Game Analytics Tools

- **Games** – breadth of experience with games, specific experience with game to be analyzed

- **Tools** – import, clean, filter, format data so can analyze

- **Statistics** – measures of central tendency, measures of spread, statistical tests

- **Probability** – rules, distributions

- **Data Visualization** – bar chart, scatter plot, histogram, error bars

- **Technical Writing** and **Presentation** – white paper, technical talk; audience is peer group, developers, boss
Outline

• Overview (done)
• Game Analytics Pipeline (done)
• Game Data Analysis Examples (next)
Example:
Project Gotham Racing 4

- Publisher – Microsoft 2007
  - 134 vehicles, 9 locations, 10 game modes

- Analyzed data
  - (Authors worked at Microsoft)
  - 3.1 million log entries, 1000s of users

http://dl.acm.org/citation.cfm?id=1985952
Project Gotham Racing 4: Results

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<thead>
<tr>
<th>Game Mode</th>
<th>Races</th>
<th>% Total</th>
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- Thoughts?
- What are some main messages?
Project Gotham Racing 4: Results

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- **Mode**
  - *Offline career* dominates
  - *Network tournament* hardly used

- **Events**
  - *Street race* and *network street race* dominate
  - *Cat and mouse* never used

- **Vehicles** (not shown)
  - 1/3 used in less than 0.1% of races
Project Gotham Racing 4: Conclusion

• Content underused - 30-40% of content in less than 1% of races

• Use to shift emphases for DLC, next version
  – Asset creation costs significant, so even 25% reduction noticeable

• Other (not shown)
  – Encouraging new players to play career mode
    • Increasing likelihood of continuing play
  – Encouraging new players to stay with F Class longer
    • Rather than move to more difficult to control A Class
Example: Halo 3


- Publisher – Microsoft 2007
  - Achievements: single player missions, challenges such as finding skulls, multiplayer accomplishments...

- Analyzed data
  - (Author worked at Microsoft)
  - 18,0000 players
Halo 3: Results

- Thoughts?
- What are some main messages?
Halo 3: Results

- 73% of players completed campaign
  - Can compare to other Xbox games
- Took 26 days to accomplish
- Double that time for all original content
- DLC provides users up to 2 years of content

Good Descriptive Example
Example: League of Legends


- Publisher – Riot Games 2009
  - Rank: ~5 Tiers, 5 divisions each → 25
- User study (52 players)
  - Play LoL in controlled environment
  - Record objective data
    - (e.g., player rank and game stats)
  - Provide survey for subjective data
    - (e.g., match balance and enjoyment)

Game Balance

Too hard! Just right! Too easy!

Fun

Sweet spot

???
League of Legends: Results

Objective:

- Cumulative Distribution of Team Imbalance (difference in average player rank)
- Cumulative Distribution of Game Imbalance (difference in average team rank)
League of Legends: Results

**Objective**

Most teams are balanced
But about 10% more than 3 from mean

Most games evenly matched
But about 5% difference of 2 from mean

**Subjective**

Main messages?

Balance

My team was much better
The teams were even
The other team was much better

Main messages?

Enjoyment

Loss
Win
League of Legends: Results

Objective

Most teams are balanced
But about 10% more than 3 from mean

Win?
Game is balanced
Lose?
Game is imbalanced

Most games evenly matched
But about 5% difference of 2 from mean

Subjective

Win?
Game is fun (70%), never not fun
Lose?
Game is almost never fun (90%)
League of Legends: Results

Matchmaking systems may want to consider - e.g., balance not so important, so long as player not always on imbalanced side.
Summary

• Data analysis for games increasingly important
  – Has potential to improve game development
• Knowledge and skills required
  – Scripting
  – Statistics
  – Data analysis
  – Writing and presentation

“Let’s get to it, already!”
-- Tracer (Overwatch)