Introduction

IMGD 2905
Groupwork

• 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/d23/groupwork/1-introduction/handout.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 collecting data, 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
• Hint at 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

How to get from data to dissemination?
→ Game analytics pipeline
Game Analytics Pipeline

- Game
- Raw Data
- Extracted Data
- Analysis
  - Exploratory Graphs/Stats
  - Statistical Tests
  - Charts and Tables
- Dissemination
  - Presentation
  - Report
Game Analytics Pipeline – Example

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

**Project 3!**
Game Analytics Components

- **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)
  – Table -
  – Scatter plot
  – Boxplot
Example: Project Gotham Racing 4

http://dl.acm.org/citation.cfm?id=1985952

- Publisher – Microsoft 2007
  - 134 vehicles, 9 locations, 10 game modes
- Analyzed data
  - (Authors worked at Microsoft)
  - 3.1 million log entries, 1000s of users
Project Gotham Racing 4: Results

- Thoughts?

- What are some main messages?

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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 emphasis to 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)
League of Legends: Results

- Main messages?
- Main messages?
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?
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**

Win? Game is balanced
Lose? Game is imbalanced

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

Imbalance in player’s favor the *most* fun!

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)