

# Week 3 Video 2

## Data Synchronization and Grain-Sizes

# You have ground truth training labels...

- How do you connect them to your log files?
- The problem of synchronization
- Turns out to be intertwined with the question of what grain-size to use

# Grain-size

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- What level do you want to detect the construct at?

# Orienting Example

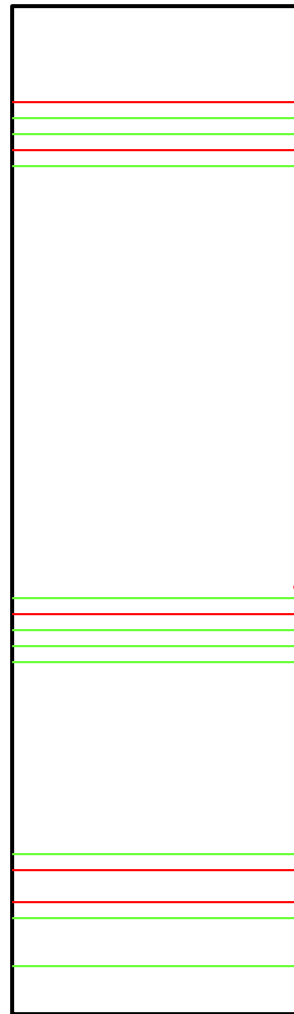
- Let's say that you want to detect whether a student is gaming the system, and you have field observations of gaming
- Each observation has an entry time (e.g. when the coder noted the observation), but no start of observation time
- The problem is similar even if you have a time for the start of each observation

# Data

Monday 8am

Monday 3pm

Friday 3pm



Gaming

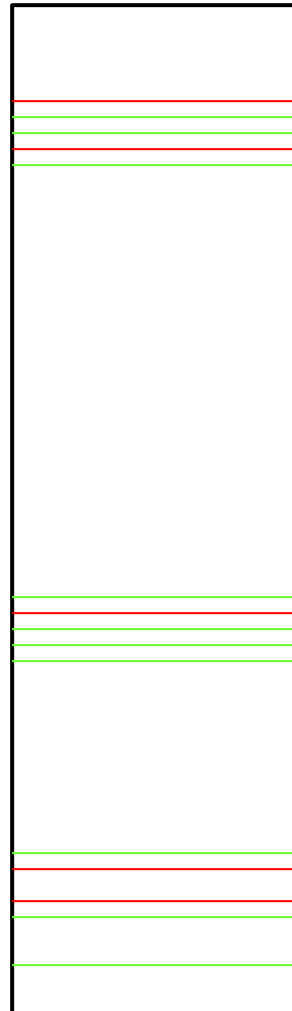
Not Gaming

# Data

Monday 8am

Monday 3pm

Friday 3pm



Notice the gap;  
maybe students  
were off this day...  
or maybe the  
observer couldn't  
make it

# Orienting Example

- What grain-size do you want to detect gaming at?
- Student-level?
- Day-level?
- Lesson-level?
- Problem-level?
- Observation-level?
- Action-level?

# Student level

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- Average across all of your observations of the student, to get the percent of observations that were gaming

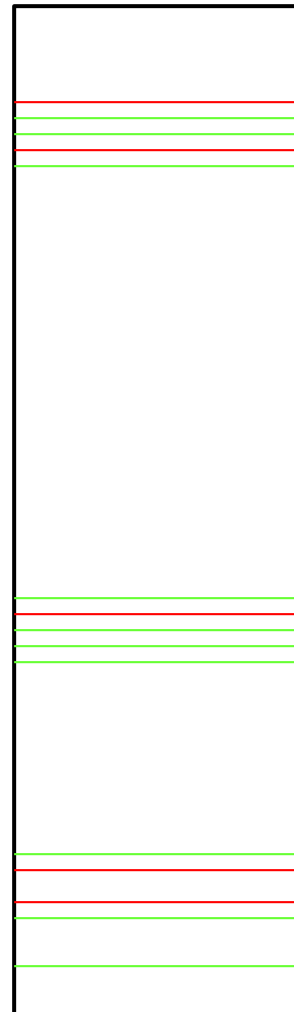


# Student level

Monday 8am

Monday 3pm

Friday 3pm



Gaming

5 Gaming

10 Not Gaming

This student is  
33.33%  
Gaming

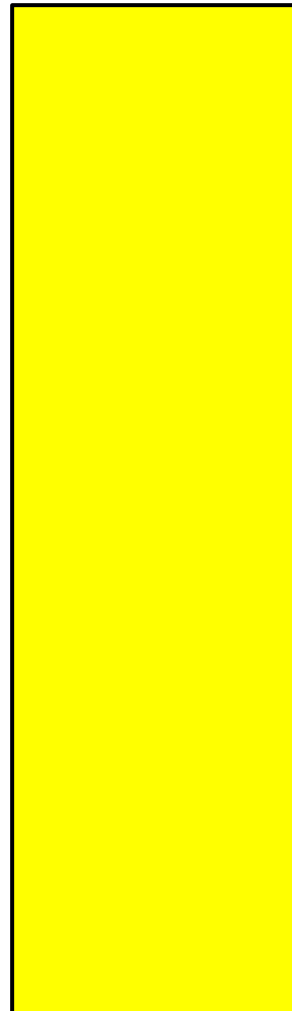
Not Gaming

# Student level

Monday 8am

Monday 3pm

Friday 3pm



5 Gaming

10 Not Gaming

This student is  
33.33%  
Gaming

# Notes

- Seen early in behavior detection work, when synchronization was difficult (cf. Baker et al., 2004)
- Makes sense sometimes
  - When you want to know how much students engage in a behavior
  - To drive overall reporting to teachers, administrators
  - To drive very coarse-level interventions
    - For example, if you want to select six students to receive additional tutoring over the next month

# Day level

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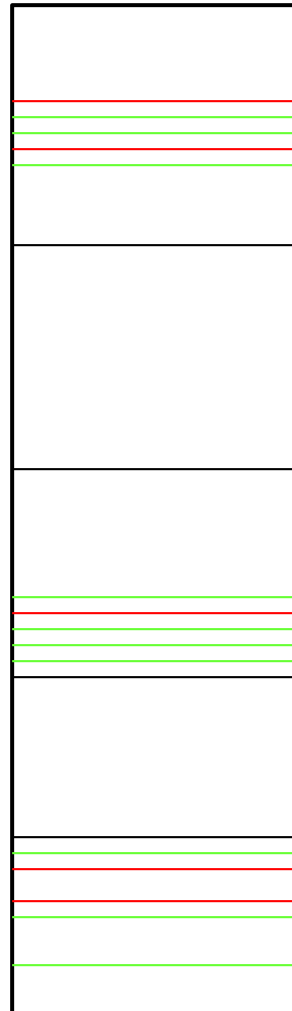
- Average across all of your observations of the student on a specific day, to get the percent of observations that were gaming

# Day level

Monday 8am

Monday 3pm

Friday 3pm



Monday 40%

Tuesday 0%

Wednesday 20%

Thursday 0%

Friday 40%

# Notes

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- Affords finer intervention than student-level
- Still better for coarse-level interactions

# Lesson level

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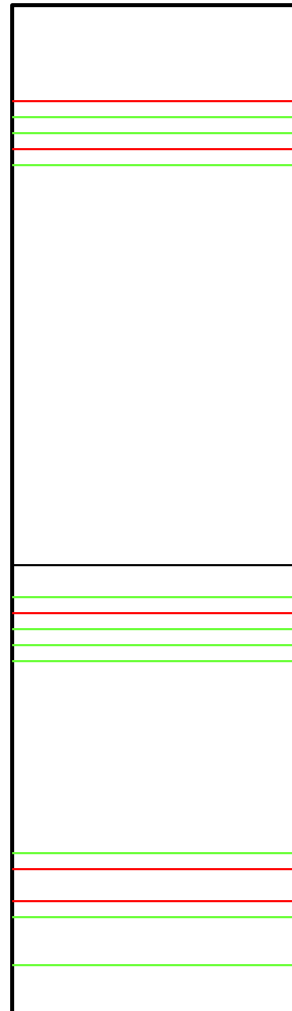
- Average across all of your observations of the student within a specific level, to get the percent of observations that were gaming

# Lesson level

Monday 8am

Monday 3pm

Friday 3pm



Lesson 1: 40% gaming

Lesson 2: 30% gaming



# Notes

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- Can be used for end-of-lesson interventions
- Can be used for evaluating lesson quality

# Problem level

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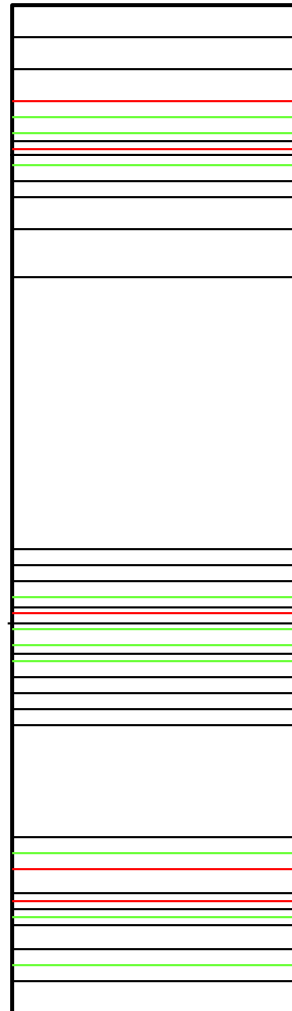
- Average across all of your observations of the student within a specific problem, to get the percent of observations that were gaming

# Problem level

Monday 8am

Monday 3pm

Friday 3pm



# Notes

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- Can be used for end-of-problem or between-problem interventions
  - Fairly common type of intervention
- Can be used for evaluating problem quality

# Challenge

- Sometimes observations cut across problems
- You can assign observation to
  - problem when observation entered
  - problem which had majority of observation time
  - both problems

# Observation level

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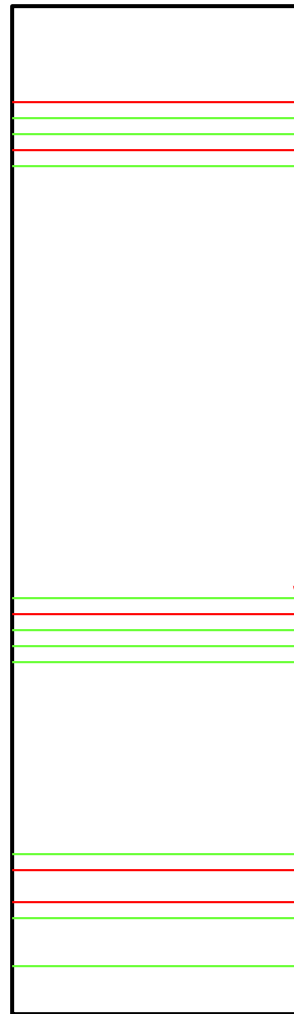
- Take each observation, and try to predict it

# Observation level

Monday 8am

Monday 3pm

Friday 3pm



Gaming

Not Gaming

# Notes

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- “Most natural” mapping
- Affords close-to-immediate intervention
- Also supports fine-grained discovery with models analyses



# Challenge

- Synchronizing observations with log files
- Need to determine time window which observation occurred in
  - Usually only an end-time for field observations; you have to guess start-time
  - Even if you have start-time, exactly where in window did desired behavior occur?
  - How much do you trust your synchronization between observations and logs?
    - If you don't trust it very much, you may want to use a wider window

# Challenge

- How do you transform from action-level logs to time-window-level clips?
  - You can conduct careful feature engineering to create meaningful features out of all the actions in a clip
  - Or you can just hack counts, averages, stdev's, min, max from the features of the actions in a clip (cf. Sao Pedro et al., 2012; Baker et al., 2012)

# Action level

- You could also apply your observation labels to each action in the time window
- And then fit a model at the level of actions
  - Treating actions from the same clip as independent from one another
- Offers the potential for truly immediate intervention

# Action level

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- Some models identify the overall construct at the action level, but validate at the clip level (Paquette et al., 2015)
- Less certain, action by action, but allows more rapid and targeted intervention

# Bottom-line

- There are several grain-sizes you can build models at
- Which grain-size you use determines
  - How much work you have to put in (coarser grain-sizes are less work to set up)
  - When you can use your models (more immediate use requires finer grain-sizes)
- It also influences how good your models are, although not in a perfectly deterministic way

# Next Lecture

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- Feature Engineering