

CPSX

a tool for online collaborative problem solving in
OpenEdX

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Collaborative work with Peter Halpin (NYU)

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Motivation

- Use of pairwise or small group discussion is a well-established and highly valued classroom practice
 - Webb, 1989; Topping, 2005; Smith et al., 2009



Mennonite Church USA
Archives, via Wikimedia
Commons

Motivation

- Computer-mediated discussion replaces face-to-face interaction in online learning environments



Motivation

- Most LMSs have asynchronous forums
 - but not real-time discussion for small groups
- External tools (Skype, Google, etc.)
 - do not dovetail with LMS user/author experience and logging opportunities
- Some apps wrap task creation in with the collaboration affordance
 - Bazaar (Adamson & Rosé, 2012)
 - MoocChat (Coetzee et al., 2015)
- Small group discussion applies to assessment research regarding collaboration and collaborative problem solving
 - von Davier & Halpin, 2013

Foundations of Collaborative Assessment (FoCA) Project

- I. Deploy an experimental platform for collaborative assessment with a *minimal design*
 - Groups of 2 (or more) participants communicate (possibly remotely) while solving simple, text-based items
 - Measure effect size of collaboration and explore statistical models of interdependence
 - Collect pilot data from crowd-sourcing on Amazon M-Turk
 - Study repurposed publically released NAEP math items
 - Collaboration with Peter Halpin (NYU), Jason Rarick (NYU), Patrick Barnwell (ETS)
- II. Develop and release an extension (XBlock) for OpenEdX, enabling small-group, real-time chat on assignments

Why use an open-source MOOC platform for ETS research?

- Center for Advanced Psychometrics and other groups* are interested in understanding and assessing collaboration and collaborative outcomes.
- There are proprietary developments at ETS with regard to potential future assessment products.
- At the same time, an open-source contribution to OpenEdX supports ETS's educational service mission
 - and promotes collaboration with external partners
- OpenEdX has robust existing assessment tools
 - Fast prototype to experiment

* Special thanks to Patrick Kyllonen and the Center for Academic and Workforce Readiness and Success for funding this particular project


CPSX stack

- OpenEdX
- CPSX XBlock (Python)
- Chatapp (Ajax & PHP)
 - Does not itself require OpenEdX
 - Requires LAMP (Linux, Apache, MySQL, PHP)

<https://github.com/ybergner/cpsx>


- Design considerations
 - chat sessions can be limited to small groups
 - use alongside any OpenEdX media/assessment units
 - should not require maintaining a separate server

Using CPSX as an author/instructor


 CPSX CPS101
CPSX Demo


Content ▾ Settings ▾ Tools ▾


Section / Collaborative Section


Unit 


Add New Component


Advanced


Discussion


HTML


Problem


Video




CPSX CPS101
CPSX Demo

Content ▾

Settings ▾

Tools ▾

Section / Collaborative Section

Unit 

Collaborative Problem Solving

Cancel

Editing: Collaborative Problem Solving

Chat Room Name

RoomName

Common identifier
across screens

Group Size

2

Wait Time (in minutes)

5

Queuing

Save

Cancel

Using CPSX as a student

Collaborative Part

Survey

NUMERICAL RESPONSE

From a shipment of 500 batteries, a sample of 25 was selected at random and tested. If 2 batteries in the sample were found to be dead, how many dead batteries would be expected in the entire shipment?

?

☐

CHECK

Click to search for chat partners

Normally, chat initiation would take place before the presentation of the assignment

Collaborative Part

Survey

NUMERICAL RESPONSE

From a shipment of 500 batteries, a sample of 25 was selected at random and tested. If 2 batteries in the sample were found to be dead, how many dead batteries would be expected in the entire shipment?

?

CHECK

Waiting for partners to chat - Time left: 04:53

Collaborative Part

Survey

NUMERICAL RESPONSE

From a shipment of 500 batteries, a sample of 25 was selected at random and tested. If 2 batteries in the sample were found to be dead, how many dead batteries would be expected in the entire shipment?

?

CHECK

Ok! Your partners are ready. Click **Begin** to start the chat.

Begin

Collaborative Part

Survey

NUMERICAL RESPONSE

From a shipment of 500 batteries, a sample of 25 was selected at random and tested. If 2 batteries in the sample were found to be dead, how many dead batteries would be expected in the entire shipment?

?

CHECK

Collaborate with peers

Type your message...

Current chat peers: ybergner, bob

[18:21:25] bob: hello

[18:21:20] ybergner: Hi I'm yoav

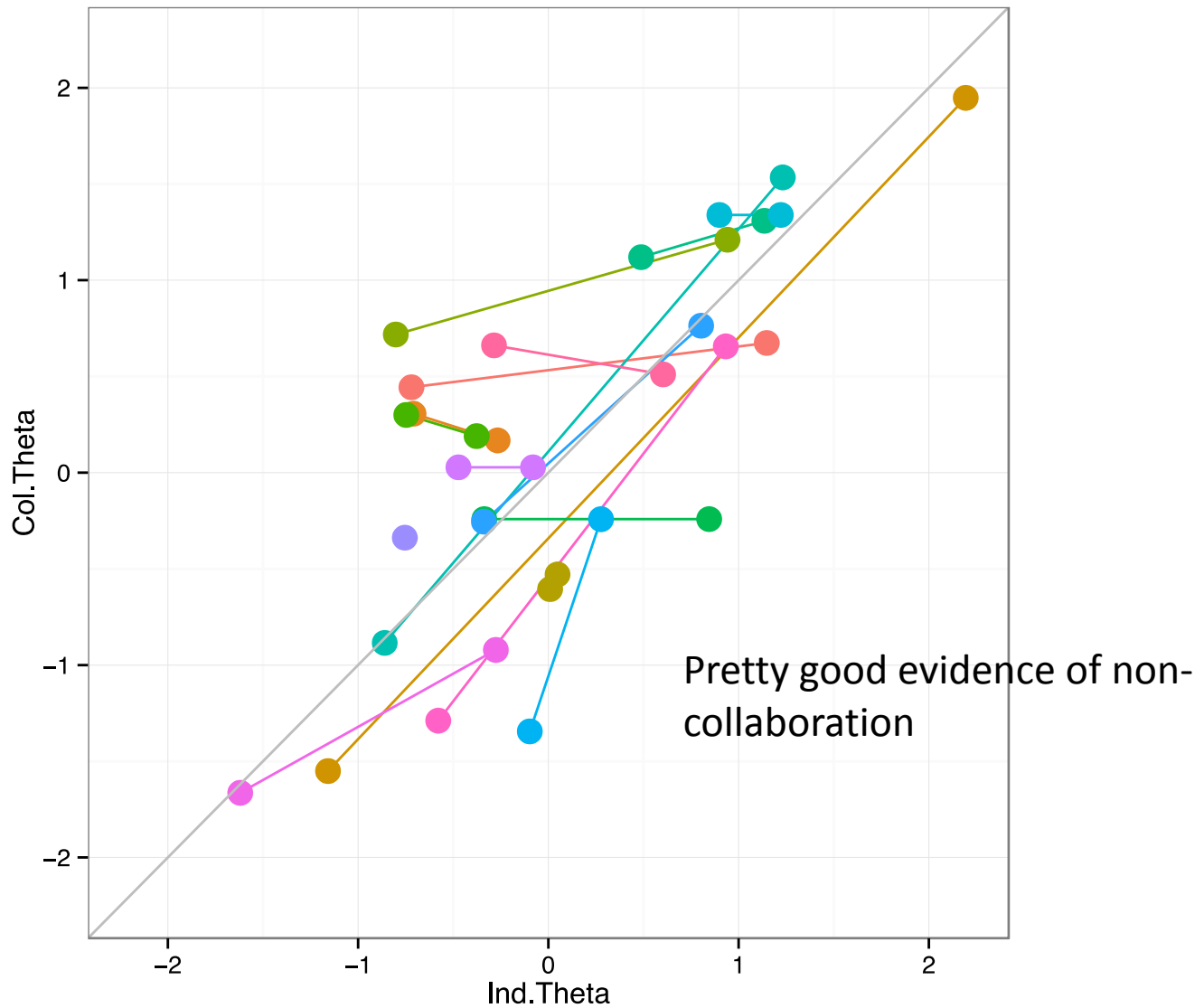
Log out of chat session

Explicit logout exists so that accidental loss of connection does not end session

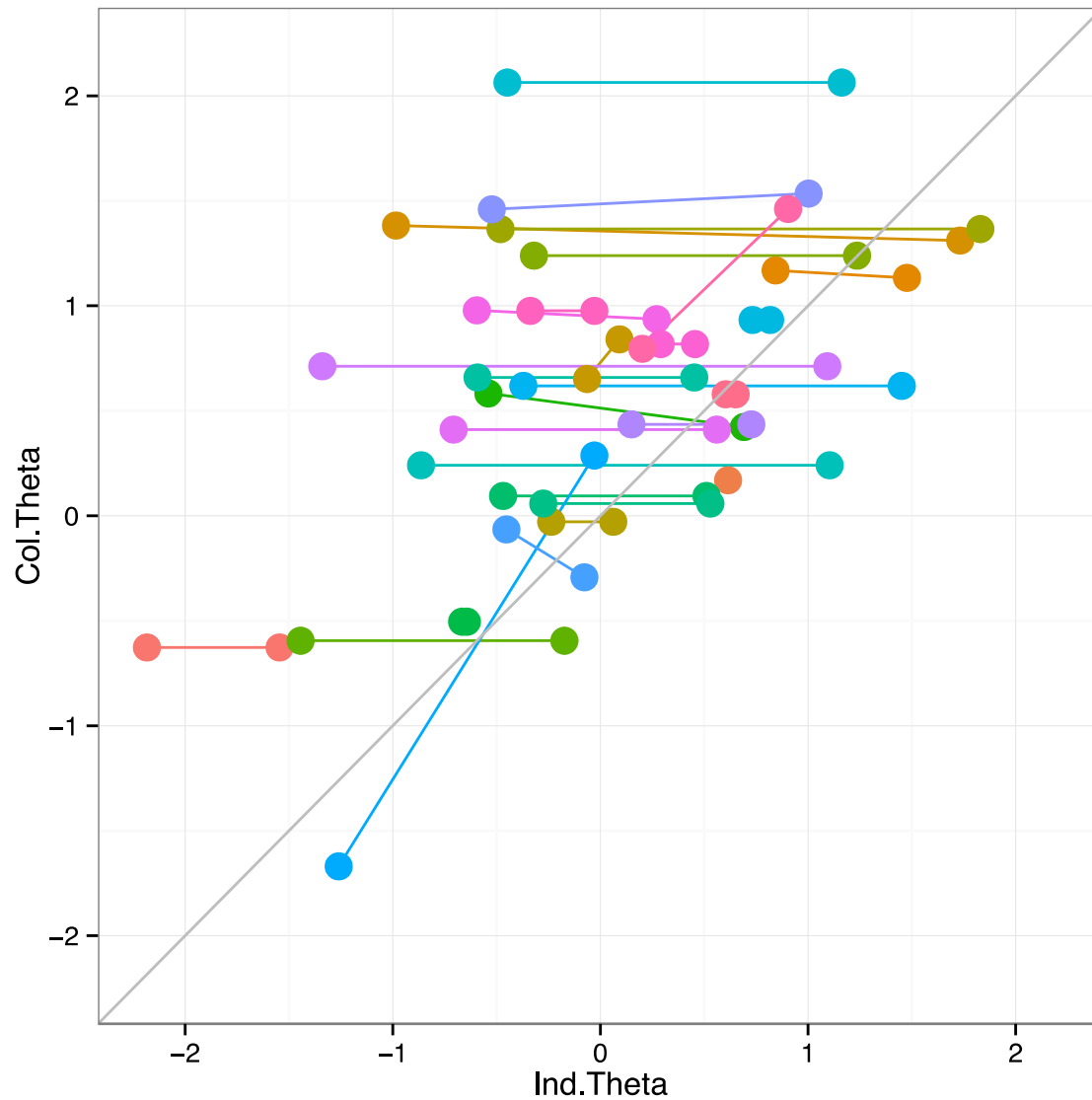
Experimental design

- Use OpenEdX platform as delivery/scoring mechanism
- Reuse 100 math items developed for NAEP Grade 12
- Calibrate items with an IRT model (2PL) based on individual performance ($N > 350$)
- Administer one test form individually and form collaboratively using chat interface
 - Ultimately would like counterbalanced design to avoid fatigue/practice effects, but pilot data are not counterbalanced
- Record interaction for analysis
- Recruited 350 M-turkers for individual calibration and 120 more for pilot testing and collaboration study
 - 46 usable pairs

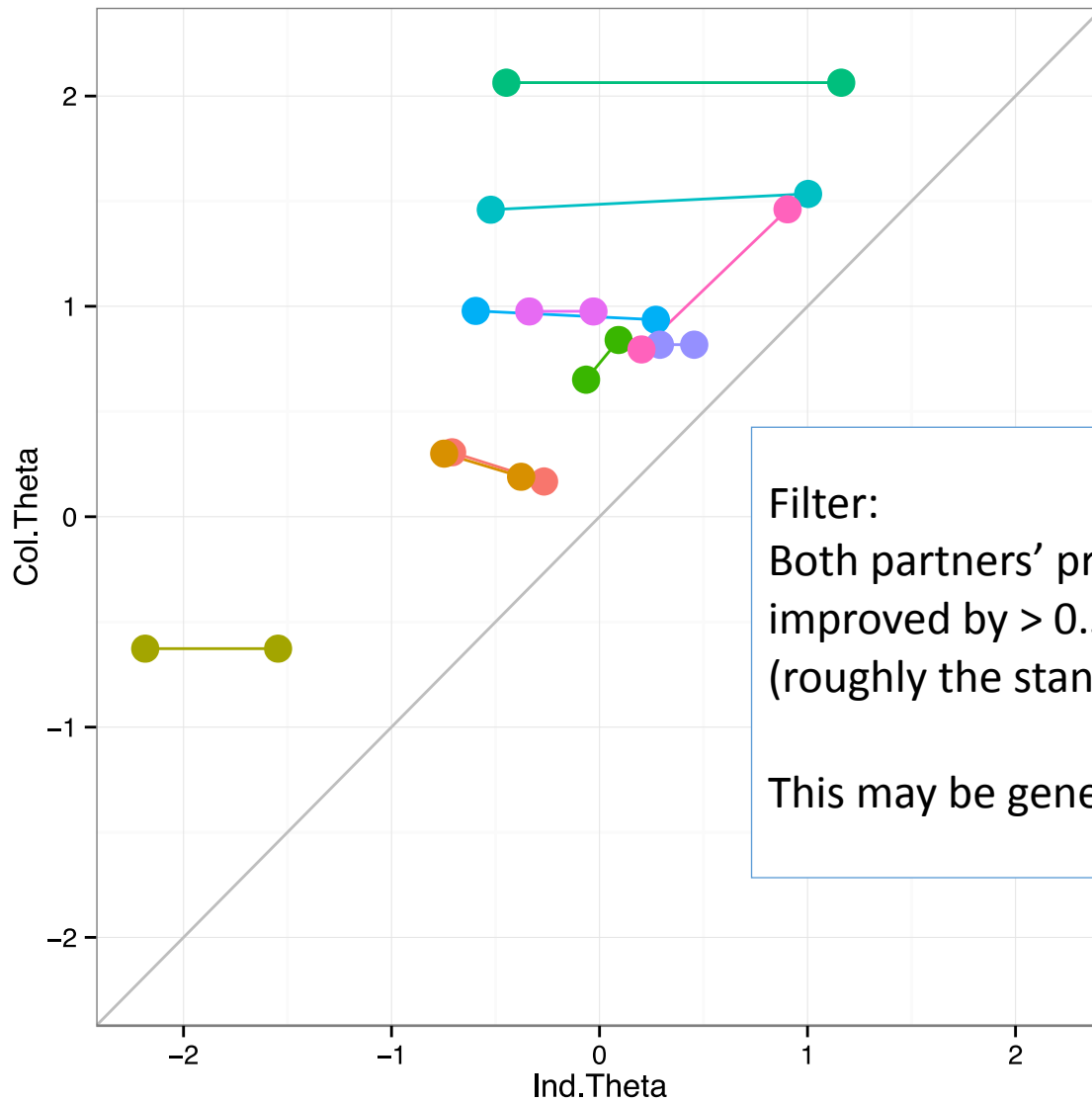
Results: early sample



Results: after instructions added



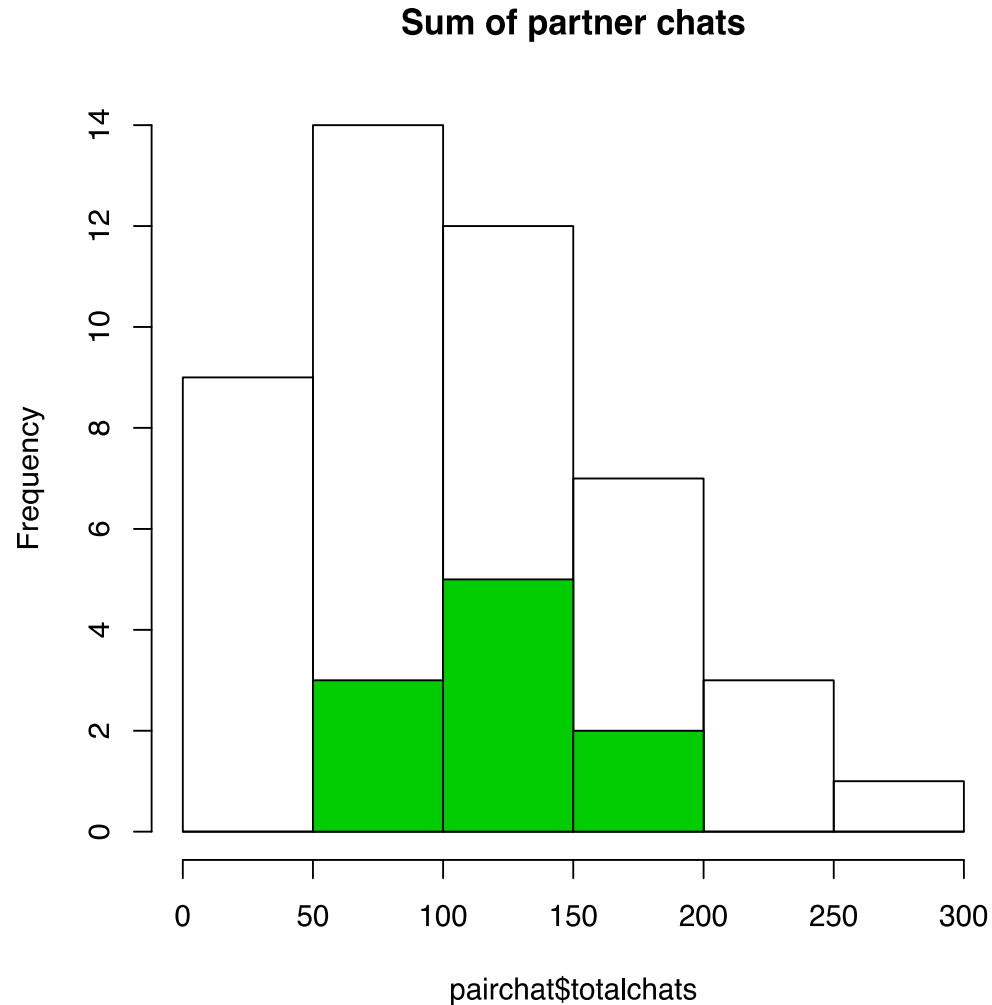
Results: “positive” collaboration



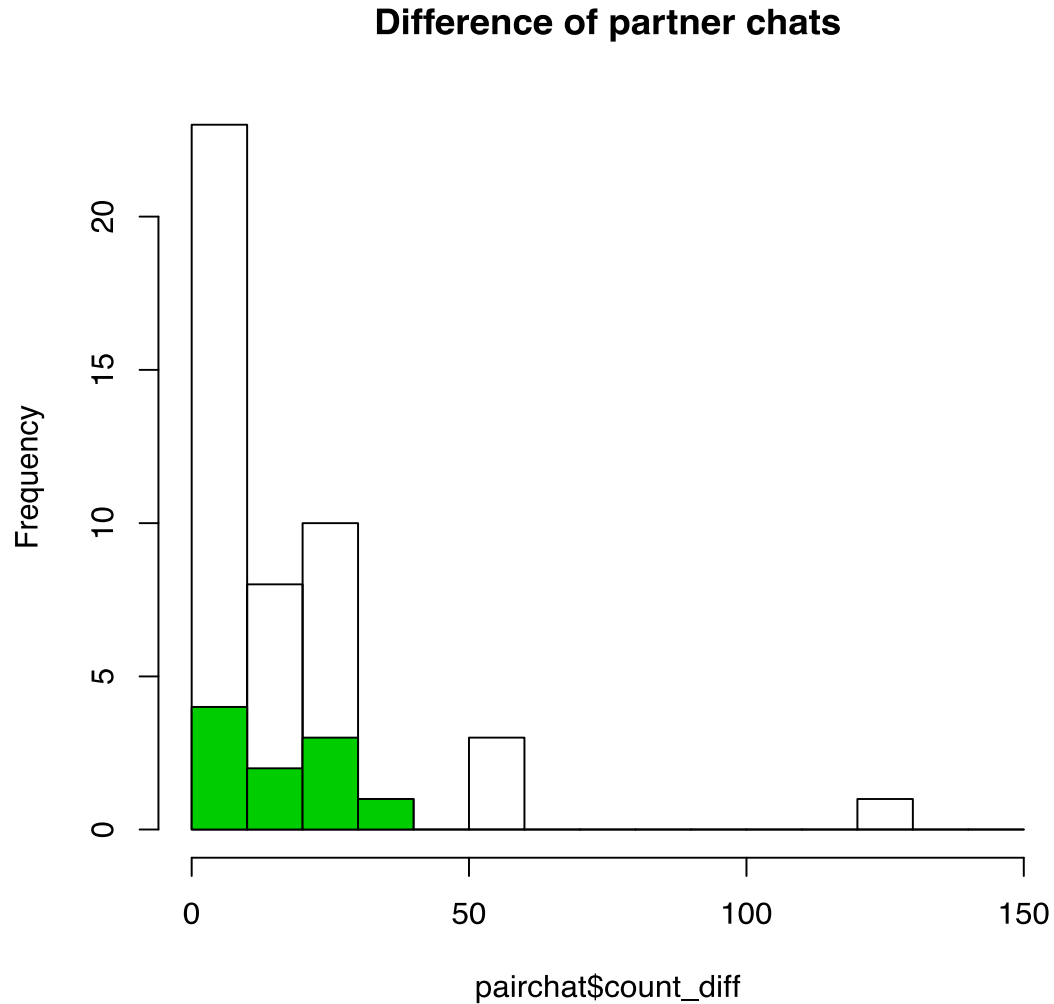
Filter:
Both partners' proficiencies
improved by > 0.35 units
(roughly the standard error)

This may be generous

It's not just the number of chats



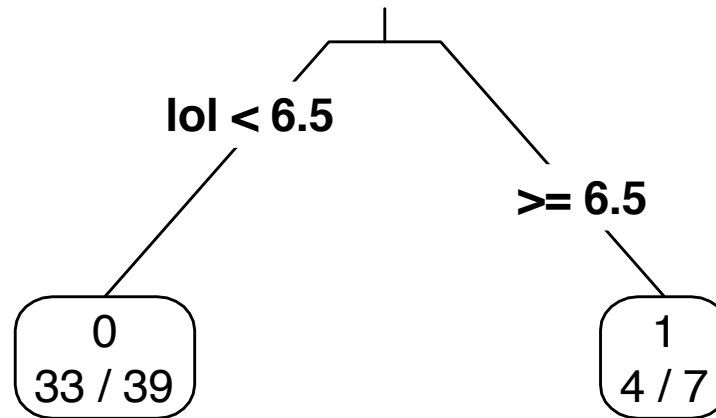
Or the balance



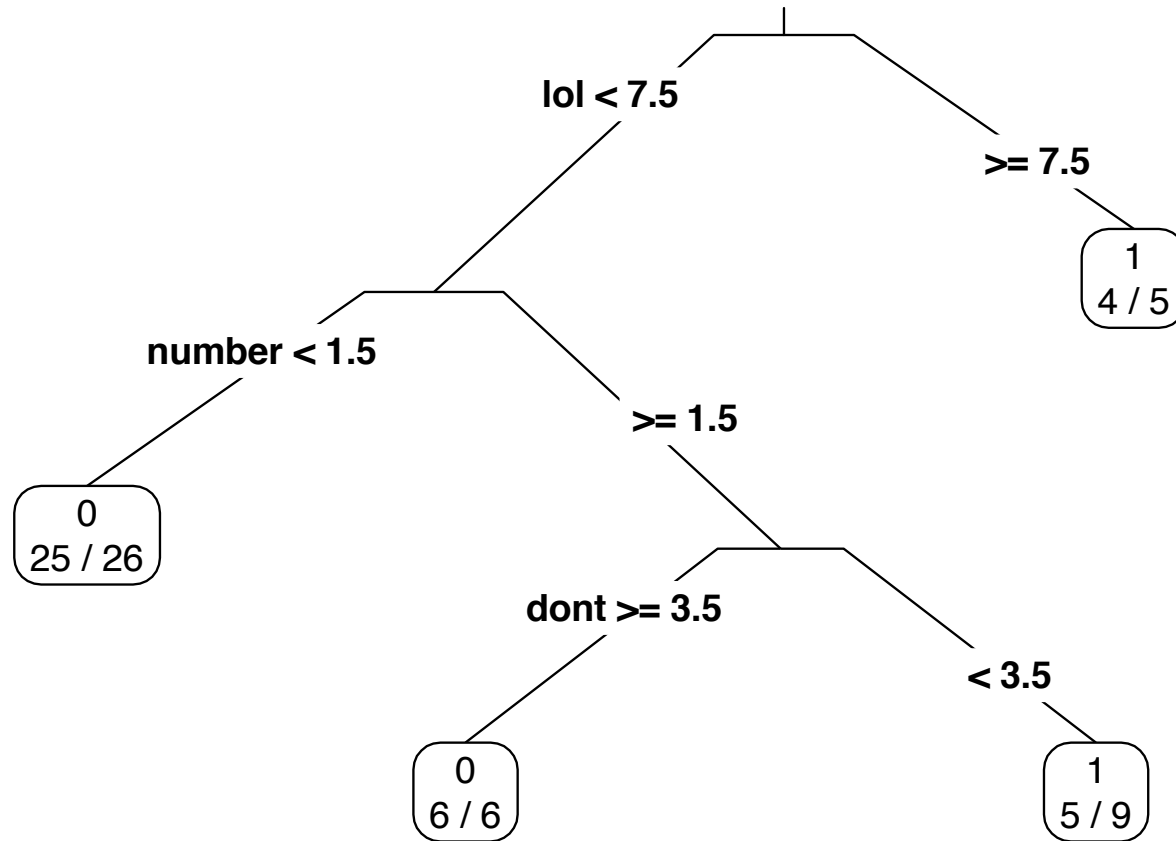
Sample chat log

member_id	message
5245	132 If it's a dollar amount that they're asking, then yeah, 5
5246	132 I think that's right
5247	133 yeah, wasn't quite sure if dollar amount or percentage
5249	132 Me either, lol :)
5250	133 lets go with the dollar figure, ok?
5252	132 Okay, 5 it is :)
5254	132 Last problem.
5259	133 doesn't seem like the graph has all the info needed.
5261	132 Yeah, I see that :/
5263	133 if I had to guess then ... 15
5264	133 1 percent of the clocks
5265	132 Okay, I'll go with 15 too :)
5268	133 cool. we're done!
5269	132 That was fun!
5270	132 Nice working with you! :)
5271	133 thanks for help
5273	132 You too, have an awesome day :)
5274	133 get that money
5275	132 Yes, you too :D

Best classifier ever! LOL!



Keep calm and talk about numbers



Ongoing and future work

- Statistical analysis of interdependence models

$$P(X_{ijk} \mid \theta_j, \theta_k, w_j, w_k) = w_j P(X_{ij} \mid \theta_j) + w_k P(X_{ik} \mid \theta_k) \\ + (1 - w_j - w_k) P(X_{ij} \mid \theta_j) P(X_{ik} \mid \theta_k)$$

- Parse chat logs for collaboration evidence
- AMT data are not great
 - Crowd-workers were not particularly conscientious
 - Not really our target population
- Conduct small study with NYU undergraduates
- Improvements of XBlock

Wishlist

- Cohort criteria — non-random pairing
- Synchronization control — condition each step
- Auto-completion — allow range of group-sizes
- Graphic enhancement
- Intelligent support (!)

<https://github.com/ybergner/cpsx>

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Thank you!

ybergner@ets.org

[GitHub: ybergner/cpsx](https://github.com/ybergner/cpsx)

- Special thanks to CAWRS initiative
 - And Peter Halpin, Jason Rarick, and Patrick Barnwell



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