The Label Complexity of Mixed-Initiative Classifier Training

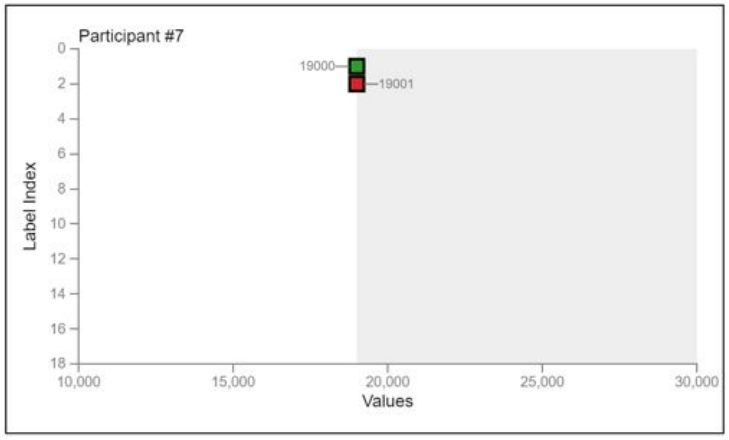
Supplementary Material - Teaching Strategy

We have formally defined three different teacher types in our paper - optimal, seed, naive teacher. This document features the data from selected participants to illustrate the challenges we outlined in the discussion section.

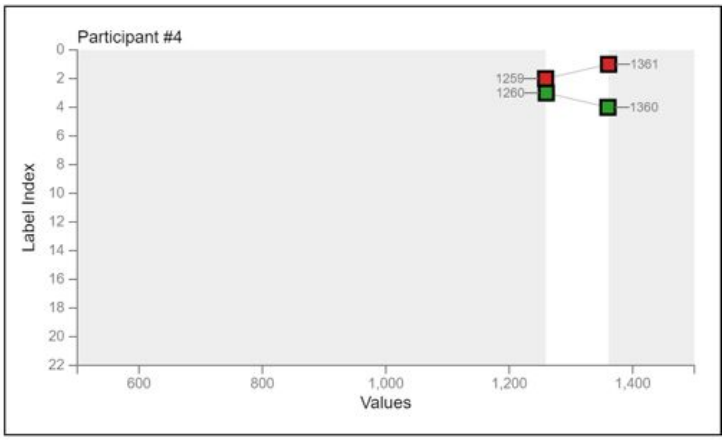
In these visualizations, the color of the data points ( ) represents the participant's label (green - positive, red - negative). The border around the data points ( ) represent that the example is part of the optimal teaching set. The lined pattern ( ) represents that the participant has made a labeling error.

1. Optimal Teacher

An optimal teacher is one who manually chooses exactly TD training items and labels to form an optimal teaching set, and does not provide more than necessary items.



Participant: #7
Task: Threshold
Condition: Human-initiated
Strategy: "When teaching about a threshold, if the parameters are known, then an example at the threshold and an example beyond the threshold should be sufficient to define the threshold."

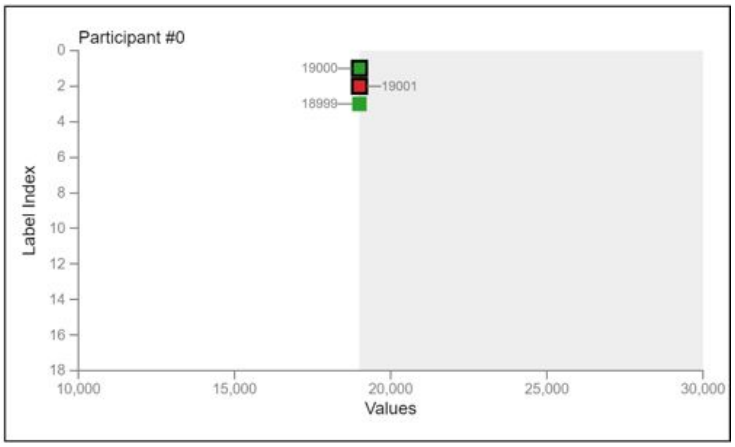


Participant: #4
Task: Interval
Condition: Human-initiated
Strategy: "For a robot I thought it would be enough to say 1259 is unacceptable, but 1260 is and 1361 is unacceptable, but 1360 is because it gives both the range and unacceptable limit."

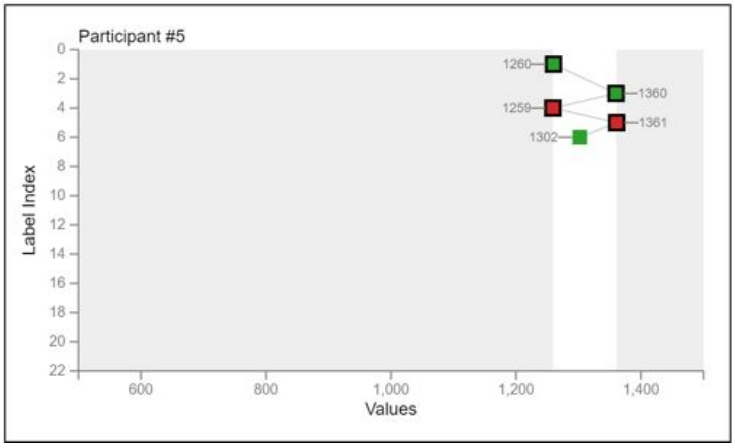
2. Seed Teacher

A seed teacher is not optimal, but one who chooses at least one positive item for each positive region in the input space.

Participants provided additional and unnecessary examples after they provided the optimal teaching set. They would have been optimal teachers if they had not provided these additional examples.

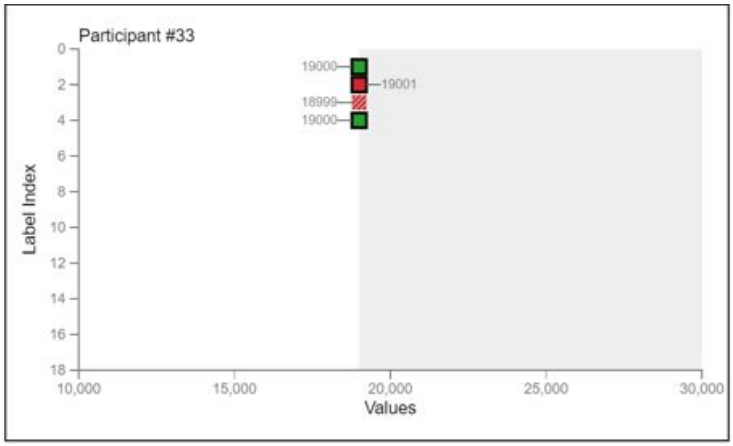


Participant: #0
Task: Threshold
Condition: Human-initiated
Strategy: "I gave the threshold as acceptable then $1 above as unacceptable and $1 below as acceptable. From this info most people could infer that anything higher than the initial level is unacceptable and anything lower is acceptable."



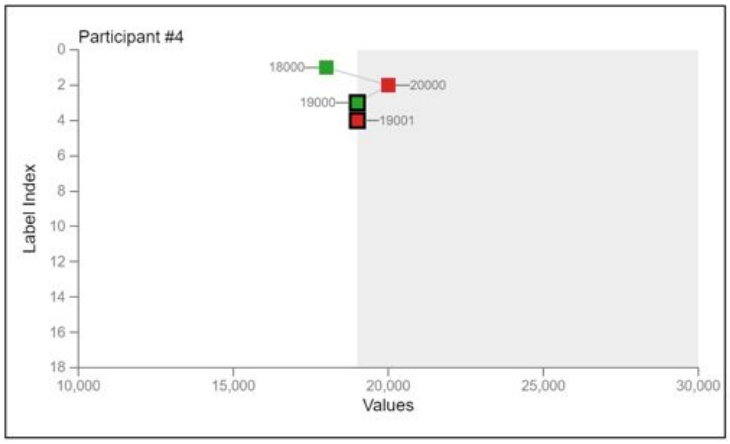
Participant: #5
Task: Interval
Condition: Human-initiated
Strategy: "I wanted to establish that the border numbers were okay as well as anything within the range. I also wanted to establish that even 1 dollar less or more would not be okay."

One participant started with an optimal teaching set, but ended up making a labeling mistake and repeating one of his previous examples.

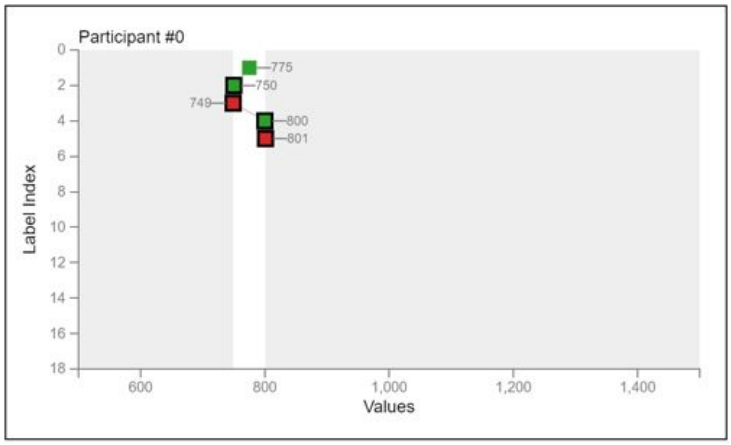


Participant: #33
Task: Threshold
Condition: Human-initiated with teacher education by analogues
Strategy: "Repetition is key"

Other participants provided unnecessary examples before providing the optimal teaching set.

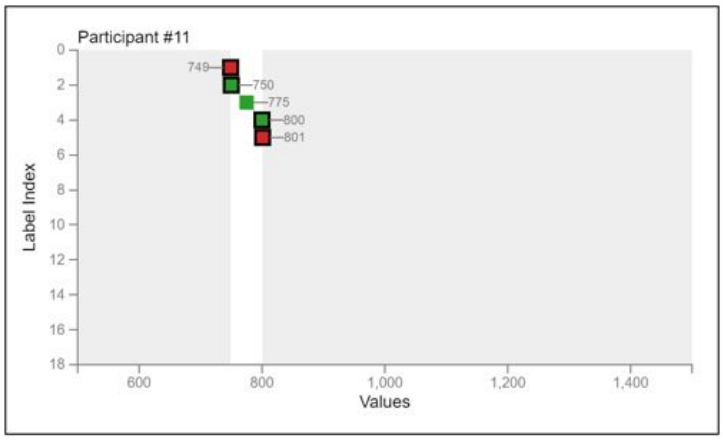


Participant: #4
Task: Threshold
Condition: Human-initiated
Strategy: “Went with what seemed logical”

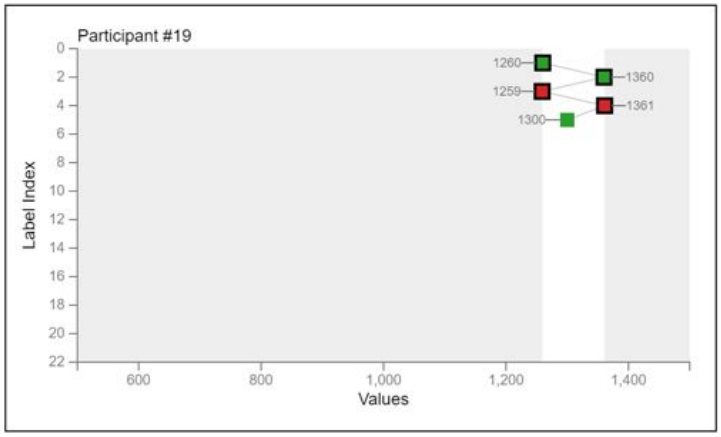


Participant: #0
Task: Interval
Condition: Human-initiated
Strategy: “I focused mostly on the low end and high end of the range to teach the robot where the thresholds lied.”

Some of these participants provided *prototypical* examples, and one admitted to making this mistake.

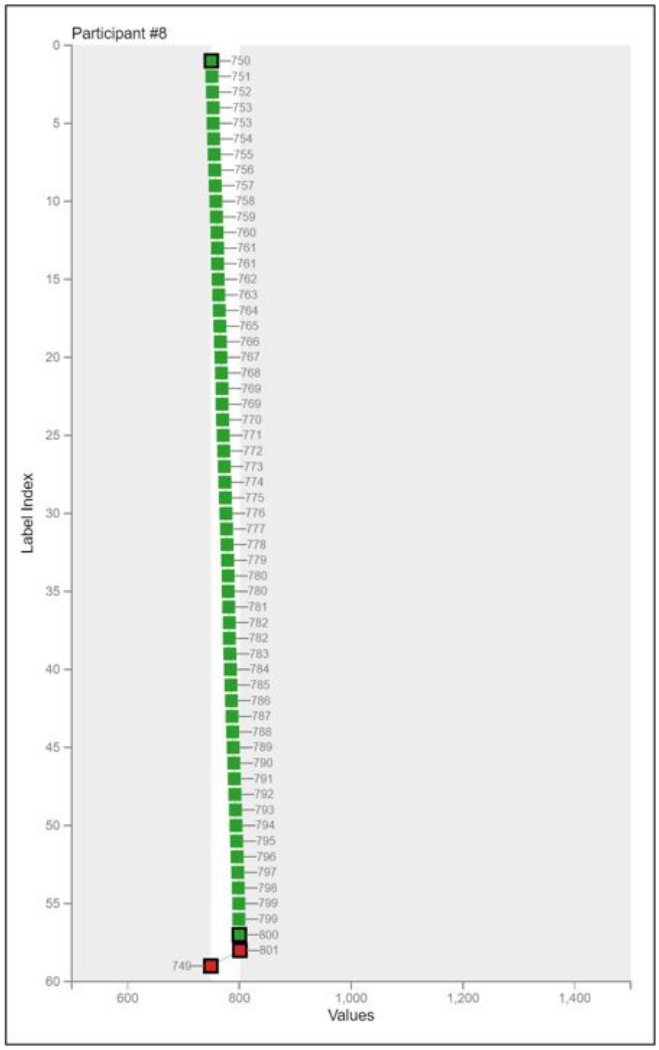


Participant: #11
Task: Interval (pilot)
Condition: Human-initiated
Strategy: "I set the lower bounds and upper bounds of the range. By doing that I set what the two out of bounds items were acceptable. I then encapsulated a mid range as being acceptable by selecting the **midpoint** of the acceptable amounts."

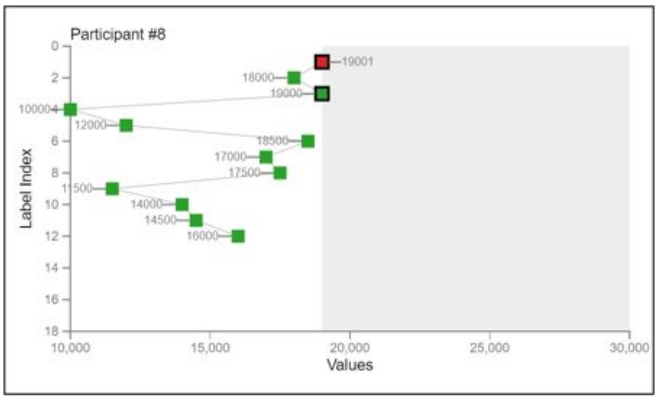


Participant: #19
Task: Interval
Condition: Human-initiated with teaching education by explanation
Strategy: "I wanted to give my lowest number and highest number, then provide unacceptable values to make sure my range was understood. I goofed by adding a 5th acceptable number in there that was in the **middle** of my two values. That number wasn't necessary."

Several participants have provided a lot more than necessary labels.

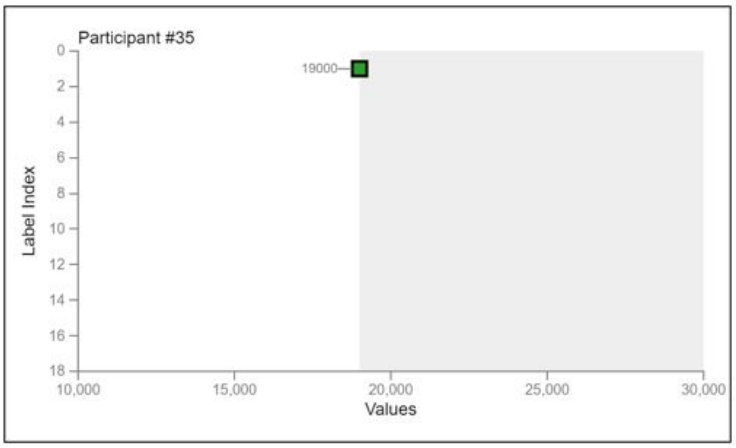


Participant: #8
Task: Interval (pilot)
Condition: Human-initiated with teacher education by analogues
Strategy: "I taught robot all acceptable price ranges."

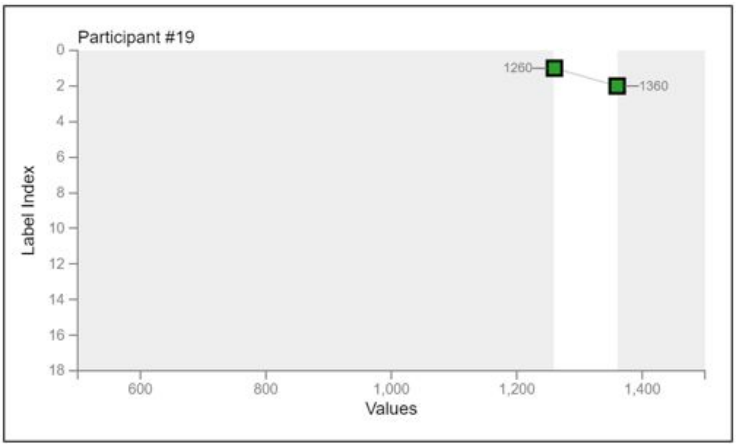


Participant: #8
Task: Threshold
Condition: Human-initiated
Strategy: "Tried to help the robot understand from the highest to the lowest and some in between prices that were okay to accept."

Several participants provided only positive examples at the boundary expecting that a single training item conveys the meaning of a boundary.

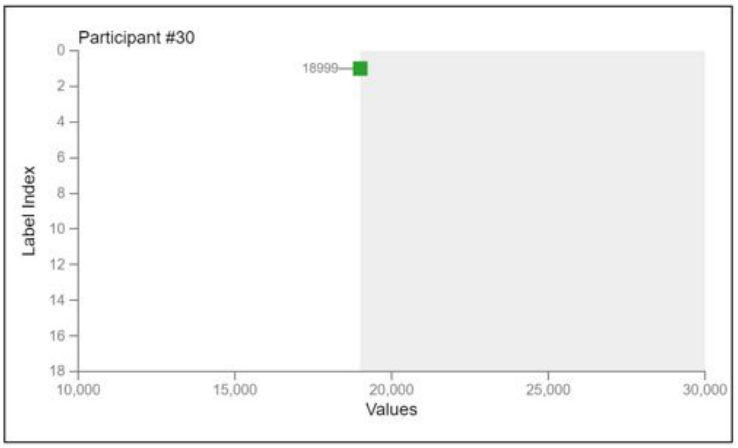


Participant: #35
Task: Threshold
Condition: Human-initiated
Strategy: “I can do this task very easily because i have some experience in mathematical calculation and computation. Also understanding of market.”



Participant: #19
Task: Interval
Condition: Human-initiated
Strategy: “I simply gave the robot the limits. Perhaps that isn't enough, but there was no option to tell it LE or GE (less than or equal,...).”

One participant had an interesting strategy that the robot’s hypothesis space consisted of one that looks at the first two digits of the example values.

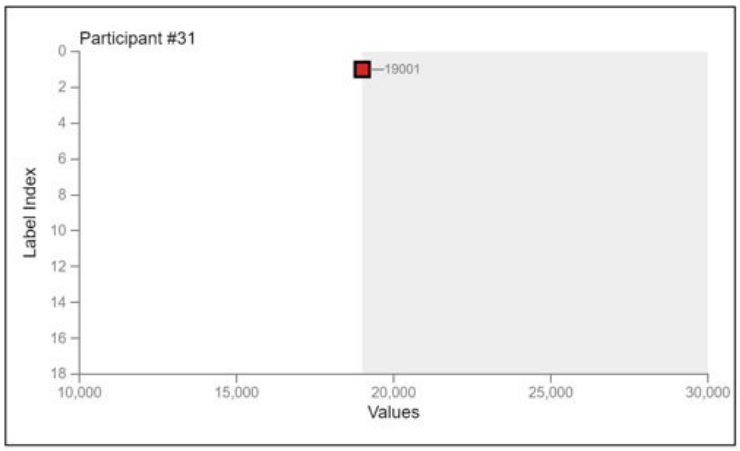


Participant: #30
Task: Threshold
Condition: Human-initiated
Strategy: “Robbot will possibly consider first two digit and if my budget is 19000 then I will instruct robot to search first number from 18 and it could be anywhere between 18-19K.”

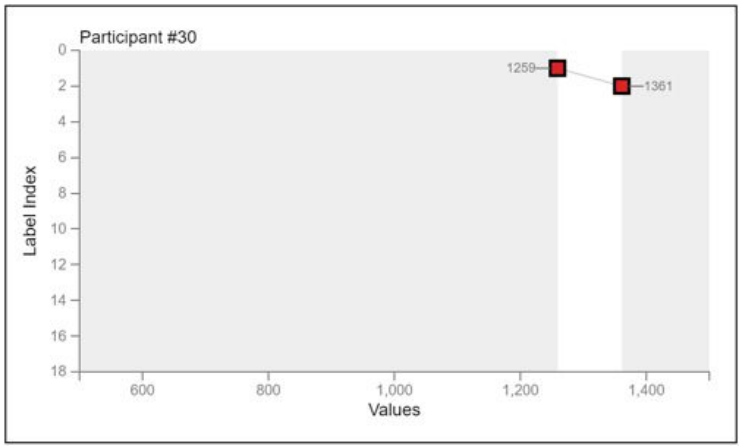
3. Naive Teacher

A naive teacher is not optimal and does not provide any positive item.

Similarly to the previous participant that only provided positive examples, several participants provided only negative examples at the boundary.



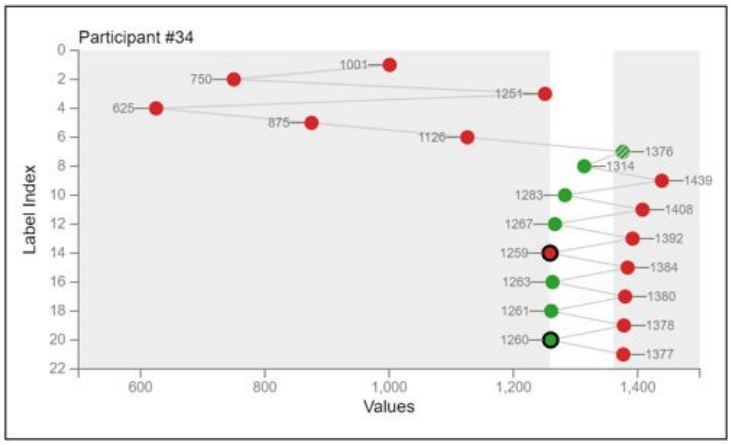
Participant: #31
Task: Threshold
Condition: Human-initiated with teacher education by analogues
Strategy: "Just followed the directions"



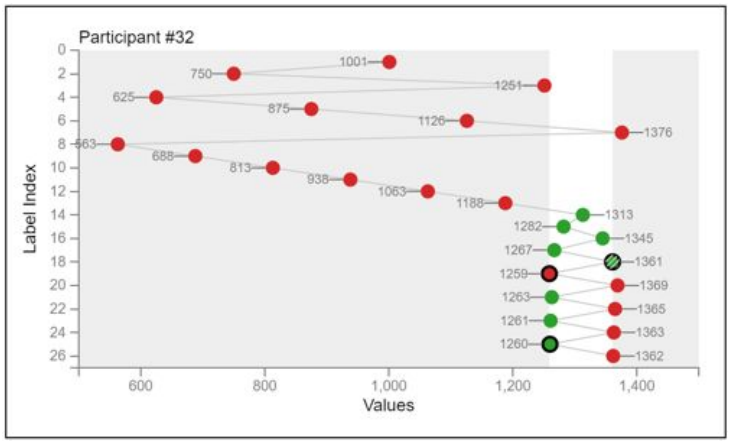
Participant: #30
Task: Interval
Condition: Human-initiated
Strategy: "I thought that selecting the numbers that were right near the limit would help get the point across."

4. Label Errors

Participants made frequent mistakes in computer-initiated conditions. These incorrect labels can sometimes lead to the active learning algorithm not able to find the solution.



Participant: #34
Task: Interval
Condition: Computer-initiated
Strategy: “providing correct examples”



Participant: #32
Task: Interval
Condition: Computer-initiated
Strategy: “I don't have a strategy, just tried to figure the numbers provided into the right money frame.”