# Supplemental Materials for "Democratizing AI: Non-expert design of prediction tasks" 

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## Contents

1 Task interfaces ..... 1
2 Table of proposed problems ..... 7
List of Figures
1 Problem proposal (phase one) task interface ..... 3
2 Problem importance ranking and categorization (phase two) task interface-part 1 ..... 4
3 Problem importance ranking and categorization (phase two) task interface-part 2 ..... 5
4 Problem learnability (phase two) task interface ..... 6
5 Data collection (phase three) task interface ..... 6

## 1 Task interfaces

Here we detail the task interfaces workers used as part of the crowdsourcing (screenshots in Figs. 1-5).
The contents of the dropdown selection menus are not shown in the screenshots so we detail them here. The problem topics dropdown in Fig. 3 contains the options (top-to-bottom):

- "Health/Wellness"
- "Demographic (personal attributes)"
- "Politics or current events"
- "Factual (look up in encyclopedia)"
- "Other"
. "Unsure"
The learnability dropdown in Fig. 4 contains the options (top-to-bottom):
- "NO ONE will answer true"
- "FEW will answer true"
- "ABOUT HALF will answer true"
- "MOST will answer true"
- "EVERYONE will answer true"

Likert-scale dropdowns (used in the "Usefulness of input questions" in Fig. 3) contain the options (top-tobottom):

- "Strongly disagree"
- "Disagree"
- "Neutral"
- "Agree"
- "Strongly agree"

Lastly, self-reported confidence dropdowns contain the options (top-to-bottom):

- "Very not confident"
- "Not confident"
- "Neutral"
- "Confident"
- "Very confident"


## Instructions (Click to expand):

We are interested in teaching computers to make predictions, and we want your creativity and experience to help us come up with new questions and answers the computer can learn from.

Our plan is for you to create a target question and four input questions. We want to build a computer method that can guess someone's answer to the target question after asking them only the input questions. To do this we will need lots of data, so we also want you to provide answers to all questions.

- Using your judgment, what is an interesting and important target question?
- Questions should not be fact-based ("Is a Labrador Retriever a type of dog?"). Instead questions should have answers that change from person to person. However, it is important that you can learn about someone's target answer from their input answers, whatever they may be.
- With your target question in mind, what are the most useful input questions to help answer the target question
- Please do not provide input questions that are just rephrased versions of the target question!

To create a question

1. Write a short sentence in the input boxes below, ending with a question mark
2. Describe what type of answer the question should be. For now, please only ask questions where the answer is either a number or a true/false
3. Provide your own answers to your questions

Lastly, please no offensive questions.
Thanks!

What is your target question?

```
    Enter question here
```

What type of answer does this question take?
O A number
O A true or false

What is your answer for the target question?
Enter answer here (put in 'true' or 'false' if it's a true/false question)

What is your first input question?
Enter question here

Figure 1: Problem proposal (phase one) task interface. The input question entry forms farther down the page are not entirely shown but they are identical to the target question entry form which is shown.

## Comparing and classifying problems

## -Instructions

We have collected a number of problems and we want your help to categorize and assess their quality. Two problems are shown below.

- A problem consists of a target question and four input questions. Our goal is to guess someone's answer to the target question by only asking them the input questions. Answers to questions can be either numbers or true/false statements.
- We are especially interested in studying important and useful problems. Guessing that $1+1=2$ may be less interesting than other problems, for example. Using your best judgment, which of the two problems below is better in this sense?
- We also want to know how useful the input questions are. Does it seem like answering the input questions will tell us about the target question, or do you think the questions are unrelated?
- Are any or all of the input questions redundant compared to the target question, meaning that they are essentially asking the same thing, just in a rephrased way?

To proceed, please read the two problems and then complete the following survey questions.
Thanks for your help!

Problems

- First problem (placeholder)

Text of question Type of answer
Target question: Here will be a question? True/False
Input question: Here will be another question? Number
Input question: Here will be another question? True/False
Input question: Here will be another question? Number
Input question: Here will be the last question? True/False
-Second problem (placeholder)

## Text of question Type of answer

Target question: Here will be a question? True/False
Input question: Here will be another question? Number
Input question: Here will be another question? True/False
Input question: Here will be another question? Number
Input question: Here will be the last question? True/False

Figure 2: Problem importance ranking and categorization (phase two) task interface-part 1. This is the top half of the web interface; see Fig. 3 for the bottom half. In use, the web interface is a single scrollable page. When workers have accepted a real task, the instruction box at the top is presented initially collapsed, with a "click to expand" option made available in case the worker wants to reread the instructions.

## Survey questions

-Which problem is better?
First problem is better (more important/useful) than the second.
Second problem is better (more important/useful) than the first.
-Problem topics
What topic is covered by the first problem? Please Select $\hat{v}$
What topic is covered by the second problem? Please Select $\hat{v}$

Subjectivity
Will most answers to the first problem be subjective or objective?
Most will be subjective.
Most will be objective.
Will most answers to second problem be subjective or objective?
Most will be subjective.
Most will be objective.
-Usefulness of input questions
First problem: Answering the input questions will help guess the answer to the target question.

Second problem: Answering the input questions will help guess the answer to the target question.
$\qquad$

Figure 3: Problem importance ranking and categorization (phase two) task interface-part 2. This is the bottom half of the web interface; see Fig. 2 for the top half. In use, the web interface is a single scrollable page.

## Please consider the following true/false question

Here is a true/false question?

Suppose thousands of people answered this question. How many do you think will answer TRUE?
Please select the closest option $\hat{v}$
(Required) How confident are you in your answer? Please Select $\hat{v}$

```
Submit
```

Figure 4: Problem learnability (phase two) task interface). For an actual prolem, the response fields for each question are dynamically generated as radio buttons (for true/false questions) or text entry fields (for numeric questions). The submit button is disabled until any/all radio buttons are checked and text fields contain numbers, as determined dynamically by javascript.

## Please answer the following questions as best you can

- Use your own opinion or knowledge. No need to use google to look up answers.
- Enter numbers ( 1 or 1.23 , not one or twelve, for example) into any text fields. You can use decimals but no commas please ( 8000 not 8,000 ).

Thanks for your help!

1. Here is the first question asking for a number? Enter a number
2. Another question, in this case true or false? True $\bigcirc$ False
3. Yet another question? True $\bigcirc$ False
4. Yet another question? Enter a number
5. The last question? Enter a number
(Required) How confident are you in your answers? Please Select $\hat{v}$

Submit

Figure 5: Data collection (phase three) task interface. For an actual problem, the response fields for each question are dynamically generated as radio buttons (for true/false questions) or text entry fields (for numeric questions). The submit button is disabled until any/all radio buttons are checked and text fields contain numbers, as determined dynamically by javascript.

## 2 Table of proposed problems

Workers proposed, categorized, and ranked $N=50$ problems during our main experiment. Here we present all problems. Associated with each problem is its majority categorization along with the percentage of workers who gave that categorization. Problems are ranked from most "important and useful" (Rank 1) to least (Rank 50) according to worker judgment using an efficient spectral ranking algorithm based on pairwise comparisons of problems (Which problem is better, A or B?). See main text for details.

The rank 3 problem ("How far is the earth from the sun?") is the unitless regression problem where learning failed; see main text for discussion. As we progress down the ranking, we see that problems become less meaningful, demonstrating that the importance ranking can filter out at least the obviously unimportant problems.

Rank 1 (Politics/current events, 43.4\%) Text of question
Target question: What Category hurricane was Hurricane Harvey when it made
Type of answer landfall in Texas?
Input question: Are there 5 categories total for Hurricanes? True/False
Input question: Is it true that Hurricane Harvey was a weak hurricane? True/False
Input question: Is it true Hurricane Harvey was a category 4 with a peak wind speed of 131 mph before making landfall on Texas?
Input question: Are categories of hurricanes determined by windspeed? True/False
Rank 2 (Politics/current events, 94.8\%)
Text of question
Target question: Has racial profiling in America gone too far?
Type of answer
Input question: Do you feel authorities should use race when determining who to give scrutiny to?
Input question: How many times have you been racially profiled?
Input question: Should laws be created to limit the use of racial profiling?
Input question: How many close friends of a race other than yourself do you have?

True/False
True/False
Number
True/False Number

Rank 3 (Factual, 95.1\%)
Text of question
Target question: How far is earth from the sun?
Input question: How big is the solar system?
Input question: How long does it take earth to circle the sun?
Input question: How strong is the sun's gravational pull on earth?
Input question: What is the strenght of earth's gravity?
Type of answer
Number
Number
Number
Number
Number
Rank 4 (Other, 53.7\%)

## Text of question

Target question: Is college a good investment?
Input question: Is your degree in the STEM field?
Input question: Are you able to get your degree without going into debt?
Input question: Are you sure you know exactly what kind of job and what the pay is that you will be able to get with your degree?
Input question: Have you considered other options?
Type of answer
True/False
True/False
True/False
True/False
True/False
Rank 5 (Politics/current events, 83.8\%)

|  | Text of question | Type of answer |
| ---: | :--- | :--- |
| Target question: | is justice the same for everyone? | True/False |
| Input question: | should gay people be penalized | True/False |
| Input question: | is homosexuality a sin? | True/False |
| Input question: | is the justice system working well | True/False |
| Input question: | do women get equal treatment in the law | True/False |

Rank 6 (Politics/current events, 97.4\%)

| Target question: | Text of question |
| :---: | :--- |
| Input question: | Are you concerned about crime more from people of color than <br> white people? |
| Input question: | Is immigration bad for the United States? |
| Input question: | Do feel at personal risk from immigrants? |
| Input question: | Do you watch Fox News? |

Type of answer
True/False
True/False
True/False
True/False
True/False

Rank 7 (Demographic/personal, 87.1\%)
Text of question
Target question: Will you go to college after high school?
Input question: Do you want to make good money after high school?
Input question: Do you want to have a good job after high school?
Input question: Do you want to be successful after high school?
Input question: How much money do you want to make after high school?
Type of answer
True/False
True/False
True/False
True/False
Number
Rank 8 (Demographic/personal, 81.7\%)
Text of question
Target question: What is your annual income?
Input question: You have a job?
Input question: How much do you make per hour?
Input question: How many hours do you work per week?
Input question: How many weeks per year do you work?
Type of answer
Number
True/False
Number
Number
Number
Rank 9 (Politics/current events, 94.7\%)
Text of question
Target question: Antifa is the most violent political group in America?
Input question: Your political affiliation is republican? Input question: Violent is becoming common at protests?
Input question: Anyone can use a vehicle as a weapon of mass murder?
Input question: How many people were murdered in Charlottesville?
Type of answer
True/False
True/False
True/False
True/False
Number
Rank 10 (Health/Wellness, 96.1\%)
Text of question
Target question: True or false, you lose more weight by staying to a strict diet and exercising well.
Input question: True or false. Does running help with your health?
Type of answer
True/False

True/False
Input question: How many calories should you limit yourself to if you're 5'8 and 240 lbs ?
Input question: True or false. Is sugar good for your diet? True/False Input question: True or false. Is an increase in fiber good for you? True/False

Rank 11 (Health/Wellness, 91.2\%)

|  | Text of question | Type of answer |
| ---: | :--- | :--- |
| Target question: | Do you have a good doctor? | True/False |
| Input question: | How many times have you had a physical in the last year? | Number |
| Input question: | How many times have you gone to the doctor in the past year? | Number |
| Input question: | How much do you weigh? | Number |
| Input question: | Do you have high blood pressure? | True/False |

Rank 12 (Health/Wellness, 71.7\%)
Text of question Type of answer
Target question: Does the weather effect the way you feel?
True/False Input question: Do you feel sleepy on a cloudy day?

True/False Input question: When it is sunny and warm outside are you more energetic? True/False Input question: Does the cold weather make you want to hibernate?

True/False
Input question: Does the fall season depress you?
True/False

Rank 13 (Demographic/personal, 57.8\%)
Text of question
Target question: Am I an introvert? Input question: Do I like social events?
Input question: Do I get anxious easily?
Input question: Do I hate teamwork?
Input question: Do I cherish alone times?
Type of answer
True/False
True/False
True/False
True/False
True/False
Rank 14 (Other, 50.0\%)
Text of question
Target question: I find social media to be educational for younger children?
Input question: $\quad$ Social media should be accessed in school classrooms?
Type of answer
True/False
True/False
True/False
True/False
$\begin{array}{lll}\text { Input question: } & \text { Social media is helpful to further a child's intelligence? } & \text { Tre/Fa } \\ \text { Input question: } & \text { how many times do you let your child access social media per } & \text { Number }\end{array}$ day?

Rank 15 (Other, 57.3\%)
Text of question
Type of answer
Target question: How many times should you allow your spouse to lie to you? Number Input question: A person should disclose any extra-marital affairs to his/her True/False spouse
Input question: Infidelity is a deal-breaker in a marriage True/False Input question: How many nights a week should your spouse spend hanging out Number with his/her own friends?
Input question: It is okay to marry someone who cheated on you before mar- True/False riage

Rank 16 (Demographic/personal, 64.1\%)
Text of question
Target question: Are children the most important thing in life?
Input question: Do you have children?
Input question: Do you work full time?
Input question: How many children do you have?
Input question: Does your spare time revolve around your family?
Type of answer
True/False
True/False
True/False
Number
True/False

Rank 17 (Health/Wellness, 88.2\%)
Text of question Type of answer
Target question: How many days a week do you exercise?
Input question: Do you exercise as part of a routine?
Input question: Do you exercise on weekends?
Input question: Do you exercise any weekdays?
Input question: Do you take any weekdays off?
Number
True/False
True/False
True/False
True/False
Rank 18 (Demographic/personal, 89.7\%)
Text of question
Target question: Were you born to a highly educated family? Input question: Did your father graduate from college? Input question: Did your mother graduate from college? Input question: Did any of your siblings graduate from college? Input question: Did any of your extended family graduate from college?

Type of answer
True/False
True/False
True/False
True/False
True/False
Rank 19 (Politics/current events, 90.2\%)
Text of question
Target question: Is it true or false that you approve of President Trump? Input question: Is it true or false that you voted for Donald Trump? Input question: Is it true or false that you are a republican? Input question: Is it true or false that you are a conservative? Input question: Is it true or false that you supported Hillary Clinton?

Rank 20 (Demographic/personal, 80.5\%)
Text of question
Target question: Are you a college graduate?
Input question: Do you go to college now?
Input question: Did you go to college?
Input question: Were you in a degree program?
Input question: Did you finish your program?
Rank 21 (Demographic/personal, 56.9\%)
Text of question
Target question: What is the best age to get married?
Input question: What is the best age to have your first child? Input question: What is the best age to buy your first home? Input question: What is the best age to start planning for job security? Input question: What is the best age to start saving for retirement?

Rank 22 (Health/Wellness, 61.3\%)
Text of question
Target question: What is your weight in pounds?
Input question: What is your height in inches?
Input question: Are you male?
Input question: Do you exercise regularly?
Input question: How many meals a week do you eat meat?
Type of answer
True/False
True/False
True/False
True/False
True/False

Type of answer
True/False
True/False
True/False
True/False
True/False

Type of answer
Number
Number
Number
Number
Number

Type of answer
Number
Number
True/False
True/False
Number
Rank 23 (Other, 69.3\%)

|  | Text of question | Type of answer |
| ---: | :--- | :--- |
| Target question: | Is soccer a popular sport in the United States? | True/False |
| Input question: | Do a lot of people play soccer recreationally? | True/False |
| Input question: | Is it well regarded among the youth? | True/False |
| Input question: | Do people consider it an exciting sport? | True/False |
| Input question: | Do people prefer it over other sports? | True/False |

Rank 24 (Demographic/personal, 50.0\%)
Text of question Type of answer
Target question: What age did your most memorable experience happen?
Input question: Did this happen when you were in college?
Input question: Were any friends there?
Input question: Was alcohol involved?
Input question: How many other people were there? Number
Rank 25 (Demographic/personal, 67.2\%)
Text of question
Number
True/False
True/False
True/False

Target question: How many vehicles are in your driveway?
Type of answer
Number Input question: How many vehicles belong to your family?

Number Input question: How many of your family's vehicles are kept at home? Number Input question: Does your family park your vehicles in the home's driveway? True/False Input question: How many of your family's vehicles are parked in the driveway? Number

Rank 26 (Demographic/personal, 85.5\%)
Text of question
Target question: Are you a college student?
Input question: Do you live with your parents?
Input question: Do you have a roommate?
Input question: Do you have a college degree?
Input question: Do you attend classes?
Type of answer
True/False
True/False
True/False
True/False
True/False
Rank 27 (Other, 59.3\%)

## Text of question

Type of answer
Target question: How many great pop acts have there been in the last 10 years? Number Input question: Is Lady Gaga a great musician? True/False Input question: How many great albums have been released in the last 10 years? Number Input question: Is Madonna still relevant?

True/False Input question: Does pop music have a future?

True/False
Rank 28 (Factual, 45.5\%)
Text of question
Type of answer
Target question: Is Mike Trout the best MLB player currently? True/False
Input question: What is the amount of RBI's that Mike Trout has in 2017 so far? Number
Input question: How many home-runs has Mike Trout hit in 2017 so far? Number
Input question: What is Mike Trout's batting average in 2017 so far? Number Input question: What is Mike Trouts on base percentage in 2017 so far? Number

Rank 29 (Demographic/personal, 91.5\%)

|  | Text of question | Type of answer |
| ---: | :--- | :--- |
| Target question: | How old are you? | Number |
| Input question: | Do you have a degree? | True/False |
| Input question: | Are you retired? | True/False |
| Input question: | Are you married? | True/False |
| Input question: | Do you have a car | True/False |

Rank 30 (Health/Wellness, 70.3\%)
Text of question Type of answer

Target question: Are you having a good day?
True/False
Input question: Did any good occurrences happen within the course of today? True/False Input question: Did the good occurrences of today outweigh the bad occur- True/False rences?
Input question: Did you have a general feeling of happiness throughout the day? True/False Input question: Did you feel overwhelmed with negative feelings (ex. sadness, True/False irritability, guilt, etc.) throughout the day?

Rank 31 (Health/Wellness, 52.7\%)
Text of question Type of answer
Target question: Are you depressed?
Input question: How many siblings do you have?
Input question: Did you graduate from college?
Input question: How old are you?
True/False
Number
True/False
Number
True/False

Rank 32 (Demographic/personal, 90.3\%)
Text of question Type of answer
Target question: Are you married? Input question: You do not wear a ring on your left-hand ring finger? Input question: Do you live alone? Input question: How many incomes are reported on your tax return? Input question: Do you celebrate a special anniversary every year?

True/False
True/False
True/False
Number
True/False
Rank 33 (Factual, 61.7\%)
Text of question
Type of answer
Target question: HOW MANY COUNTRIES ARE THERE IN THE WORLD? Input question: ARE WE LIVING IN EARTH? Input question: IS HUMAN BEINGS HAVING SIXTH SENSE? Input question: IN A YEAR HOW MANY DAYS ARE THERE?

Number True/False
True/False Number Input question: on which year second world war started? Number

## Rank 34 (Factual, 58.7\%)

Text of question
Target question: Donald Trump is the 45th president. Input question: California is on the east coast. Input question: Earth is the _---- planet from the sun? Input question: How many states are in the US? Input question: How many is a dozen?

Type of answer
True/False
True/False
Number
Number
Number

Rank 35 (Demographic/personal, 93.4\%)

|  | Text of question | Type of answer |
| ---: | :--- | :--- |
| Target question: | How old are you? | Number |
| Input question: | What year where you born? | Number |
| Input question: | What is the date today? | Number |
| Input question: | Have you had your birthday yet this year? | True/False |
| Input question: | How old will you be on your next birthday? | Number |

## Rank 36 (Other, 80.0\%)

Text of question
Target question: Is Disneyworld is the best place for vacation?
Input question: Is Disneyworld fun?
Input question: Do you enjoy the attractions at Disneyworld?
Input question: Does Disneyworld have the best live shows?
Input question: Does Disneyworld have the best food?

Type of answer
Number
Number
Number
True/False
Number

Type of answer
True/False
True/False
True/False
True/False
True/False

Rank 37 (Factual, 95.6\%)
Text of question
Target question: does the sun rise in the east? Input question: does the sun set in the west?
Input question: is the sun pointing a direction?
Input question: is the sun in the sky? Input question: does the earth rotate around the sun?

Rank 38 (Demographic/personal, 54.5\%)
Text of question
Target question: What size dress do you wear? Input question: How much do you weigh in pounds? Input question: What is your waist size in inches? Input question: Do people consider you to be petite? Input question: Do people compliment you on your figure?

Rank 39 (Demographic/personal, 83.1\%)
Text of question
Target question: When you were little did you ever go to kindergarden?
Input question: Did you grow up in the northeast? Input question: Did you grow up in Pennsylvania? Input question: Did you go to kennett consolidated school district? Input question: Was your first school called "the kindergarden" center?

Rank 40 (Demographic/personal, 46.7\%)
Text of question
Target question: Are you human?
Input question: Do you have an imagination?
Input question: Do you have a sense of humor?
Input question: Can you appreciate beauty? Input question: Have you ever had rebellious tendencies?

Type of answer
True/False
True/False
True/False
True/False
Number

Type of answer
Number
Number
Number
True/False
True/False

Type of answer
True/False
True/False
True/False
True/False
True/False

Type of answer
True/False
True/False True/False True/False True/False

Rank 41 (Health/Wellness, 57.6\%)

|  | Text of question | Type of answer |
| ---: | :--- | :--- |
| Target question: | You smoke marijuana? | True/False |
| Input question: | you like it? | True/False |
| Input question: | how many times have you smoked it? | Number |
| Input question: | at what age did you start smoking? | Number |
| Input question: | Marijuana affects your health negatively? | True/False |
|  |  |  |
| Target question: | Text you question | Type of answer |
| Input question: | Do you have a dog? | True/False |
| Input question: | Do you have a cat? | True/False |
| Input question: | Do you have a bird? | True/False |
| Input question: | Do you have a snake? | True/False |

Rank 43 (Factual, 93.5\%)

Text of question
Target question: Are there 30 days in August? Input question: How many months are there in the year that have 31 days? Input question: are there 31 days in January and March? Input question: are there 31 days in december and october? Input question: Are there 31 days in may and july?

Type of answer
True/False
True/False
True/False
True/False
True/False

Type of answer
True/False
Number
True/False
True/False
True/False

Rank 44 (Other, 76.1\%)
Text of question
Target question: Pugs are nice pets?
Input question: Pugs are good with kids?
Input question: Pugs like to entertain people?
Input question: Pugs are aggressive?
Input question: Pugs are so ugly that they're cute?
Type of answer
True/False
True/False
True/False
True/False
True/False
Rank 45 (Other, 43.9\%)
Text of question
Target question: are people are getting fatter all around the world?
Input question: does everyone has a soul?
Input question: is there is a heaven and a hell?
Input question: are ghost real?
Input question: is the locknes monster real?
Type of answer
True/False
True/False
True/False
True/False
True/False
Rank 46 (Factual, 76.9\%)

## Text of question

Target question: One plus one equal what number?
Input question: True or false that two plus two equal four?
Input question: How many days in a week?
Input question: Is it true or false that pink is a color?
Input question: Five plus Five equal what number?
Type of answer
Number
True/False
Number
True/False
Number
Rank 47 (Demographic/personal, 70.2\%)

Text of question Type of answer
Target question: Is Emilys hair brown?
Input question: Emilys hair is dark?
Input question: Emilys hair is blonde?
Input question: Emilys hair is red?
Input question: Emilys hair is black?
True/False
True/False
True/False
True/False
True/False
Rank 48 (Politics/current events, 52.6\%)
Text of question Type of answer
Target question: Is the president of the United States is Donald Trumph?
Input question: Is the sky always Blue?
Input question: What is 9 divided by 3 ?
Input question: What is 81 divided by 9 ?
Input question: What is 100 multiplied by 0 ?
Rank 49 (Demographic/personal, 41.7\%)
Text of question
Target question: How many weeks do you normally go between haircuts? Input question: Your hair is less than shoulder length?
Input question: You have bangs?
Input question: Your hair grows fast?
Input question: You have a stylist that you go to regularly?
True/False
True/False
Number
Number
Number

Rank 50 (Factual, 64.4\%)
Text of question
Target question: What date of the month is it?
Input question: What is $4+4$ ?
Input question: Is tomorrow Wednesday?
Input question: Does the sun rise in the west?
Input question: How many days are in a week?
Type of answer
Number
True/False
True/False
True/False
True/False

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Type of answer
Number
Number
True/False
True/False
Number

