

# Do Machine Teachers Dream of Algorithms?

Gonzalo Ramos - Felicia Ng - Nicole Sultanum  
Christopher Meek - Jina Suh - Soroush Ghorashi  
goramos@microsoft.com - fng@cs.cmu.edu - nicolebs@cs.toronto.edu  
meek@microsoft.com - jinsuh@microsoft.com - sorgh@microsoft.com

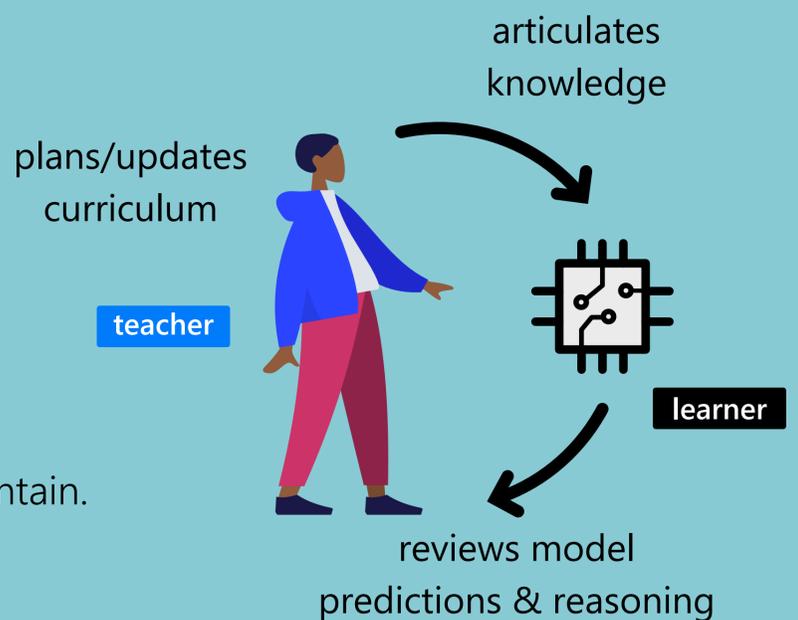


**Machine Teaching focuses on processes where ML models are the result of incremental iterations with a person that acts as a Teacher.**

- Teachers are subject-matter experts.
- Teachers express knowledge beyond just labels.
- Teachers evaluate learners beyond predictions.

## Why Machine Teaching?

- It leverages people's knowledge and ability to teach.
- It leads to ML models that are semantic, reusable and easy to maintain.
- It makes ML model building accessible to non-ML experts.
- It is a solution when there is no initial labeled data set.

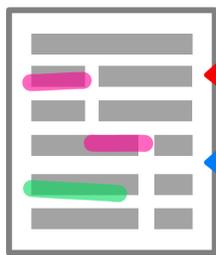


## We Want to Understand how People Teach:

What teachers do can inform how we design the parts of teaching and learning systems.

We observed how people tried to teach "Wizard of Oz"-driven learning systems to:

Assign tags to text documents...

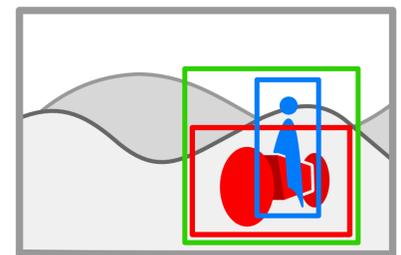


Food

Business

or

Segment concepts from an image...



person riding bicycle

person

bicycle

Using office materials and people role-playing as the learning system, we aimed at not limiting what teachers wanted to express.

We did not explicitly describe to teachers how the learner worked or made predictions...still, teachers formed ideas about how the learning system worked.

## Things people did when teaching to the learning systems:

### Provide Knowledge

Teachers gave labels, semantic features, rules as well as semantic and structural relationships.

"A Bicycle has (two) Wheels"

### Weigh the Evidence

Teachers deemed some knowledge as more important than others. This information was also used to specify prediction rules.

"If you see this set of words, then I am 90% sure it is Business"

### Learn from Examples

Teachers' plans were informed by the examples they saw or expected to see.

"I need to first look at some documents to have a sense of what is there."

### Demonstrate by Examples

For some concepts, teachers preferred to show instead of tell.

"Clay looks like this"

### Modulate Knowledge

Biased by how they thought the learner worked, teachers withheld useful knowledge.

"Money is not a useful concept, because it can apply to Food or Business."

### Use Rule-Based Thinking

Biased by how they thought the model worked, teachers produced knowledge to be used in a decision-tree way.

"If a Person is holding a Racket, then the Person is Playing Tennis"

## Applying these Findings Needs Interdisciplinary Research in ML and HCI.

To build better teaching and learning systems we need:

1. Algorithms that leverage what people want to teach, and
2. Experiences that support and encourage teachers to express appropriate, useful knowledge.

Want to know more? Here are some readings!

