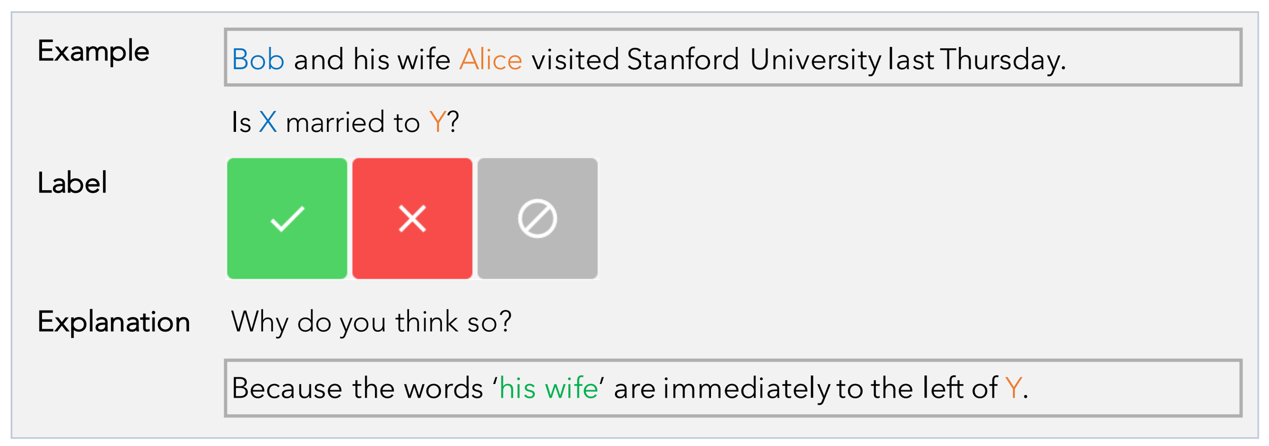
Babble Labble: Learning from Natural Language Explanations

Braden Hancock, Paroma Varma, Percy Liang, Chris Ré

Big Idea: Explain Yourself!

- Collecting supervision one bit (one binary label) at a time is tedious, slow, expensive, and not very scalable.
- Explanations describing why certain labels were given can be used to vicariously label large amounts of unlabeled data.
- The potentially overlapping/conflicting labels can be resolved statistically to generate probabilistic "noise-aware" labels for downstream discriminative models.

Explain why you labeled this...

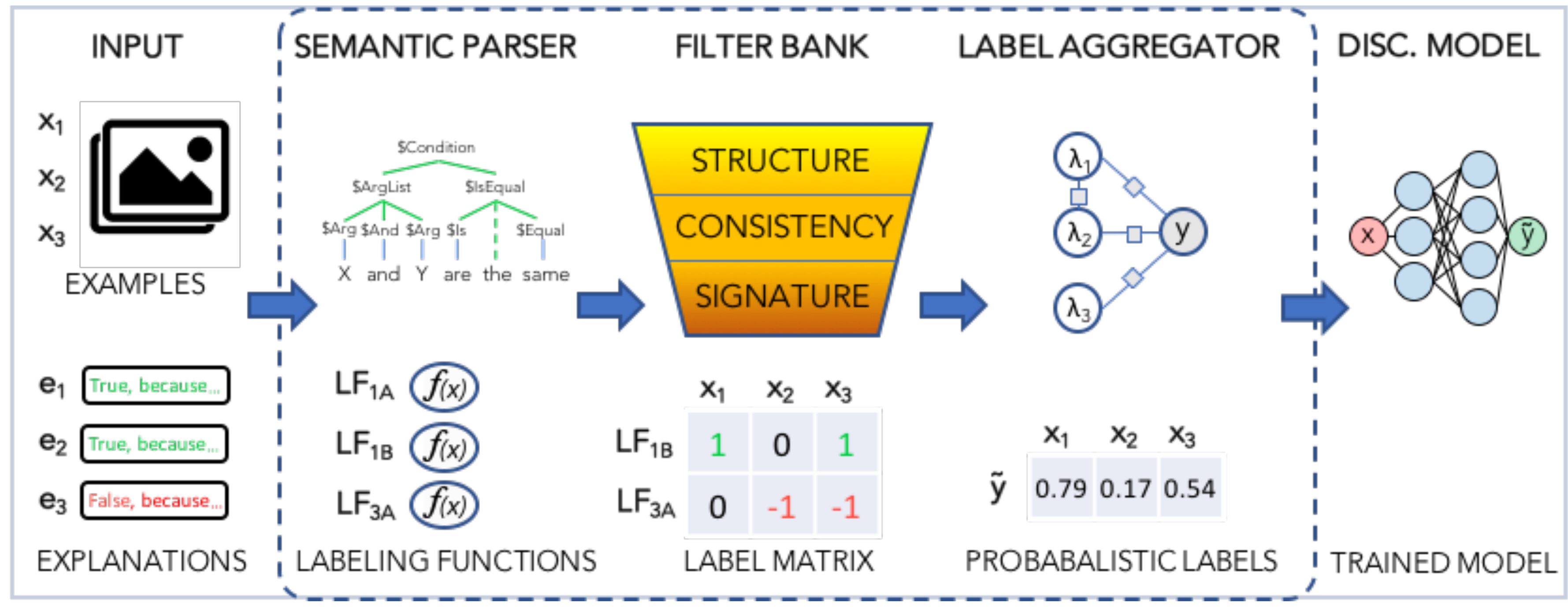


And get supervision on these for free...

- ✔ "Barack batted back tears as he thanked his wife, Michelle, for all her help."
- ✔ "Both Bill and his wife Hillary smiled and waved at reporters as they rode by."
- ✔ "George attended the event with his wife, Laura, and their two daughters."

The Babble Labble Framework

Key Idea:
Use natural language explanations to programmatically label large training sets. Use filters and noise modeling to address the ambiguity introduced by using natural language.



Inputs:

-Unlabeled Data
-Explanations

Babble Labble:

-Runs automatically
-Requires no training

Outputs:

-Labeled Dataset
-Trained Model

Filter Bank & Label Aggregator

Filters

Consistency (Bad information)

Input: X has label ● because Y
Evaluate: $LF_Y(X)$ = ● ≠ ●

Uniform Signature (No information)

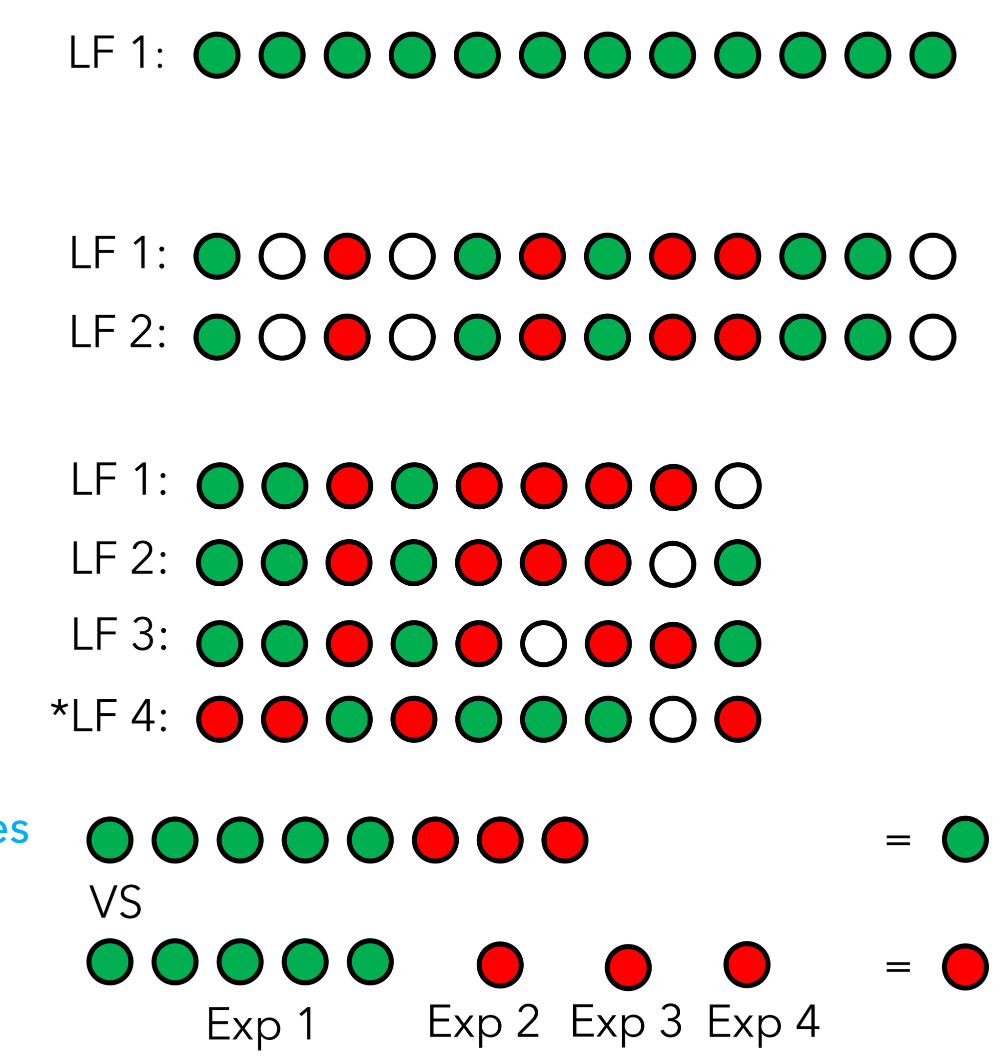
Redundant Signature (No new information)

Label Aggregation

Model LF accuracies

*high disagreement = low assumed accuracy

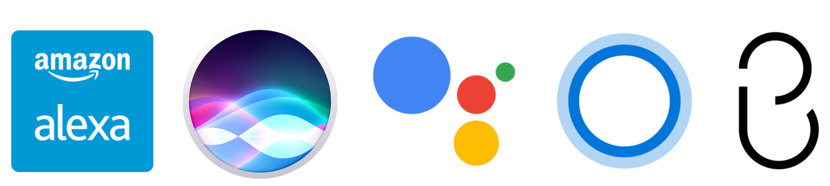
Model LF dependencies (Structure learning)



Motivation

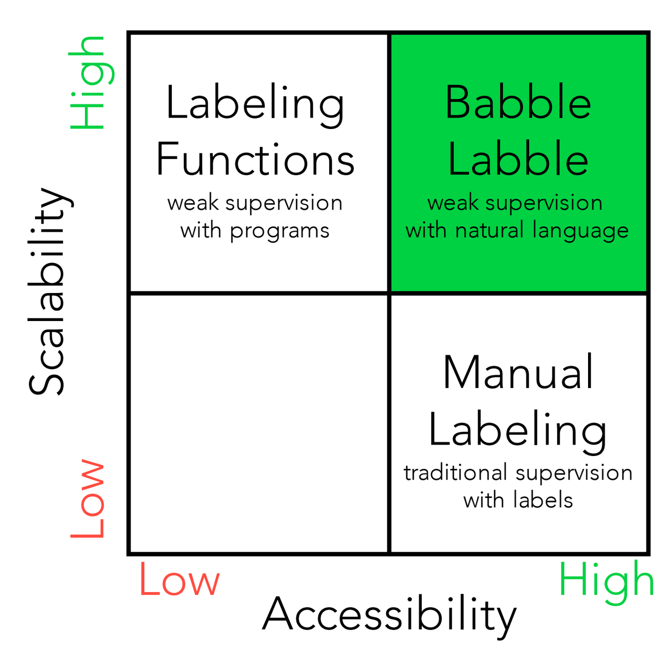
Why supervise with natural language instead of formal programs?

1) Ease of Use:
Conversational interfaces are the new normal!



2) Faster supervision:
No need to look up syntax or find missing semicolons!

3) More sources of supervision:
Not everyone can program.
Everyone can explain.



Semantic Parser

Example X:

A B
Barack and his wife Michelle live in the White House.

Explanation Y:

"'wife' precedes Michelle in the sentence"

Normalized Explanation:

"'wife' precedes B in the sentence"

Candidate Programs:

#	Program	Observations
1	Before('wife', B)	Correct
2	Before(B, 'wife')	False for X
3	In(B, Sentence)	Trivially True for all examples
4	After(B, 'wife')	Correct, but redundant with #1

Traditional approach: use labeled examples to learn to rank candidate programs
Our approach: handle parsing ambiguity downstream with filters and modeling

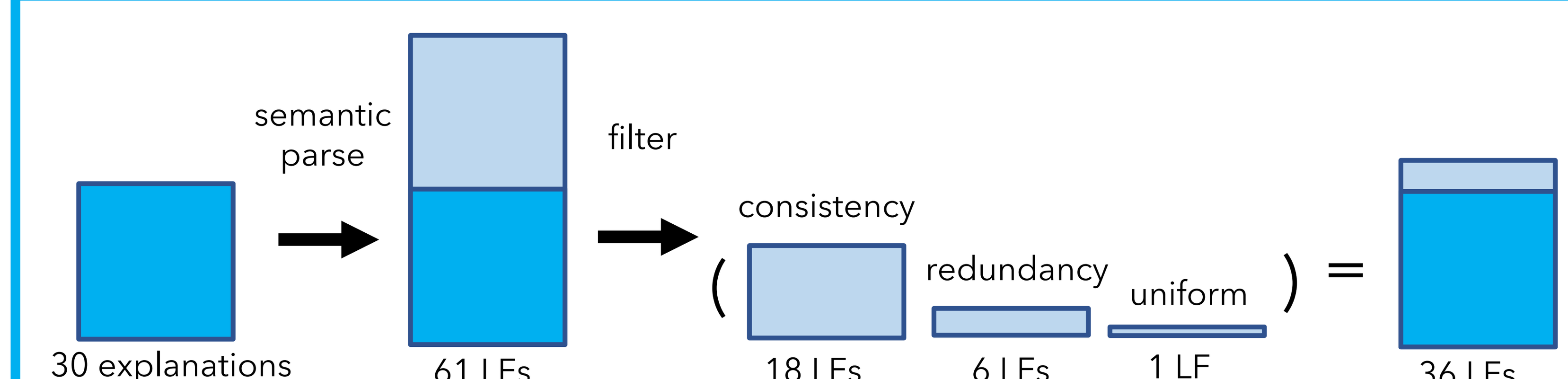
Experimental Results: Chemical-Disease Relations

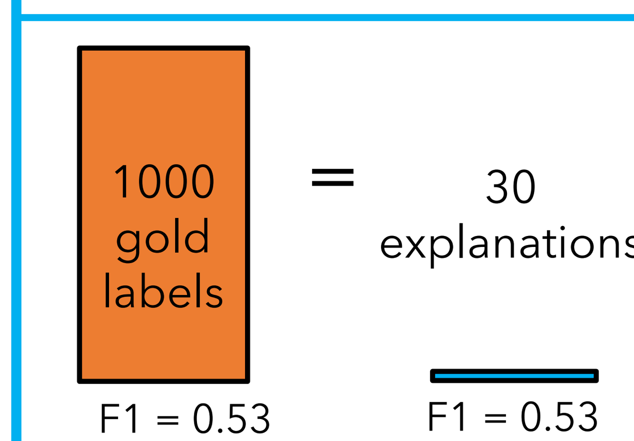
Task: Identify mentions of chemicals causing diseases in PubMed.

True – "because 'induced by', 'caused by', or 'due to' is between the disease and the chemical"

False – "because a treatment word is between the chemical and the disease and the chemical is within 100 characters to the left of the disease"

False – "because the pair of canonical IDs of the chemical and the disease is in the therapeutic combinations dictionary"





Same quality with 33x fewer inputs!