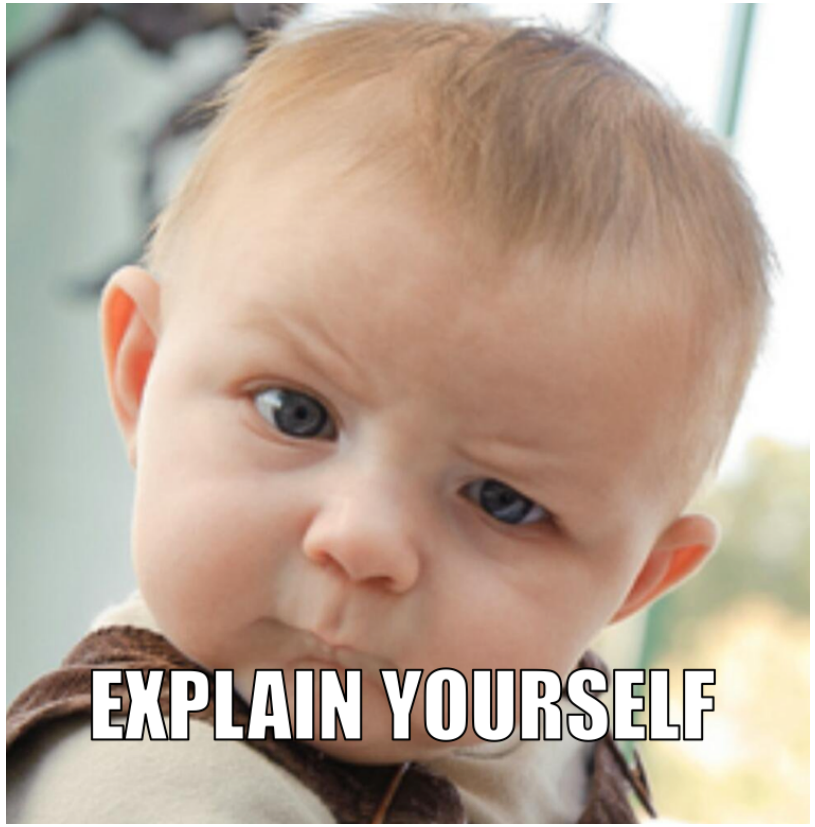
Babble Labble:

Learning from Natural Language Explanations

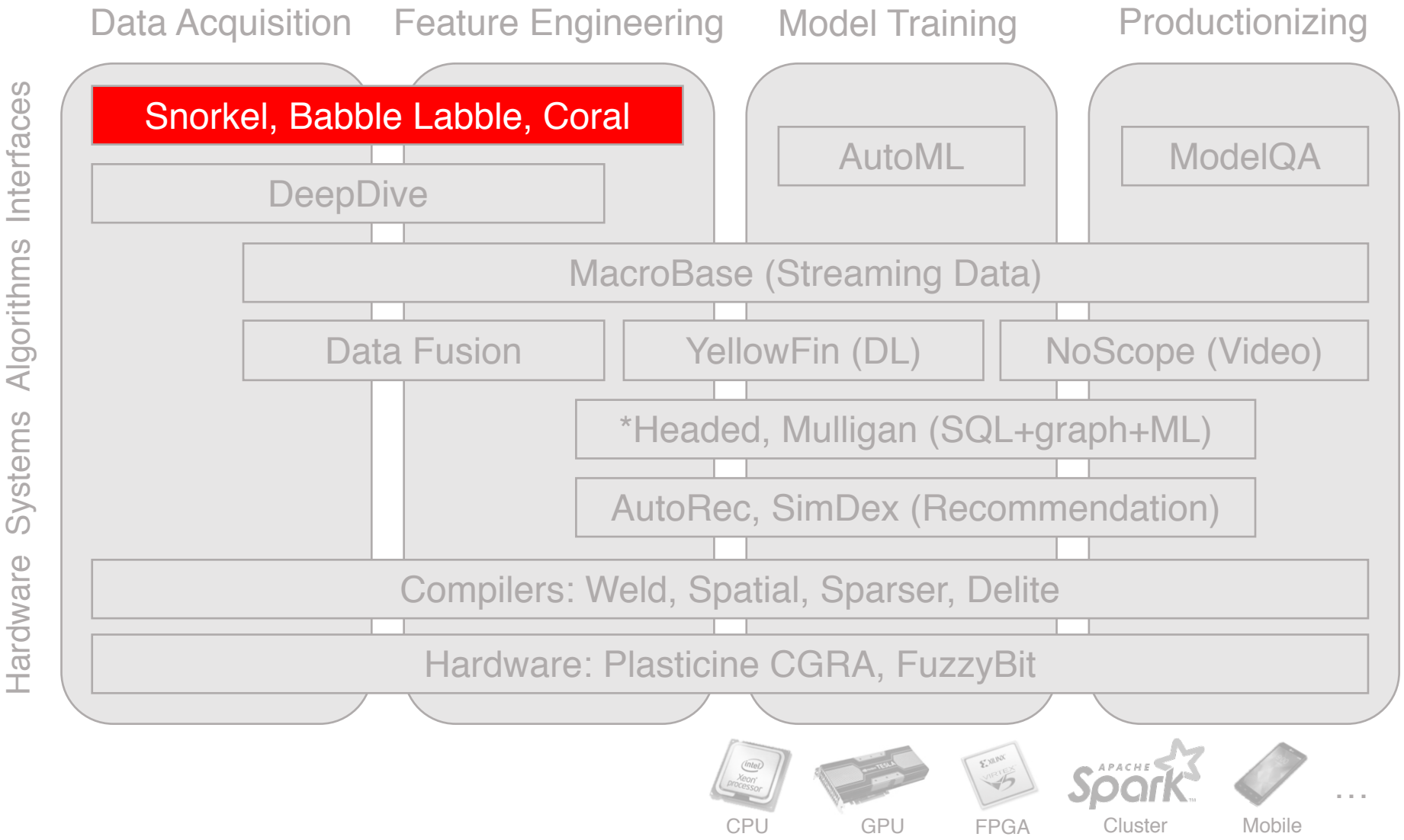


Braden Hancock, Paroma Varma, Percy Liang, Chris Ré

DAWN Retreat 12 Sept 2017

Blog: Google “Babble Labble”

The DAWN Stack



Labeled data

+

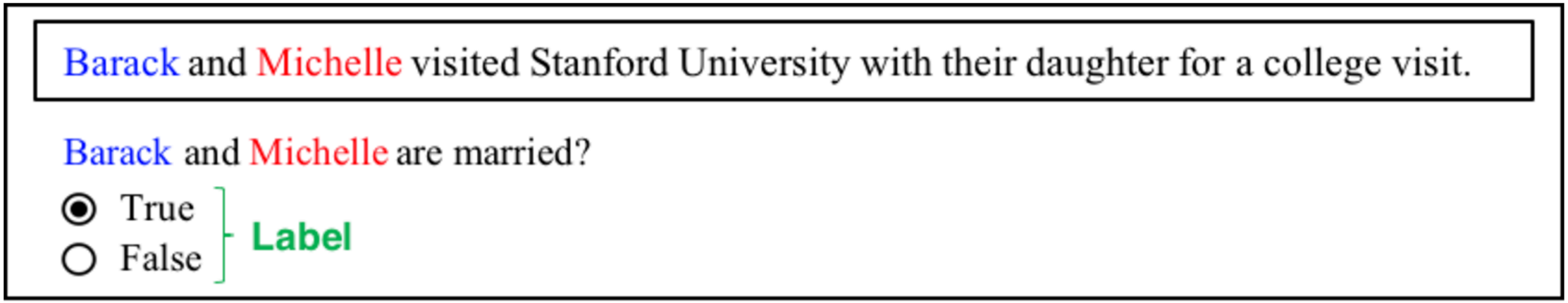
Deep Learning

=

State of the Art

“How can I get enough labels?”

Option 1: With Labels (One by One)



Option 1: With Labels (One by One)

Barack and Michelle visited Stanford University with their daughter for a college visit.

Barack and Michelle are married?

- (●) True
- ( ) False

← Label

Not Scalable

$100k

At $0.10 per label…

1M labels

Not Direct

- Person1 is ‘Barack’
- Person2 is ‘Michelle’
- ‘visited’ is after Person2
- ‘Stanford University’ is in the sentence
- ‘and’ is between Person1 and Person2
- Person1 is the first word in the sentence
- ‘and’ is the second word in the sentence
- Person3 is the third word in the sentence
- …
- ★ ‘their daughter’ is after Person1 and Person2
- …

Option 2: With Labeling Functions (DP)

Barack and Michelle visited Stanford University with their daughter for a college visit.

Write a simple program that labels +1 if the people in the example above are married, -1 if they are not married, and 0 if the program is unsure.

```
def lf(example):
    if (Between(example.person1, example.person2, 'and') and
        After(example.person2, 'their daughter'):
        return 1
    else:
        return 0
```

Labeling Function

Option 2: With Labeling Functions (DP)

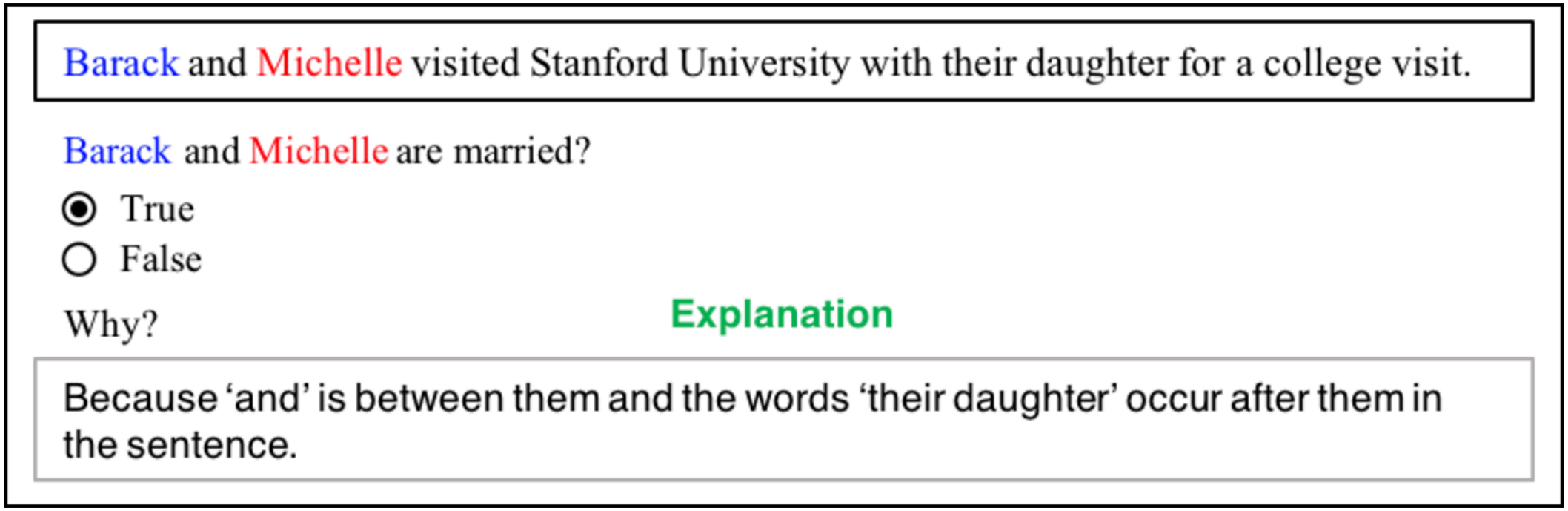
Pro:

- Labeling scales (label 1000 examples at a time)

Con:

- Not everyone can (or wants to) write programs!

Option 3: With Explanations (Babble Labble)



Option 3: With Explanations (Babble Labble)

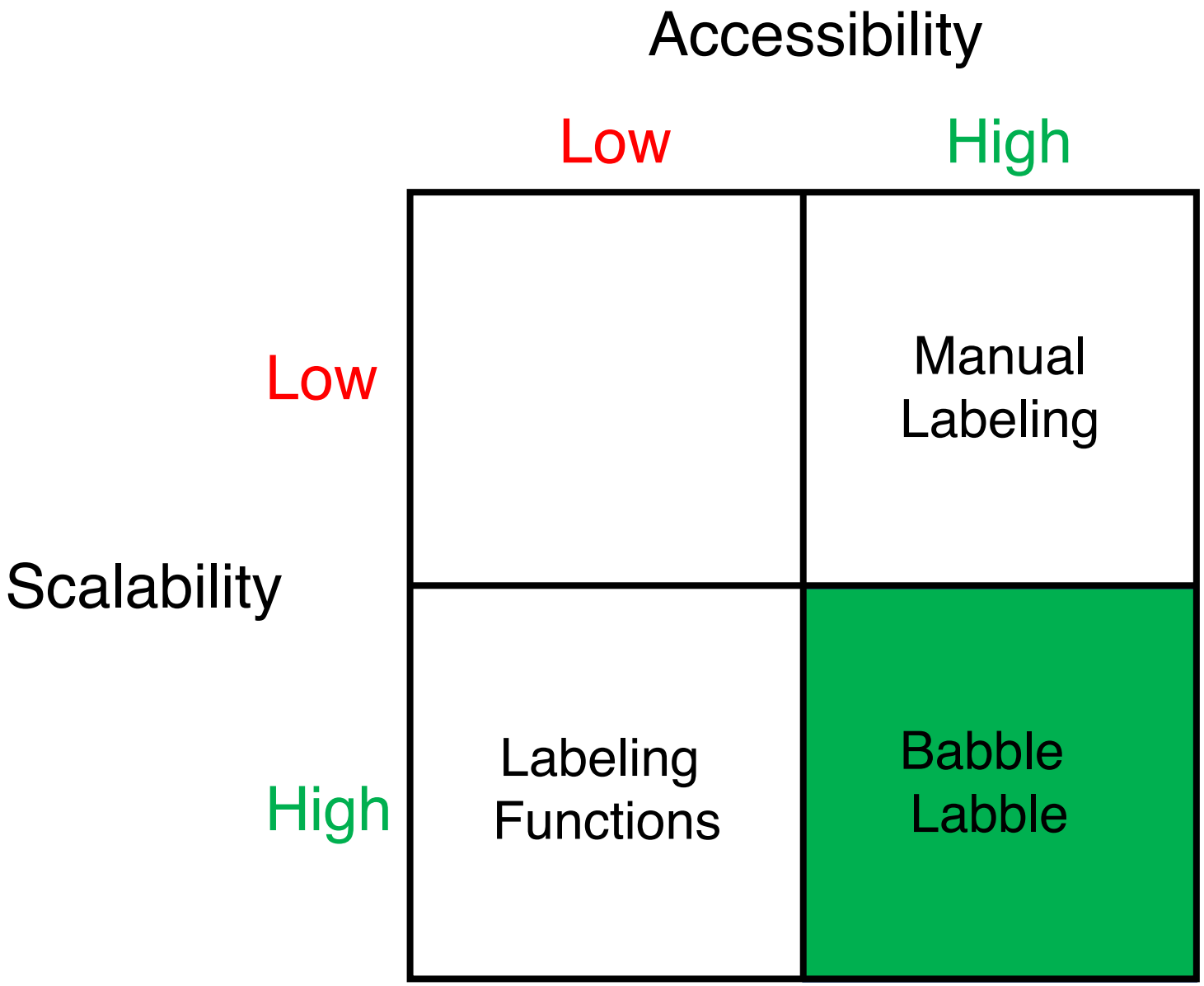
Pros:

- Ease of use
  - Conversational interfaces
  - Hands-free interfaces
- Faster supervision
  - No need to learn new syntax/libraries
  - No debugging of tabs, semicolons, etc.
- More sources of supervision
  - More people in the world can talk than can program
  - More natural language in the world than programs



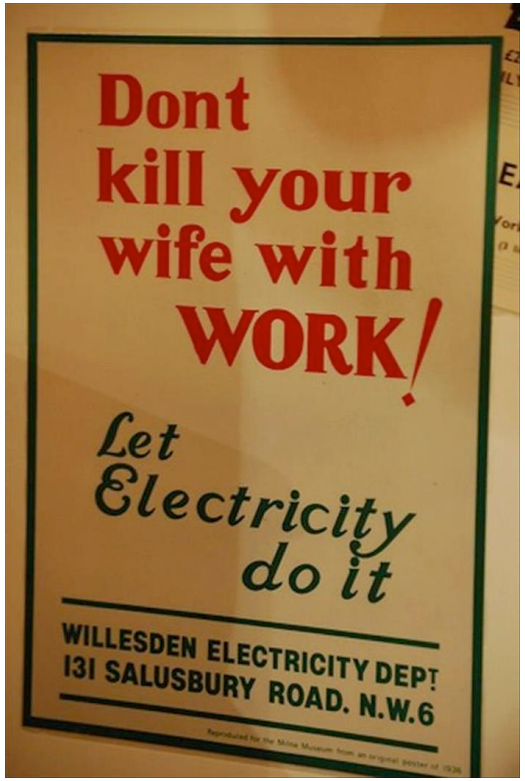
10x faster?

1000000x more?


Accessibility
Low
High
Low
Scalability
High
Manual
Labeling
Labeling
Functions
Babble
Labble

Natural Language is Ambiguous

Students Cook & Serve Grandparents

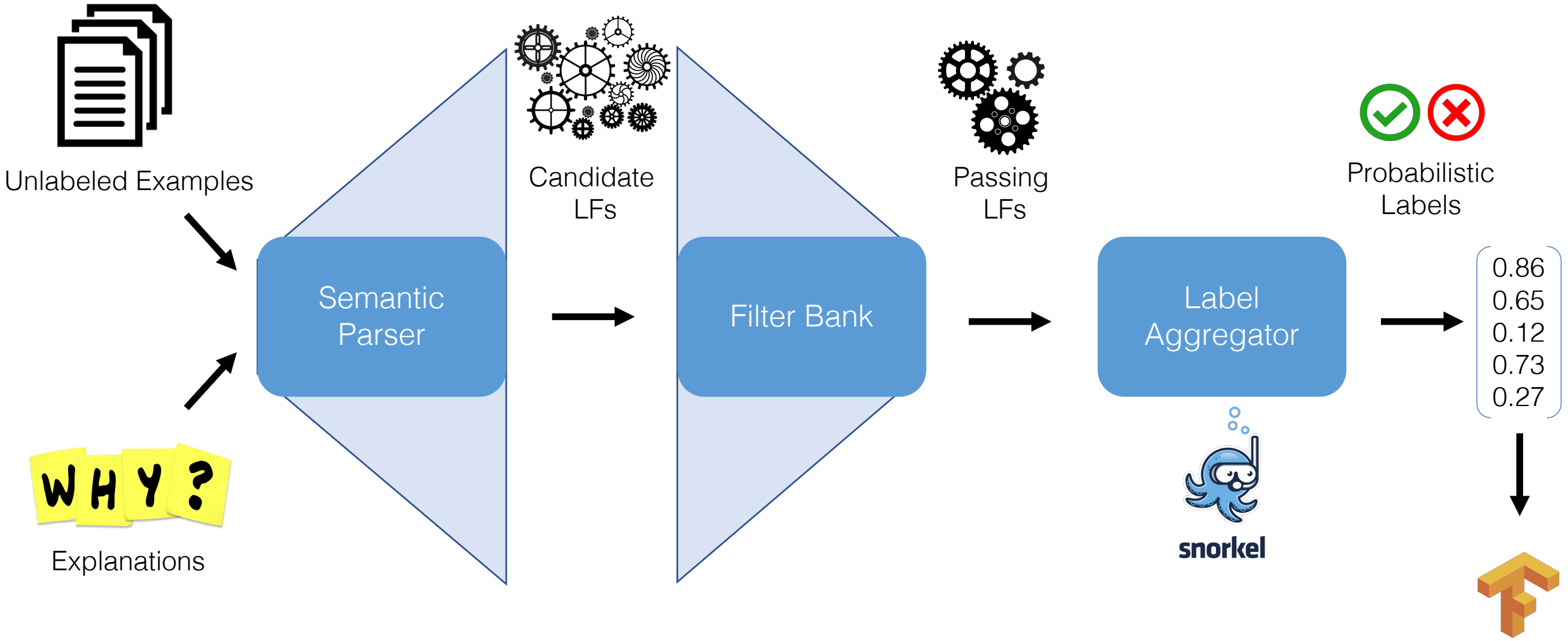


Boy paralysed after tumour fights back to gain a black belt

15 pit bulls rescued; 2 arrested

The Journal News (White Plains, NY) 3/6/08

Babble Labble Framework

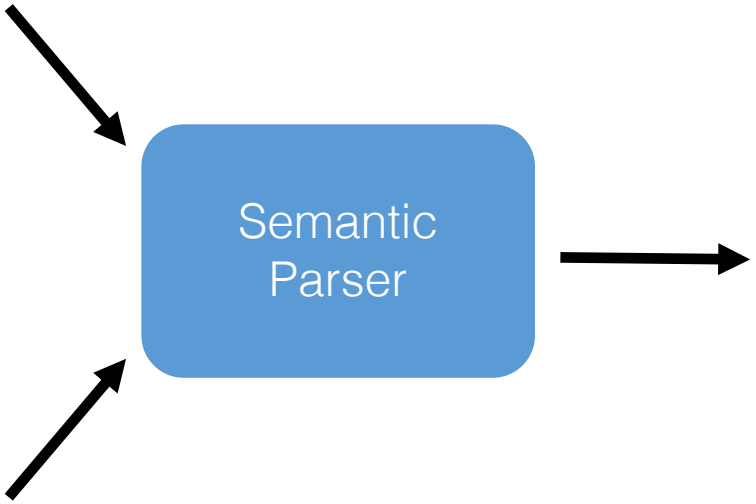


Spurious Programs

Example X:

A B

Barack and his wife Michelle live in the White House.



Candidate Programs:

Before('wife', B)	Intended
Before(B, 'wife')	Spurious
In(B, Sentence)	
In("'wife' precedes B", Sentence)	
And(Before('wife', B), In(B, Sentence))	

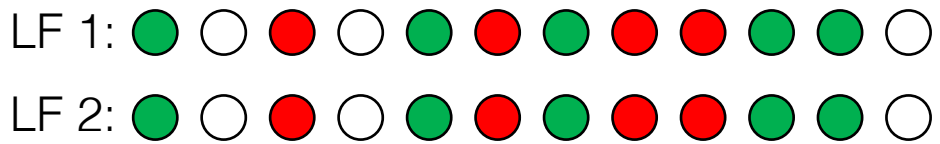
Explanation Y:

"True because 'wife' precedes B in the sentence"
(for candidate (A, B))

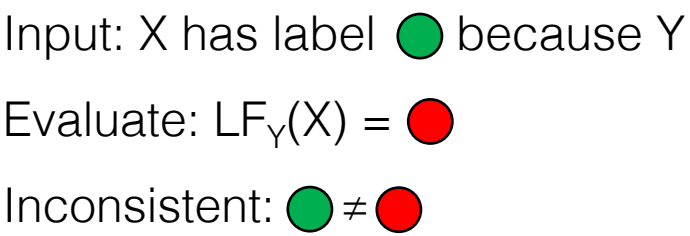
Filter Bank

- Uniform signature

- Redundant signature

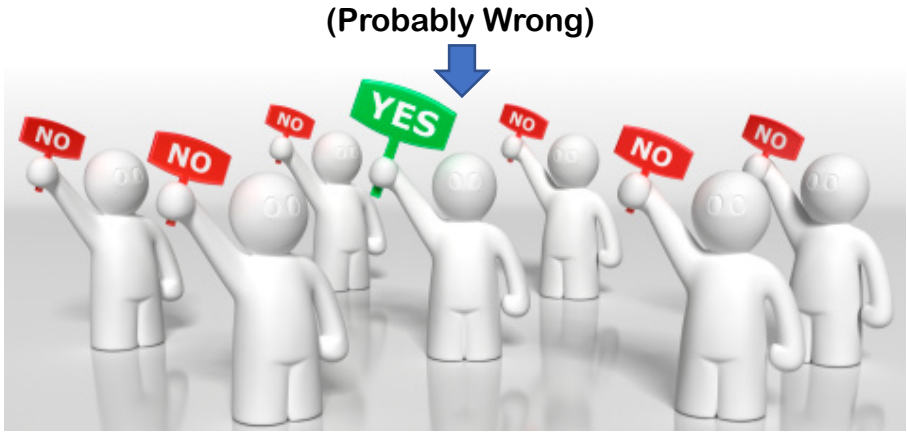


- Example consistency

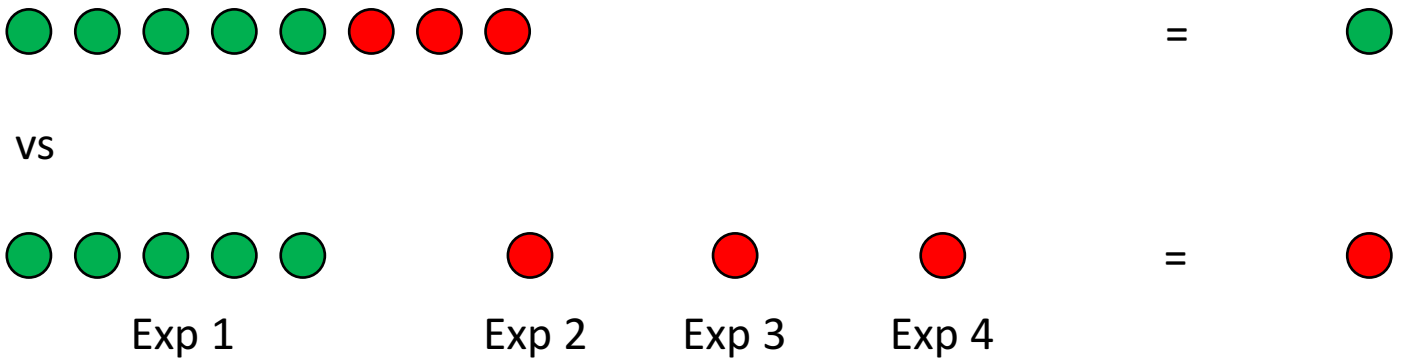


Label Aggregator

- Model the LFs' accuracies



- Model the LFs' dependencies



How *Weak* Can We Go?

Data Programming: Feed a larger set of “accurate enough” labels to the discriminative model

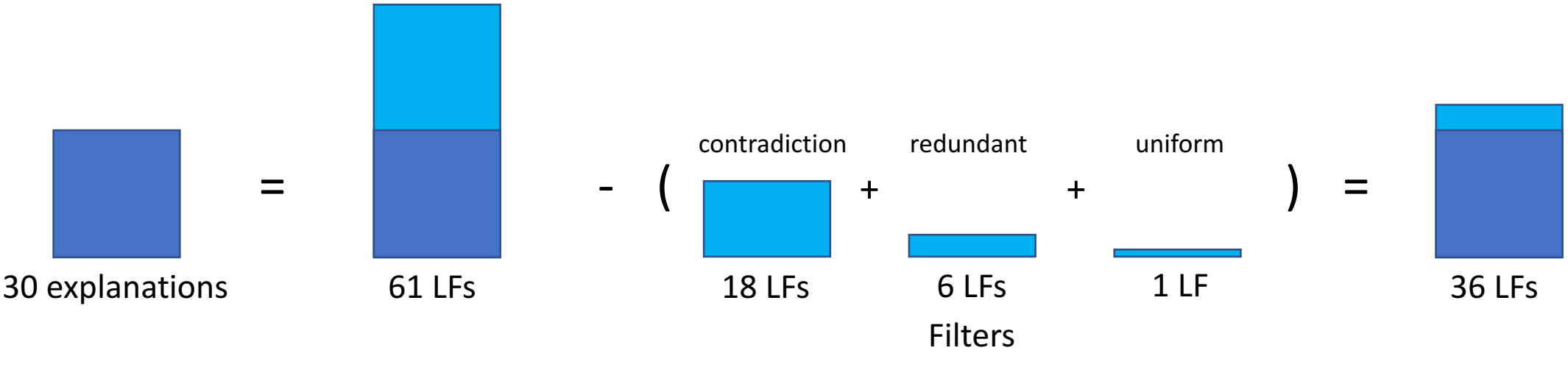
Babble Labble: Feed a larger set of “accurate enough” LFs to the generative model

Experiment: Chemical-Disease Relations

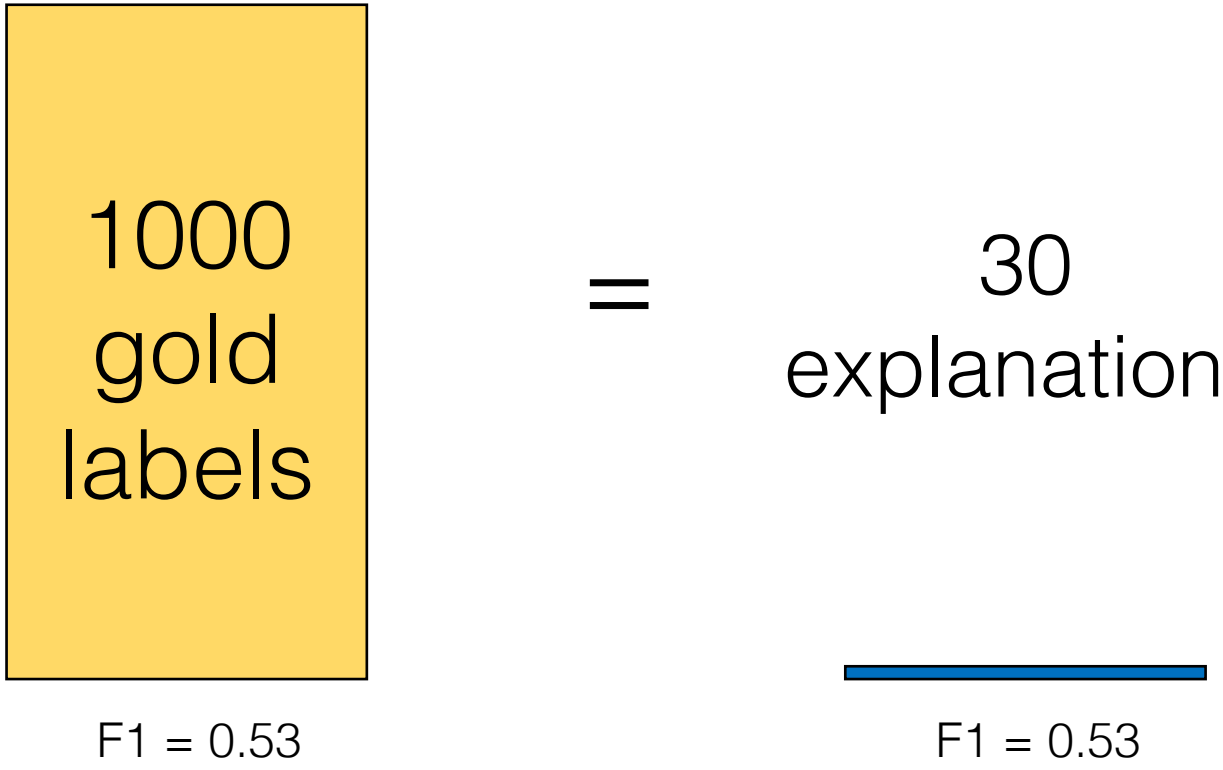
True – “because ‘induced by’, ‘caused by’, or ‘due to’ is between the disease and the chemical”

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”



Experiment: Chemical-Disease Relations

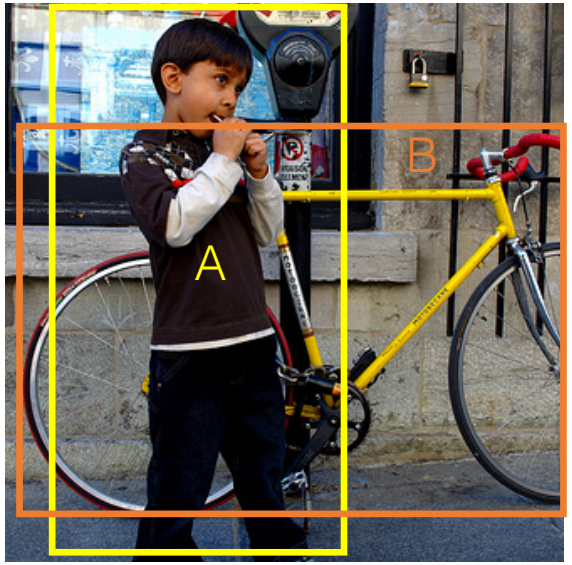


33x

fewer inputs

Expanding to More Domains

Images



"Is person A riding bike B?"

Text

A popular screen star, Lily, who is the daughter of British rocker Phil Collins and his American wife Jill Tavelman was the ideal guest at the film premiere. Her next project is an untitled Warren Beatty biopic on Howard Hughes that is due to be released in 2016.

"Are person A and Person B married?"

Tables

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector - Emitter Voltage BC546 / BC547 / BC548	V_{CEO}	65 / 45 / 30	Vdc
Collector - Base Voltage BC546 / BC547 / BC548	V_{CBO}	80 / 50 / 30	Vdc
Emitter - Base Voltage	V_{EBO}	6.0	Vdc
Collector Current – Continuous	I_C	100	mAdc
Total Device Dissipation @ T_A = 25°C Derate above 25°C	P_D	625 5.0	mW mW/°C
Total Device Dissipation @ T_C = 25°C Derate above 25°C	P_D	1.5 12	W mW/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	–55 to +150	°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction–to–Ambient	$R_{\theta JA}$	200	°C/W
Thermal Resistance, Junction–to–Case	$R_{\theta JC}$	83.3	°C/W

"Is Value A the collector-base voltage of Part B?"


DEMO

What’s Next?

- Applications!
- Where would natural interfaces be useful?
- Where would you like to see this used?

Extra Slides

Spurious LFs can still be helpful

Intended:

"'their daughter' precedes A and B"

Misinterpreted as:

"A and B are preceded by 'their daughter'"

Following the birth of their daughter Beyoncé and Jay-Z took to Twitter to celebrate.

(Talk: Tuesday 2:50-3:10)

Babble Labble: Learning from Natural Language Explanations

Braden Hancock, Paroma Varma, Percy Liang, Chris Ré

Bob and his wife Alice visited Stanford University last Thursday.

Do you think Bob and Alice are married?

◉ Yes
○ No

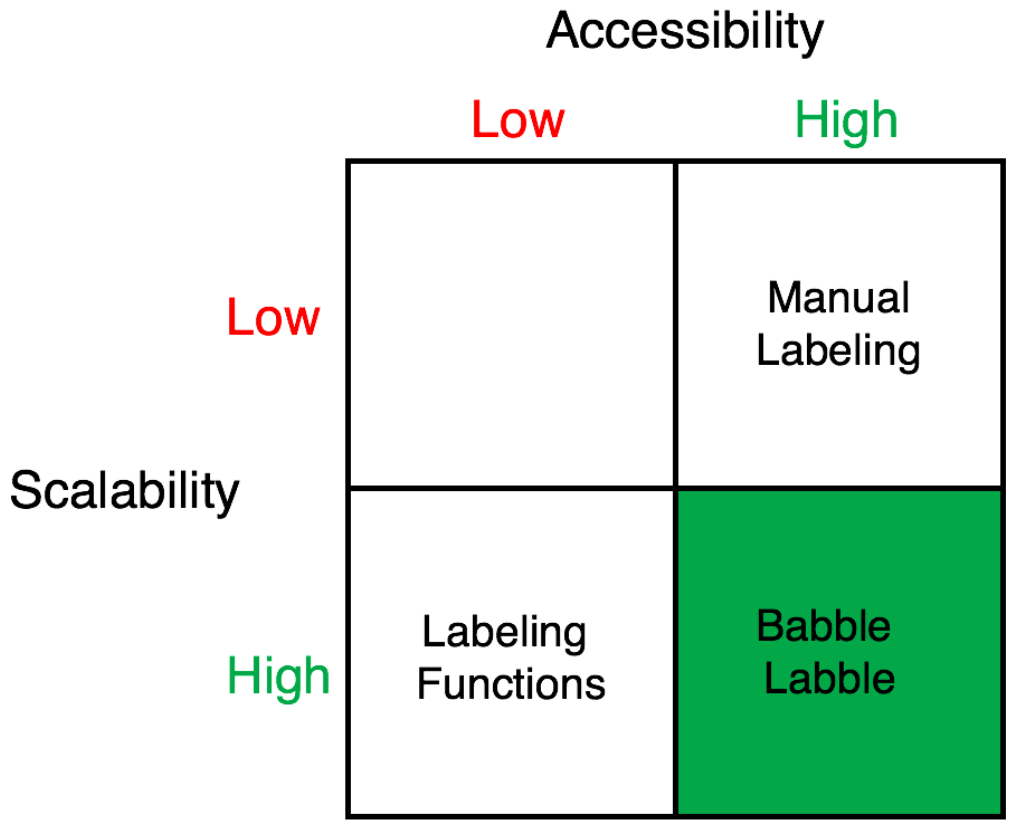
Why?

Because the words 'his wife' are immediately before Alice.

30 explanations = **1000** labels

for identical F1 on a real-world biomedical task

(**33x** fewer inputs)



Blog: https://hazyresearch.github.io/snorkel/blog/babble_labble.html