

Get Your Vitamin C!

Robust Fact Verification with Contrastive Evidence



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Automatic Fact Verification

Determine the veracity of a claim by predicting whether the retrieved evidence **Supports/ Refutes** it, or if there is **Not Enough Information**

Claim

*More than 90K people
live in Beaverton*

Supports

its population is estimated to be 91,757



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Beaverton, Oregon

From Wikipedia, the free encyclopedia

Beaverton is a city in Washington County, Oregon, United States, seven miles (11 km) west of Portland in the Tualatin River Valley. As of 2008, its population is estimated to be 91,757,^[1] almost 14% more than the 2000 census figure of 76,129. This makes it the second-largest city in the county and Oregon's sixth-largest city.

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Beaverton, Oregon

City



Downtown Beaverton, along Broadway



Limitations of static datasets

- Data can be biased
On FEVER, a claim-only classifier can reach 62% accuracy
- Models might ignore the evidence

Limitations of static datasets

Claim:

The 2020 Olympics will occur in the year their name implies

Supports



Wikipedia 2018

The 2020 Summer Olympics [...] is scheduled to take place from **24 July to 9 August 2020**.



Limitations of static datasets

Claim:

The 2020 Olympics will occur in the year their name implies

Wrong!

Supports



Supports

The 2020 Summer Olympics [...] is scheduled to take place from **24 July to 9 August 2020**.



| **ESPN Updates:**
| Tokyo 2020 Olympics officially
| postponed until 2021
|
|

[...] scheduled to be held from 23 July to 8 August 2021 in Tokyo, Japan [...] Despite being **rescheduled for 2021**, the event **retains the Tokyo 2020 name** for marketing and branding purposes.



Wikipedia revisions

Over 6K edits every hour

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2009 version



Beaverton is a city in Washington County, Oregon, United States, seven miles (11 km) west of Portland in the Tualatin River Valley. As of 2010 US census the population is 89,803^[1] This makes it the second-largest city in the county and Oregon's sixth-largest city. In 2010, Beaverton was named by Money magazine as one of the 100 "best places to live", among smaller cities, in the country.^{[2][3]}

2011 version

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2011 version

Supported

*More than 90K people
live in Beaverton*

Refuted

Vitamin C dataset

- Large fact verification dataset with contrastive evidence
- Based on real and synthetic Wikipedia revisions
- Enables new and important fact-related tasks

Revisions with factual modification

Non factual

Jordan Peele **will also host, narrate and produce** the CBS All Access anthology series The Twilight Zone (2019–present).



Jordan Peele **has also served as the host and producer of** the CBS All Access anthology series The Twilight Zone (2019–present).

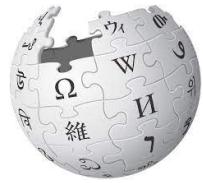
Factual

In animals, spaying involves an invasive removal of the ovaries, but rarely has major complications **other than that spayed animals tend to gain weight**.



In animals, spaying involves an invasive removal of the ovaries, but rarely has major complications; **the superstition that it causes weight gain is not based on fact**.

Data collection



5K most-viewed articles + COVID-related



200M revisions



Extracting sentence-level modifications



Ranking for existence of factual change

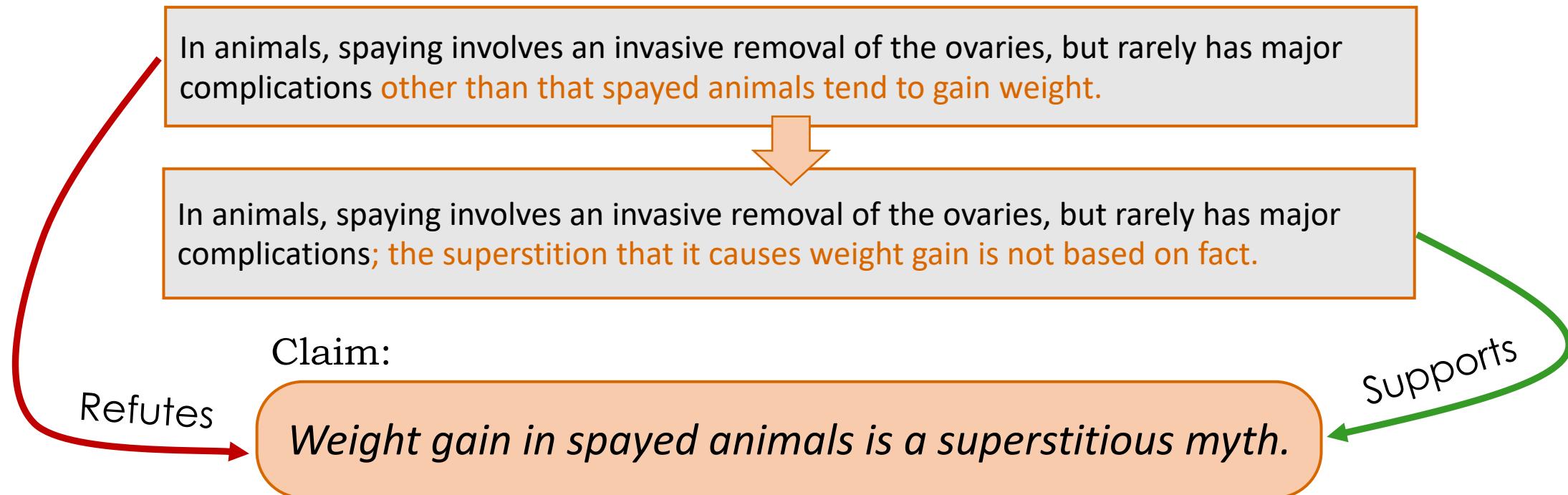


305K top sentences



107K confirmed by human annotators

Writing claims



When a “Refutes” relation was not suitable, annotators labeled the case as “Not Enough Information” (NEI)

Synthetic revisions

- Many factual revisions are numerical (~48%)
- To capture less common claims, we also create synthetic revisions:

Caroline Bouvier Kennedy (born November 27, 1957) is an American author, attorney, and diplomat who served as the United States Ambassador to Japan from 2013 to 2017



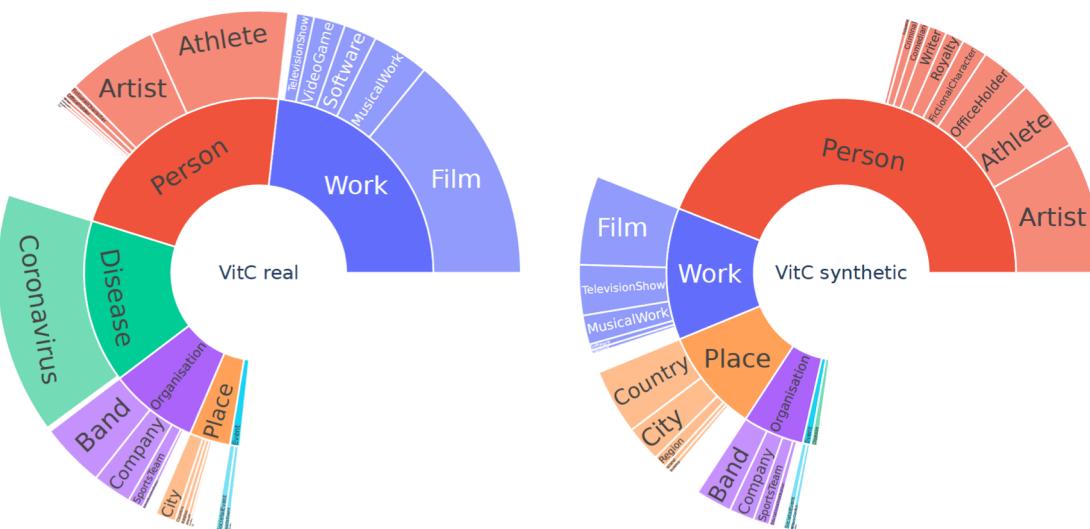
Caroline Bouvier Kennedy is an Italian author, attorney, and diplomat

Dataset statistics

- Total of almost 500k claim-evidence pairs

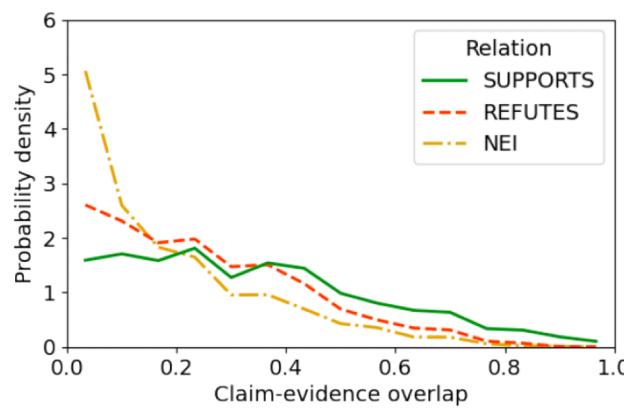
	Supports	Refutes	NEI
Train	185K	132K	53K
Validation	31K	22K	9K
Test	27K	20K	7K

- Diverse topics

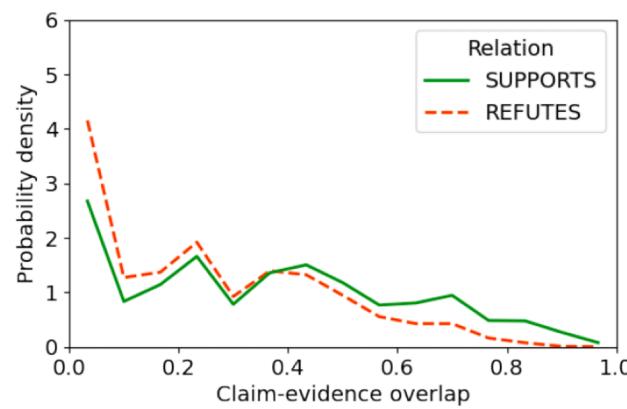


Dataset analysis

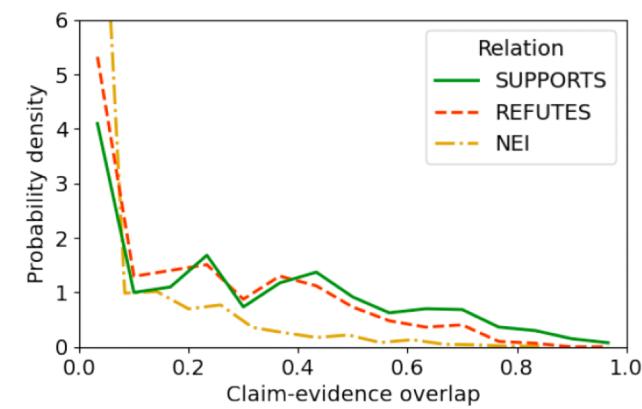
- We verify that simple heuristics like claim-only classifiers fail on Vitamin C
- Claim-Evidence word overlap:



(a) VITAMINC real



(b) VITAMINC synthetic



(c) FEVER

Tasks

1. Factual revision flagging

This revision is factual because it modifies when the first case was identified

The outbreak was first identified in Wuhan, Hubei, China in **December** 2019 and recognized [...].



The outbreak was first identified in Wuhan, Hubei, China in **17 November** 2019 and recognized [...].

2. Robust fact verification

Claim: *COVID was identified before Dec.*

3. Word-level rationales

The words in orange are the main reason for the claim-evidence relation

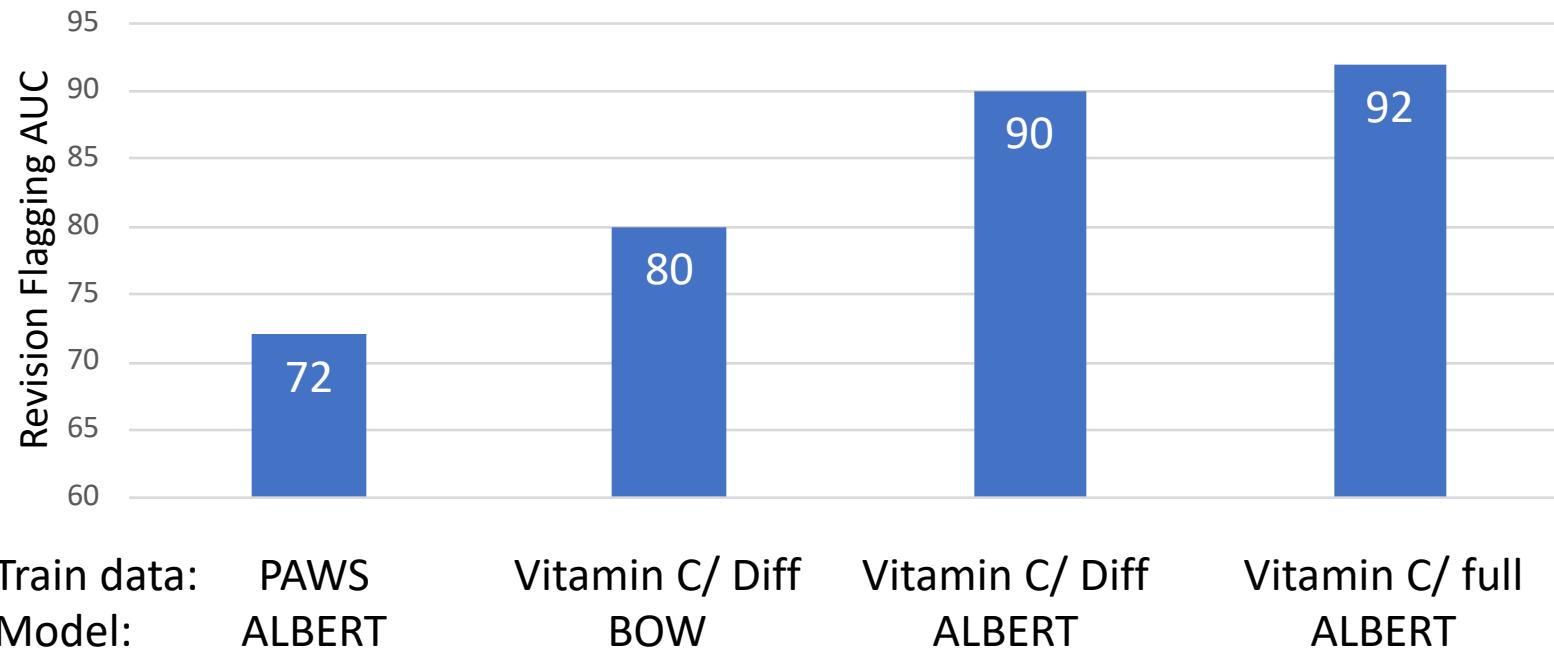
4. Factually consistent generation

- a. Automatic revisions
- b. Claim extraction

1. Factual revision flagging

Paraphrase detection datasets don't transfer well

Mostly based on word scrambling which is different than actual Wiki revisions

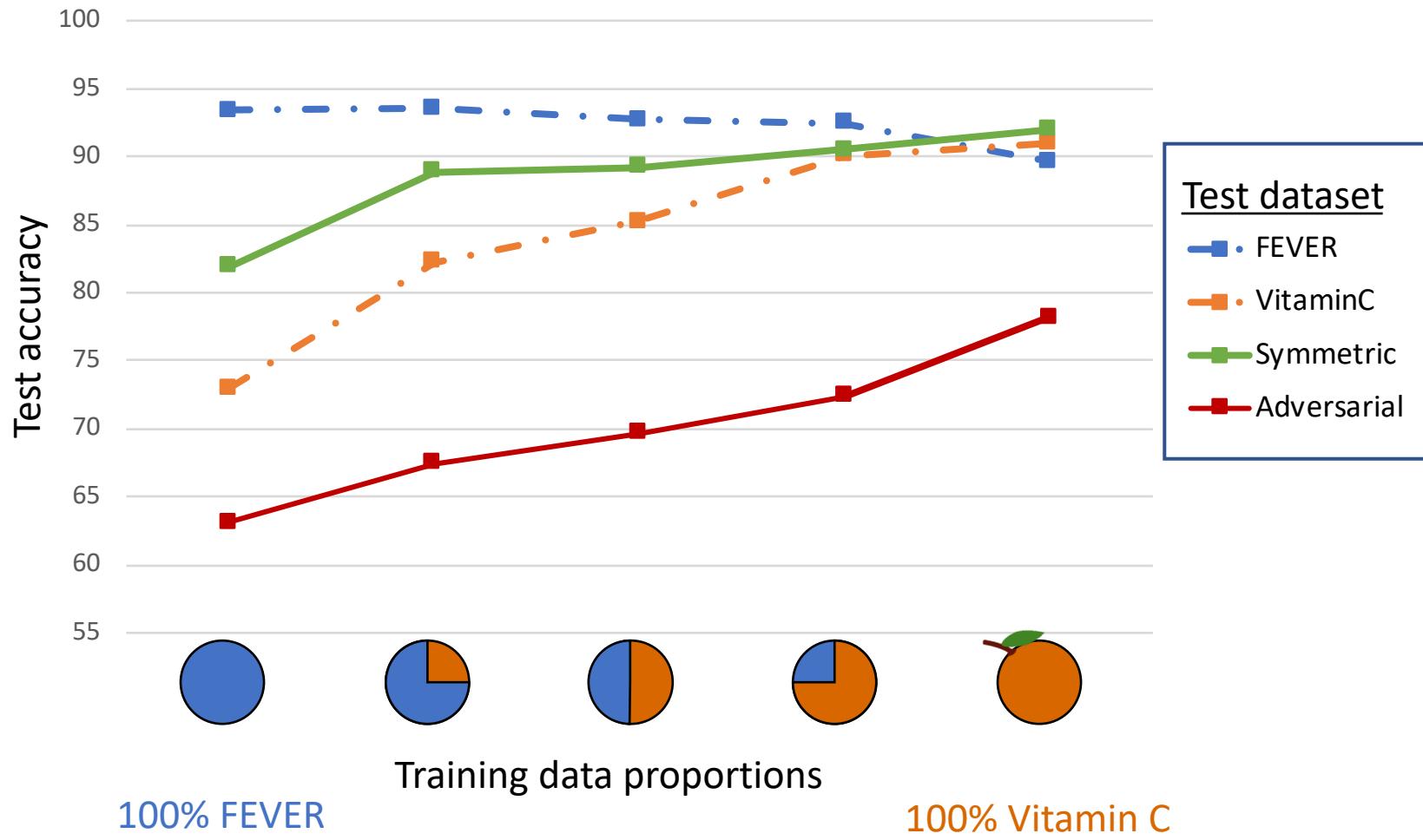


PAWS: Paraphrase dataset with word scrambling and backtranslation

Diff: Only modified words

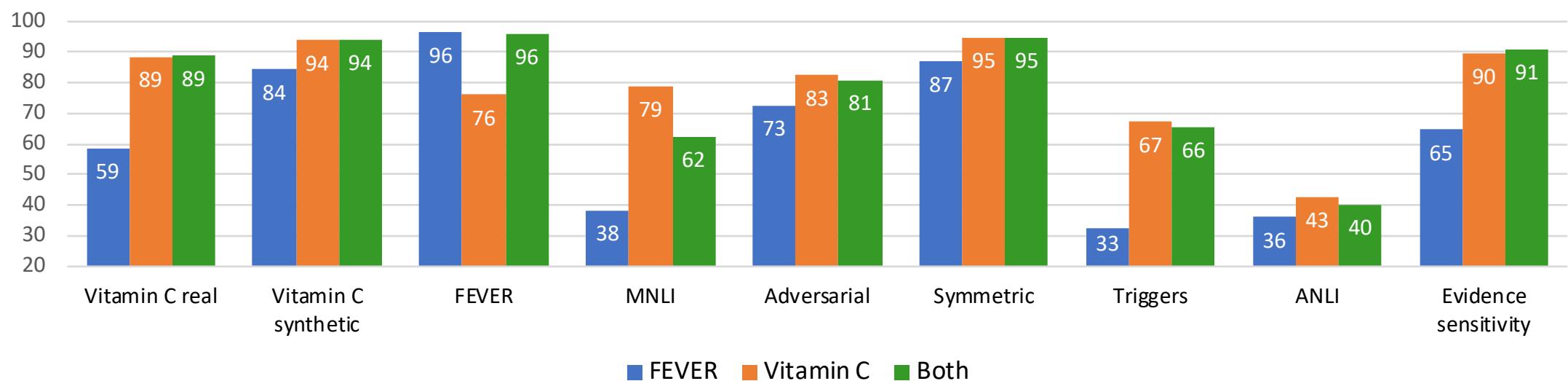
Full: Full before/ after sentences

2. Robust fact verification



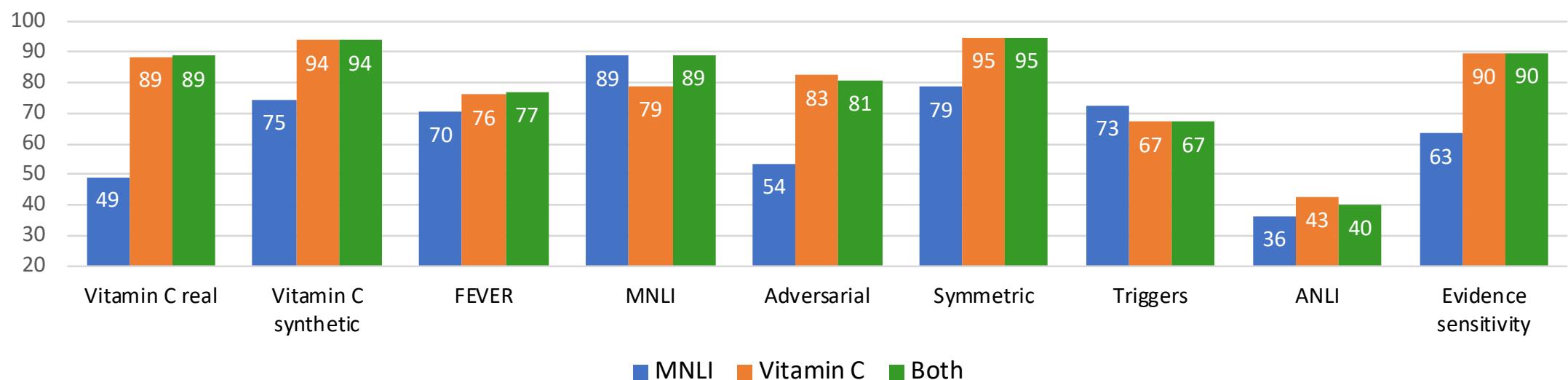
2. Robust fact verification

- Vitamin C improves **robustness** and preserves in-domain accuracy
- Significantly increases sensitivity to **contrastive evidence**



Natural Language Inference

- We see similar trends when combining with the MNLI dataset
- Trained models are more robust and **more sensitive** to the context



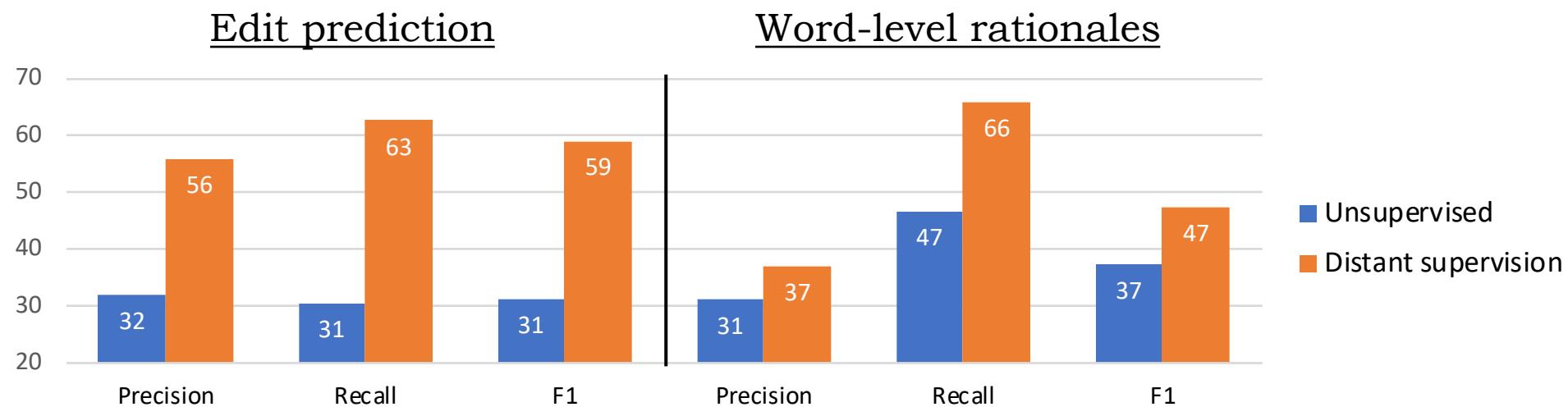
Examples of (in)sensitivity

6-shot GPT-3 with the ANLI format of Brown et al., 2020

Claim	Evidence	GPT-3	Ours
<i>Less than 90,000 people live in Beaverton, Oregon</i>	its population is estimated to be 91,757	False	False
	its population is estimated to be 86,205	False	True
<i>Cartoon Network is owned by Turner Broadcasting System</i>	Cartoon Network is an American pay television channel owned by Turner Broadcasting System	True	True
	The Walt Disney Company is the only owner of Cartoon Network	Neither	False

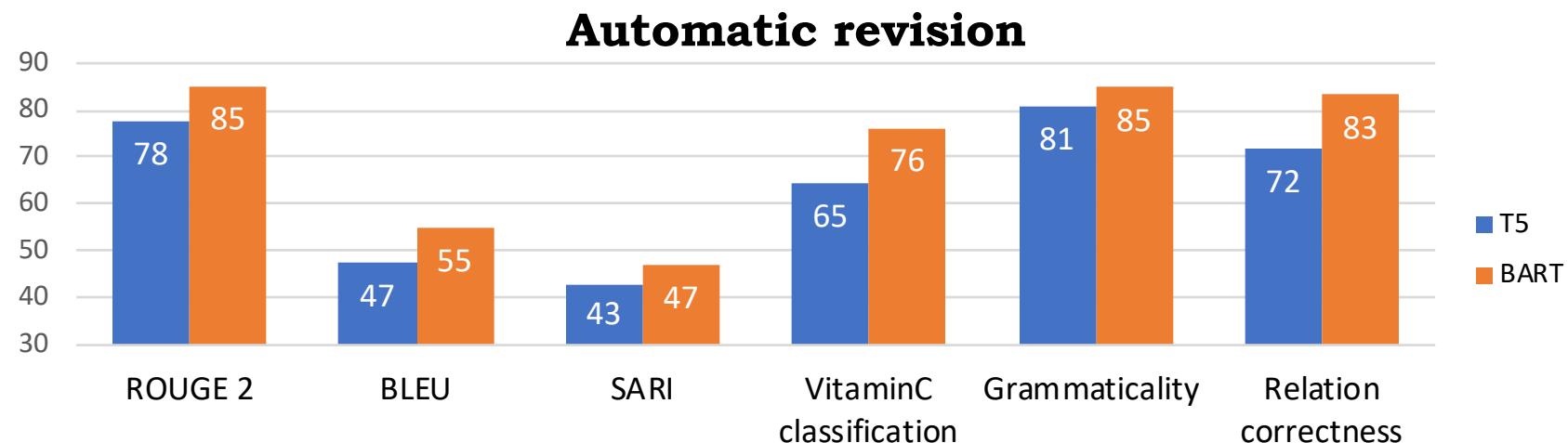
3. Word-level rationales

Distant supervision from the revisions improves rationale extraction



4. Factually consistent generation

The Vitamin C data supports high quality and consistent generations



Wikipedia sentence

Stephen Bruner (born October 18, 1984),
better known by his stage name
Thundercat [...]

Claim

*Stephen Bruner was born
on October 19, 1984*

Revised sentence

Stephen Bruner (born October 19, 1984),
better known by his stage name
Thundercat [...]

4. Factually consistent generation

Revision

2020 coronavirus pandemic in Germany:
there have been **349** confirmed cases and
16 recoveries.

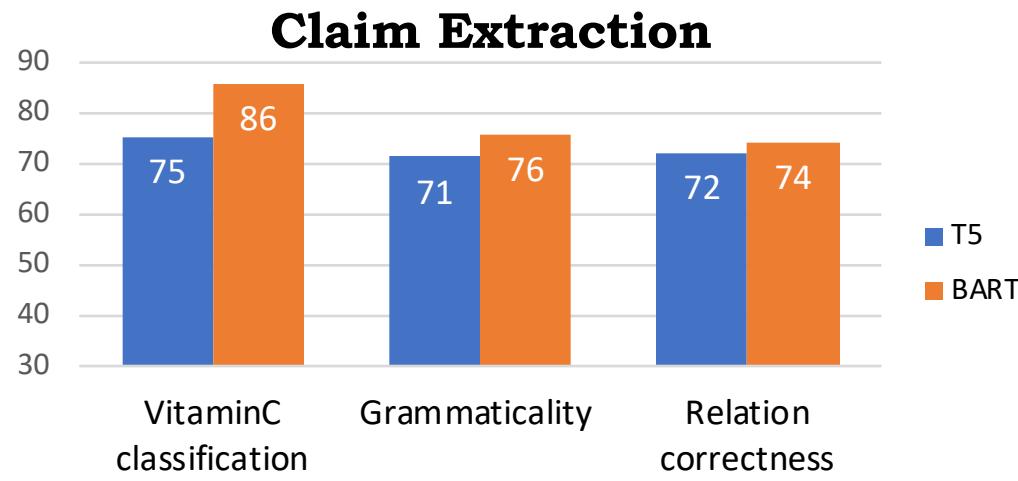
2020 coronavirus pandemic in Germany:
there have been **444** confirmed cases and
16 recoveries.

Ours:

More than 400 people have tested positive for COVID-19 in Germany.

GPT-3:

*As of March 12, there have been more than 400 confirmed cases **and 20 reported deaths***



VitaminC-trained model prediction

Supported

Not Enough Info

Conclusions

- We present the Vitamin C dataset with contrastive evidence to improve robustness of Fact Verification and NLI models
- We formulate and provide supervision for new tasks
 - Revision flagging
 - Word-level rationales from the evidence
 - Factually consistent generation (+ automatic evaluation)
- Dataset and models:  [Github.com/TalSchuster/VitaminC](https://github.com/TalSchuster/VitaminC)

Thank you