

# A Uniform Model for Generative and Discriminative Commonsense Knowledge Tuples

## 1. Background

- Commonsense knowledge is possessed by most humans and helps them in everyday situations [1].
- Types of knowledge include generative (*apple is a fruit*) and discriminative (*apple is a fruit but a cucumber isn't*) [2]
- Both types can either be positive or negative: *cucumber is not a fruit* is negative generative knowledge and *a pear and an apple are both fruits* is negative discriminative knowledge (we can't differentiate them) [2].
- Existing models for commonsense knowledge are not fit for negative and discriminative knowledge

## 3. Methodology

1. Create queries for evaluation
2. Create models
3. Evaluate models on criteria

## 4. Queries

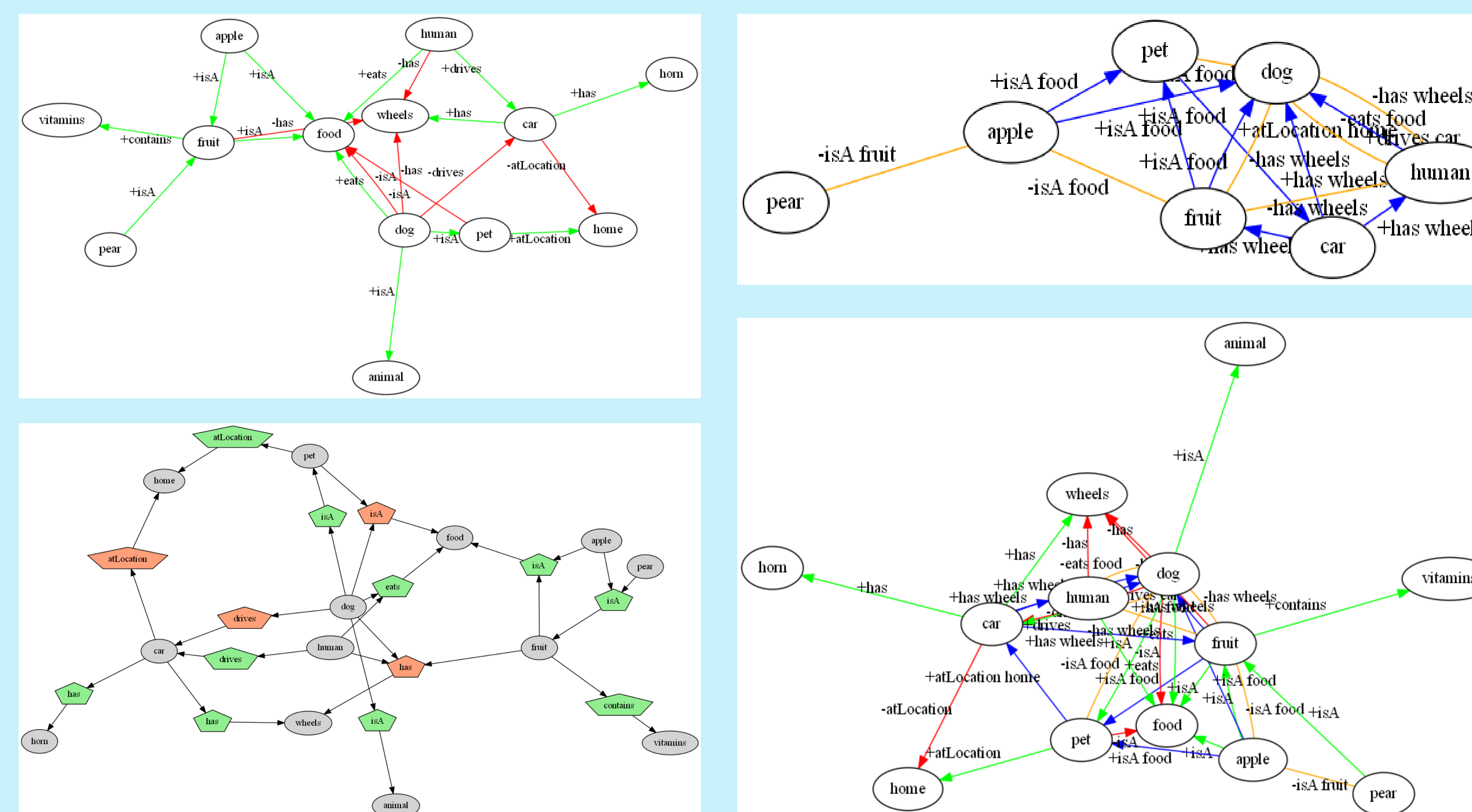
1. Given a concept and a sign, what are the relations and inputs?
2. Given a concept, relation and a sign, what are the inputs?
3. Given a concept, relation, sign and input does it exist?
4. On what relation-input combinations do two concepts differ?
5. On what relation-input combinations don't two concepts differ?
6. Can we differ two concepts for a specific relation and input?

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## 2. Research Question

How to organize discriminative and generative knowledge tuples into a unified model?

## 5. Models



## 6. Results

Model:	Generative	Discriminative	Combined	Hypergraph
Query 1	$O(E)$	-	$O(E)$	$O(HA)$
Query 2	$O(E)$	-	$O(E)$	$O(HA)$
Query 3	$O(E)$	-	$O(E)$	$O(A)$
Query 4	$O(E^2)$	$O(L)$	$O(L)$	$O(HA)$
Query 5	$O(E^2)$	$O(L)$	$O(L)$	$O(HA)$
Query 6	$O(E + E)$	$O(L)$	$O(L)$	$O(A)$
Storage	$ G $	$ D $	$ G  +  D $	$ H $

## 7. Comparing

- Discriminative model can't execute all queries → not suitable
- Combined model fastest in executing queries but expensive in storage
- Generative and hypergraph model are relatively comparably cheap in storage
- Generative model is faster in executing queries than hypergraph and is therefore preferred.

## 8. Conclusions

- Two suitable models:
  - Generative and Combined model
- Which model is more useful depends on the application and available resources

## References

- [1] F. Ilievski, A. Oltramari, K. X. Ma, B. Zhang, D. L. McGuinness, and P. Szekely, "Dimensions of commonsense knowledge," *Knowledge-based Systems*, vol. 229, p. 107 347, 2021, issn: 0950-7051. doi: 10.1016/j.knosys. 2021.107347.
- [2] A. Balayn, G. He, A. Hu, J. Yang, and U. Gadiraju, "Ready Player One! Eliciting Diverse Knowledge Using A Configurable Game," in *Proceedings of the ACM Web Conference 2022*, ser. WWW '22, New York, NY, USA: Association for Computing Machinery, Apr. 25, 2022, pp. 1709-1719