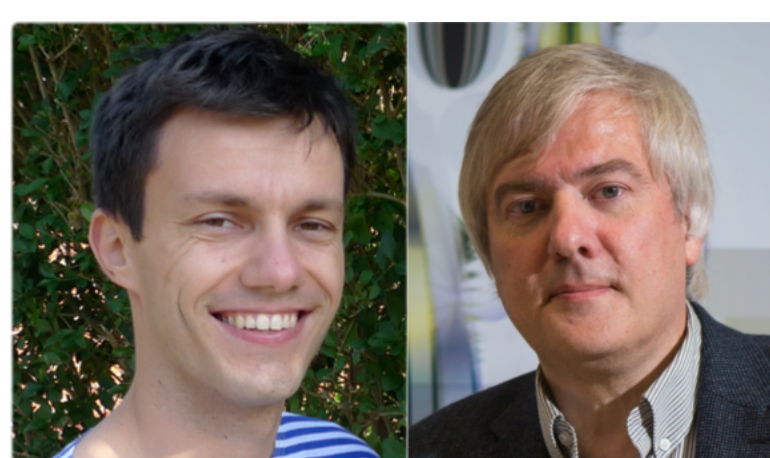


CLINICAL MACHINE COMPREHENSION USING CASE REPORTS



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READING COMPREHENSION

Machine reading comprehension is a form of question answering with a focus on **fine-grained language understanding**. A system reads a document, then answers questions about it.

A possible use case includes **clinical decision support**, where machine comprehension can be combined with retrieval to perform machine reading at scale, cf. Demner-Fushman et al. (2009, *J Biomed Inform* 42: 5).

DATA CREATION

1. Collecting all **BMJ Case Reports**
2. Recognizing medical entities using CLAMP
3. Creating queries from **Learning points**: each medical entity becomes an answer and is blanked out
4. Expanding answers using UMLS[®]: give credit to synonymous answers (hypertension → high blood pressure)

Medical specialties represented:



Our dataset is well suited for training data-intensive machine reading models:

N of cases	12,000
N of queries	105,000
N of tokens in passages	154M
N of entity types in passages	592,000
N of distinct answers	56,000

Answers are medical entities with the following distribution:

problem	67%
treatment	22%
test	11%

CONTRIBUTIONS

- A new clinical reading-comprehension dataset with cloze queries
- Examination of human performance and that of deep learning methods
- A look at skills required to provide the right answer

TASK

Passage p

[...] A gradual improvement in clinical and laboratory status was achieved within 20 days of antituberculous treatment . The patient was then subjected to a thoracic CT scan that also showed significant radiological improvement (figure 1C) . Thereafter , tapering of corticosteroids was initiated with no clinical relapse . The patient was discharged after being treated for a total of 30 days and continued receiving antituberculous therapy with no reported problems for a total of 6 months under the supervision of his hometown physicians . [...]

Query q

If steroids are used , great caution should be exercised on their gradual tapering to avoid _____ .

Answer a

relapse (sem_type=problem, cui=C0035020)

query rephrases the passage
find answer in passage

MACHINE READERS

Baselines

- randomEntity
- maxFreqEntity: pick the most common entity in the passage
- maxSimEntity: select the entity whose context vector best matches the query vector

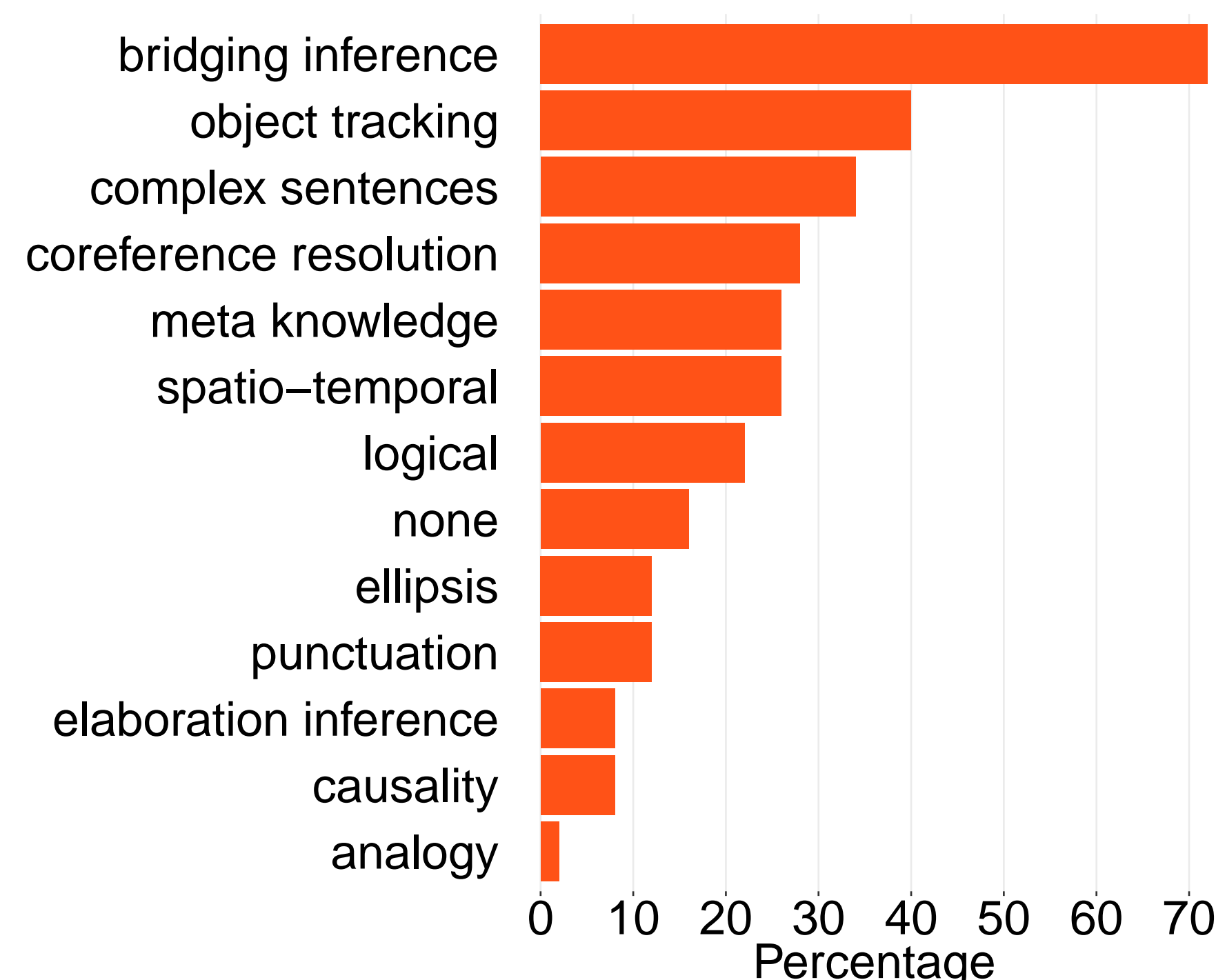
Neural readers

Model $P(a|q, p, A)$ by encoding the query and the passage with recurrent neural nets and estimating their compatibility.

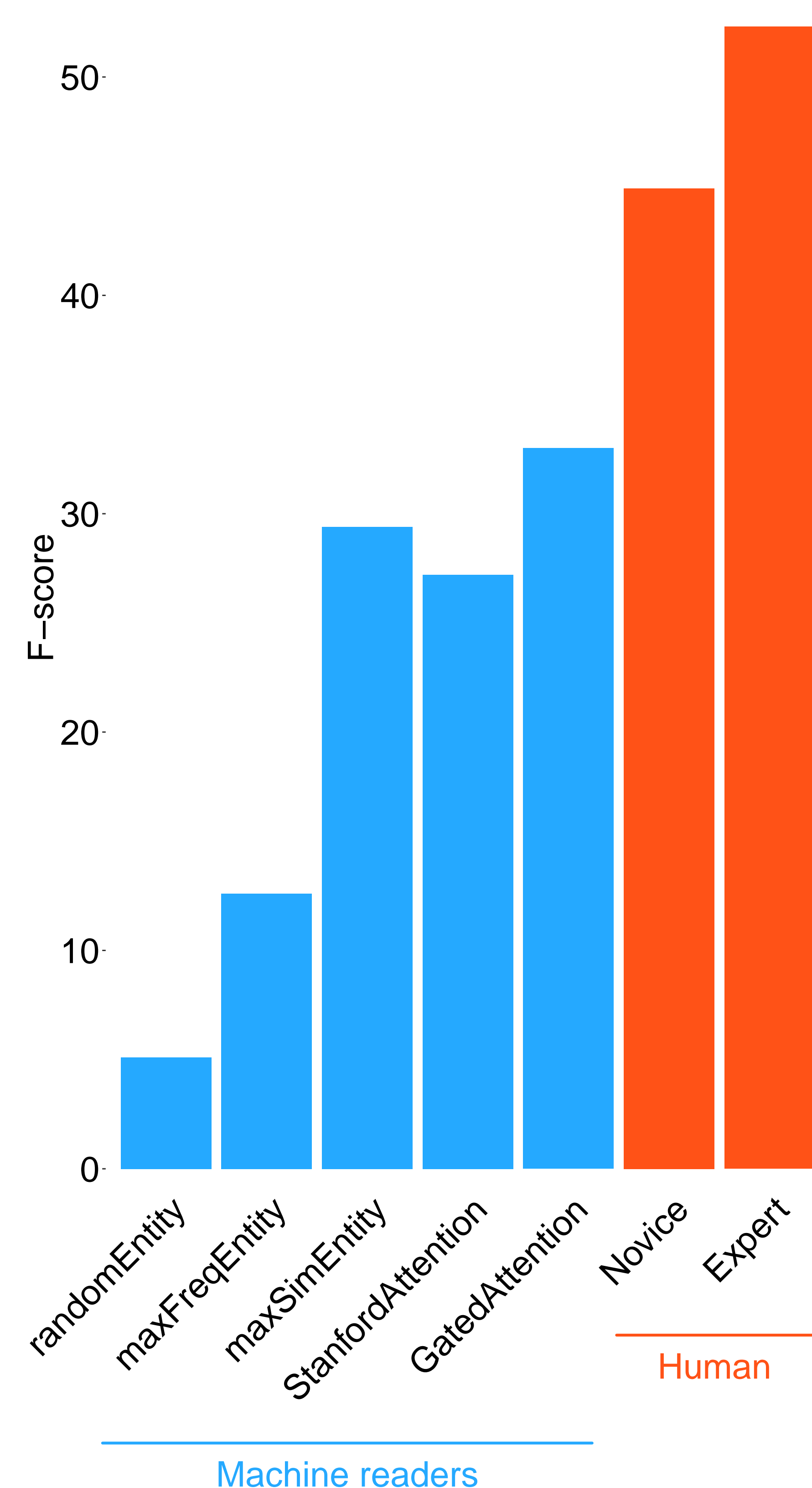
- StanfordAttention (Chen et al. 2017, *ACL*)
- GatedAttention (Dhingra et al. 2017, *ACL*)

SKILLS

A linguist-nurse annotated a part of the validation set with the reading skills according to Sugawara et al. (2017, *ACL*):



RESULTS



AVAILABILITY

Free for research purposes for institutional/individual subscribers of BMJ Case Reports.

PROJECT & ACKNOWLEDGMENTS

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