CTInfer: Natural Language Inference for clinical trials

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Introduction

- Example: **Hypothesis**: The patient does not suffer from diabetes. **Premise**: The patient took 1 unit of insulin at 7:00 a.m.
 - \rightarrow Contradiction
- Objective: Determine techniques, resources and models currently available to apply Natural Language Inference (NLI) in a clinical context, as well as tackling its gaps and challenges.

Research questions

- 1: What are the existing methods, models and datasets available to resolve the NLI task in the clinical domain?
- 2: How can NLI be beneficial to the clinical domain?
- <u>3</u>: What are the gaps of NLI applied to the clinical domain?

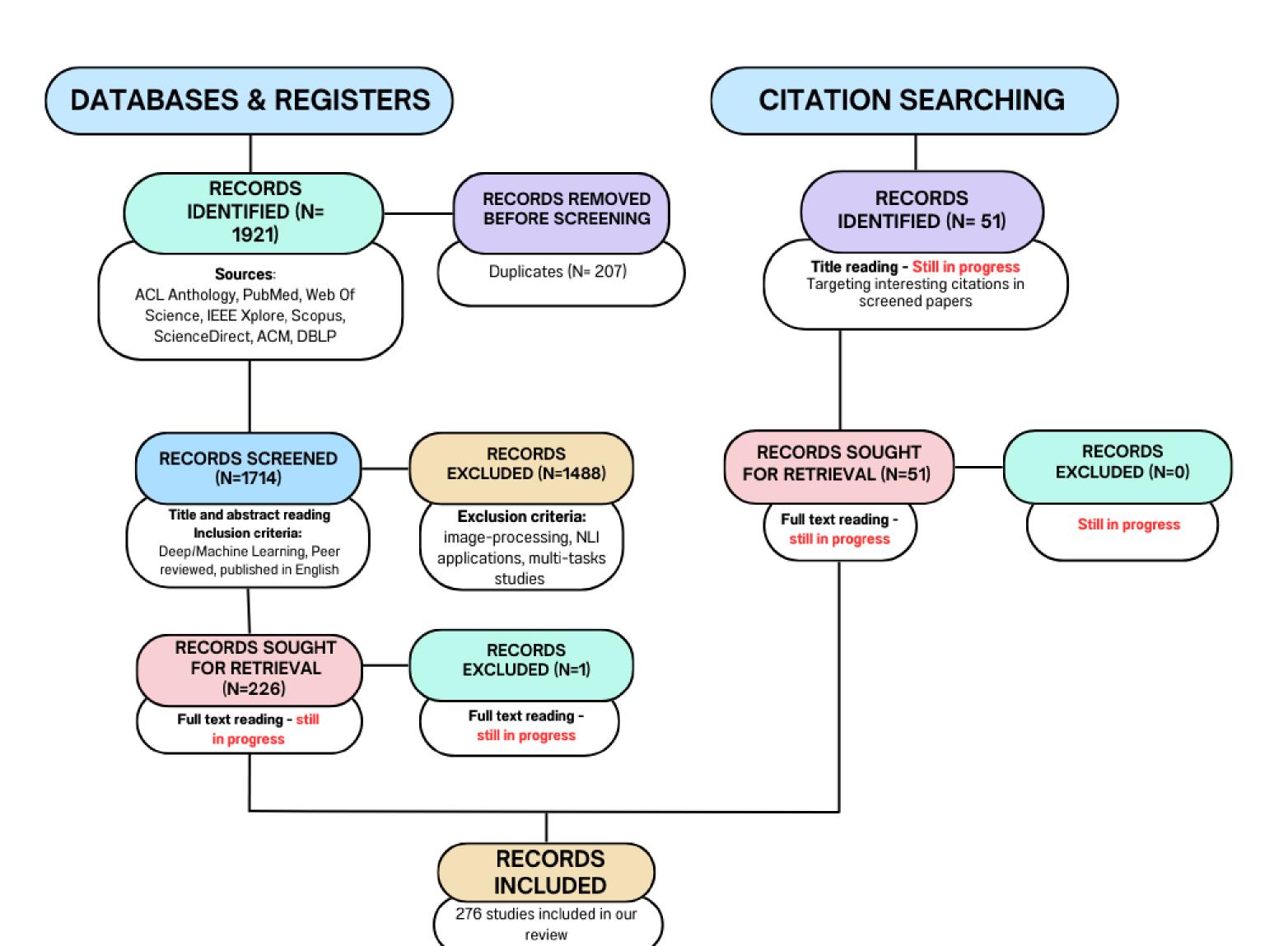
Methods

- PRISMA [1] protocol to conduct the systematic review.
- Databases screened:



- Queries:
 - 1. clinical AND "Natural Language Processing" AND "Natural Language Inference" OR NLI
 - 2. clinical AND "Textual Entailment" OR TE
- Inclusion criteria: Deep/machine learning, peer reviewed paper, published in English

permitted while on study



Adele is an 85 year old woman with Stage II histologically confirmed ER+ breast cancer with an ECOG of 0, she is eligible for the primary trial CTR **ELIGIBILITY - INCLUSION CRITERIA:** Must be female with histologically confirmed breast cancer Stage II-IV disease ER and/or PR positive ECOG Performance Status 0-1 • Tumor must be present following core needle biopsy as determined by physical exam or radiographic evaluation. No prior treatment for current breast cancer. No other active malignancy is allowed. Adequately treated basal cell, squamous cell skin cancer, in situ cervical cancer, or any other cancer from which the patient has been disease-free for 5 years is permitted. Biphosphonates and palliative radiation for bone metastasis is

STATEMENT

COMMON-SENSE REASONING H: 85 year old woman P: Must be female R: Synonyms NUMERICAL INFERENCE LABEL: H: Stage II **ENTAILMENT** P: Stage II-IV disease OR CONTRADICTION OR H: ECOG of 0 NEUTRAL P: ECOG Performance Status 0-1 R: Within the intervals CLINICAL INFERENCE **H**: ER+ P: ER and/or PR positive R: ER+ and ER both relates to oestrogen **H/P**: histologically confirmed breast cancer

*H = hypothesis, P = premise, R = reason

Results 1700 records screened and 276 studies included in the systematic review. English = Chinese = Vietnamese = Arabic = Other General domain Clinical domain Seq2Seq 3.5% 16.7% Biomedical datasets 28% Decoder Encoder 16.7% General English 66.7% domain 88.8% datasets 72% Repartition of the different models Repartition of the domain of the screened Retrieved published articles about NLI per year Repartition of the different architectures datasets languages of the screened datasets

Conclusion

- Complex task requiring different kinds of reasoning (real-world, numerical, domain-specific, etc.).
- Lack of non-English datasets.
- Lack of domain-specific datasets.

References

- [1] Page et al. The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. BMJ, 372:n71, 03 2021.
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