# Information Extraction from Biomedical Texts using Large Language Models for Natural Product-Drug Interactions

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## INTRODUCTION

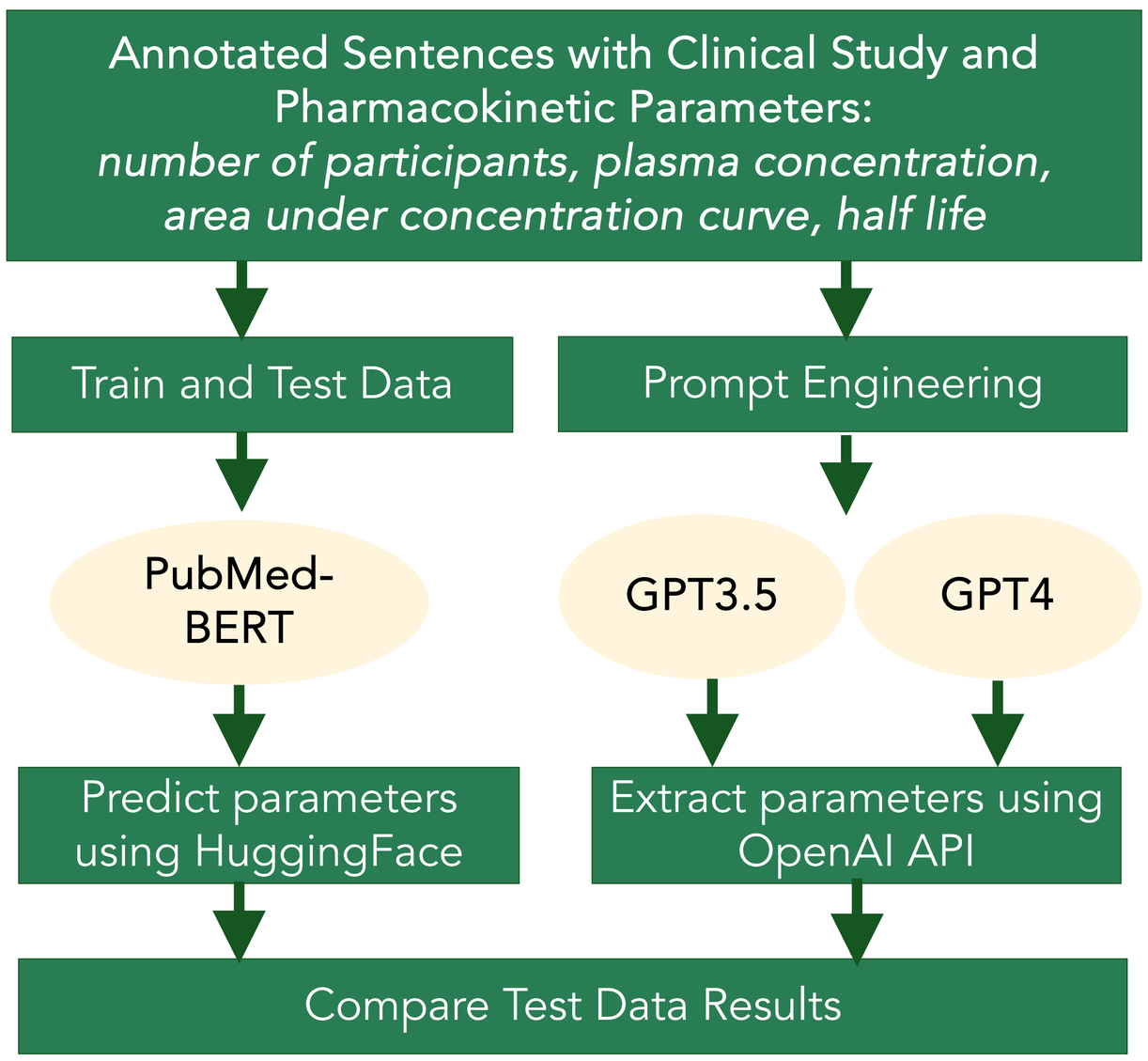
**MOTIVATION**

LLMs can be used for information extraction beyond NER and relation extraction, including context associated with events in literature-based discovery and aggregation of data from clinical studies.

**OBJECTIVES**

- Evaluate LLMs for extraction of important parameters from unstructured text and tables in biomedical studies.
- Assess GPT models' effectiveness in annotating sentences from biomedical texts to reduce annotation burden.

## METHODS




**NER:** Named Entity Recognition
**LLM:** Large Language Models
**GPT**: Generative Pretrained Transformer

Gu Y, Tinn R, Cheng H, Lucas M, Usuyama N, Liu X, Naumann T, Gao J, Poon H. Domain-specific language model pretraining for biomedical natural language processing. ACM Transactions on Computing for Healthcare (HEALTH). 2021 Oct 15;3(1):1-23.
Tian S, Jin Q, Yeganova L, Lai PT, Zhu Q, Chen X, Yang Y, Chen Q, Kim W, Comeau DC, Islamaj R. Opportunities and Challenges for ChatGPT and Large Language Models in Biomedicine and Health. arXiv preprint arXiv:2306.10070. 2023 Jun 15.

## RESULTS

| | No. of parameters | No. of sentences (%) |
|---|---|---|
| Number of participants | 26 | 25 (47.2) |
| Plasma concentration | 30 | 24 (45.3) |
| Area under conc. curve | 26 | 23 (43.4) |
| Half life | 3 | 3 (5.7) |
| Total | 85 | 53 (100) |

Table 1: Parameters and sentences in test data.

| | PubMed-BERT | GPT3.5 | GPT4 |
|---|---|---|---|
| Accuracy (%) | 92.5 | 54.72 | 77.36 |
| F1-score (relaxed) | 0.96 | 0.70 | 0.87 |
| F1-score (strict) | 0.89 | 0.61 | 0.74 |

Table 2: Performance of large language models on test data.

**Prompt:**

```
The task is to extract pharmacokinetic study measurements from the given sentence.
For the sentence delimited by <>, do the following -
1. extract measurement values in the sentence in JSON format like
   [measurement_type: [(measurement value 1 with units, position of measurement
   value 1).
2. return only the JSON output without explanation.
3. If there are no measurement values in the sentence, return 'no measurements' as
   the JSON key.
measurement_type should be values from the set (number of participants or
subjects, area under the plasma concentration curve (AUC), maximum plasma
concentration (Cmax), increase/decrease in plasma concentration/levels). 'position
of measurement value' are the start and end character indices of the measurement
value in the sentence and characters are counted sequentially from the beginning
of the sentence including punctuation and spaces as characters.
```

**Common Errors with GPT models:**

- Hallucination of parameter types not in the prompt – more frequent in GPT3.5
- Character spans not provided accurately by models.

## CONCLUSION

- GPT-4 can retrieve relevant information from limited context, but manual review is required when using it for data annotation.
- Future experiments will explore open-source models such as Llama2, information extraction with text and tables, extract additional parameters (e.g., dosage), and aim to enhance PubMedBERT's performance with annotated data and prompting strategies from LLMs.

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