

**Team Name:** NLP Health Heroes

**Project Title:** Multitask Learning Adapter for Clinical Information Extraction

### **Project Summary:**

Advancements in natural language processing (NLP) and natural language understanding (NLU) offer new and exciting applications to the fields of healthcare and public health. Specifically, extracting important pieces of information in various types of health records and assessing the certainty of clinical statements represents an important task with applications in the medical industry, public health, and several fields of research. However, currently, these domains face challenges related to a lack of resources and techniques to efficiently solve the disparate and complex tasks needed to evaluate health records. One solution is to use transfer learning, leveraging pre-trained models from the Bidirectional Encoder Representations from Transformers (BERT) family, and further fine-tuning them in the healthcare domain to develop specific task models. However, this still requires resources to fully fine-tune multiple models on specific tasks or subtasks. In recent years, several new approaches to transfer and multitask learning using "adapter transformers" have been proposed. These approaches serve as efficient parameter fine-tuning techniques, reducing the number of parameters and storage of models.

This project aims to explore approaches of parameter-efficient fine-tuning using adapters and evaluate their application in multitask learning on two linked NLU tasks using healthcare records: clinical entity extraction and clinical assertion classification.

### **Approach:**

We want to explore and compare three recent competitive multitask approaches using bottleneck adapters and parallel adapters, as described by Pfeiffer et al., Houtsby et al., and Stickland et al. [1-6]. To do so, we will base our methodology on reproducing some work by Pfeiffer et al. [1] but we will experiment using the n2c2 dataset (previously referred to as the 2010 i2b2/VA biomedical dataset) and compare our adapter performance to fine-tuning results in the literature [7-9]. Additionally, instead of restricting our objective to a general language pre-trained model, we will explore and compare other strategies such as training and combining domain-specific adapters with task adapters, also adding adapters to domain-specific language models such as ClinicalBERT. Our deliverables will mainly be several multitask models capable of both extracting clinical entities such as problems, treatments, and tests from clinical notes, and asserting if entities are present, absent, or possible. We will build and train domain and task-specific adapters to compare with previously published results.

As a stretch goal, we will extend our study to include more adapter methods and alternative multitask learning approaches. We plan to use the adapter-transformer framework for this project [1]. Ideally, we plan to contribute to the AdapterHub library by adding a new domain task, subtask adapter, share our adapter weights with the central adapter hub, and add a new adapter method.

## Resources/Related Work:

### References

- [1] Pfeiffer, Jonas et al. "AdapterFusion: Non-Destructive Task Composition for Transfer Learning." *ArXiv* abs/2005.00247 (2020)
- [2] Houlisby, Neil et al. "Parameter-Efficient Transfer Learning for NLP." *International Conference on Machine Learning* (2019).
- [3] Stickland, Asa Cooper, and Iain Murray. "Bert and pals: Projected attention layers for efficient adaptation in multi-task learning." *International Conference on Machine Learning*. PMLR, 2019.
- [4] Lialin, Vladislav et al. "Scaling Down to Scale Up: A Guide to Parameter-Efficient Fine-Tuning." *ArXiv* abs/2303.15647 (2023)
- [5] Pfeiffer, Jonas et al. "AdapterHub: A Framework for Adapting Transformers." *ArXiv* abs/2007.07779 (2020)
- [6] Pfeiffer, Jonas et al. "MAD-X: An Adapter-based Framework for Multi-task Cross-lingual Transfer." *Conference on Empirical Methods in Natural Language Processing* (2020).
- [7] Van Aken, Betty et al. "Assertion detection in clinical notes: Medical language models to the rescue?" *Proceedings of the Second Workshop on Natural Language Processing for Medical Conversations* (2021)
- [8] Özlem Uzuner, Brett R South, Shuying Shen, Scott L DuVall, 2010 i2b2/VA challenge on concepts, assertions, and relations in clinical text, *Journal of the American Medical Informatics Association*, Volume 18, Issue 5 (2011) <https://doi.org/10.1136/amiajnl-2011-000203>
- [9] <https://paperswithcode.com/dataset/2010-i2b2-va>

### Additional Resources:

- Modular and Composable Transfer Learning with Jonas Pfeiffer : <https://www.youtube.com/watch?v=3ycETDjVzOQ&t=1915s>
- EMNLP 2022 Tutorial - "Modular and Parameter-Efficient Fine-Tuning for NLP Models" : <https://www.youtube.com/watch?v=KoOlcX3XLd4&t=12968s>
- <https://docs.adapterhub.ml/index.html>

## Datasets:

[2010 i2b2/VA Challenge on Concepts, Assertions, and Relations in Clinical Text](#), can be accessed via the portal : <https://portal.dbmi.hms.harvard.edu/projects/n2c2-nlp/>

## Team Members:

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