

Relative and Incomplete Time Expression Anchoring for Clinical Text

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Introduction and motivation

- Extracting and modeling temporal information in clinical text is an important element for developing timelines and disease trajectories.
- Few studies have specifically addressed the challenge of relative and incomplete time expressions (RI-Timexes), expressions that require additional information for their temporal value to be resolved.

She arrived on **09/10/2002**. She was transferred **three days later**.

absolute *relative*

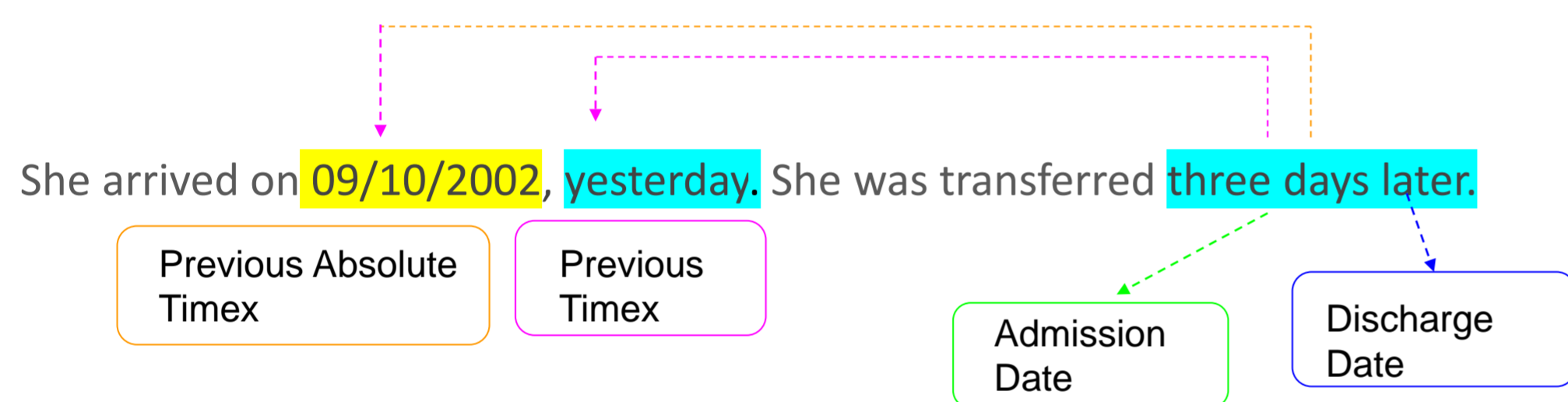
Our aims :

- Reproducing Sun et al. (2015)'s results
- Propose an alternative annotation model
- Use a novel computational approach

Source code available at: <https://github.com/KCL-Health-NLP/NeuralTime>

SVM Anchoring and Annotations

We reproduced the methodology of Sun et al (2015) : we used Support Vector Machines to classify RI-Timexes as being anchored to one of four categories : Admission Date, Discharge Date, Previous Timex and Previous Absolute Timex.



Custom Annotations

310 documents from the 2012 i2b2 Temporal Expression Challenge were annotated by three annotators.

		Admission	Discharge	Previous T.	Previous Absolute T.	Before	Equal	After
A	F-score	83.1	56.0	63.6	76.5	66.7	84.2	87.7
	Accuracy	79.5	84.9	67.1	78.1	94.5	87.7	87.7
B	F-score	80.1	57.5	83.3	80.3	69.2	77.4	81.4
	Accuracy	80.4	88.4	90.0	85.3	92.1	81.8	84.1
C	Accuracy	77.6	92.5	68.9	75.2	93.4	81.4	92.1

A : 2015 RI-Timex data, B: 2020 RI-Timex data, C: Results reported by Sun et al (2015)

Annotations available upon request.

BERT Anchoring

We used a novel approach to leverage the power of publicly available pre-trained clinical BERT embeddings from Alsentzer et al (2019) to predict anchor dates of RI-Timexes.

(Relative Time Expression , Potential Anchor Date)

(**three days later** , **09/10/2002**)

(**three days later** , **yesterday**)

- Is the RTimex anchored to the other Timex ?
- If yes : what is the relationship between them ? (Before, After or Equal)

		Is an Anchor	Before	Equal	After	Average
Validation	Precision	85.2	85.0	86.5	83.0	85.5
	Recall	88.2	94.4	94.4	86.1	86.7
	F-score	86.7	89.4	89.4	84.5	85.8
Test	Precision	34.0	35.4	35.4	29.4	32.2
	Recall	76.2	60.5	57.2	72.1	70.3
	F-score	47.0	44.6	39.2	41.8	44.1

Discussion and conclusion

SVM Anchoring

- Results show that we were able to successfully reproduce the findings of the previous study.
- We found that about 7% of the anchor dates were not part of the 4 categories used by Sun et al.

BERT Anchoring

The differences between the results on the two test sets show that while BERT models are not able to capture the strict guidelines that were implemented to decide a unique anchor date, they are able to predict anchor relations that are relevant.

References

- Sun, W., Rumshisky, A., & Uzuner, O. (2015). Normalization of relative and incomplete temporal expressions in clinical narratives. *Journal of the American Medical Informatics Association*, 22(5), 1001-1008.
- Alsentzer, E., Murphy, J. R., Boag, W., Weng, W. H., Jin, D., Naumann, T., & McDermott, M. (2019). Publicly available clinical BERT embeddings. *arXiv preprint arXiv:1904.03323*.