Sentence Segmentation in Clinical Notes

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Motivation

- Definition: sentence segmentation is the task of finding the boundaries of sentences in texts
- Most **sentence segmentation** systems are developed for well-formed, proofread text, causing a **drop in performance** when applied on **clinical notes** (differences in structural and writing conventions)

Methods

- Dataset of 90 clinical notes from MIMIC-III database manually-annotated with sentence spans
- State of the art: deep-learning architecture with character and word embeddings (CNN-BiLSTM)
- Evaluate existing systems against annotations
- Character-level predictions using BIO schema
- Metrics: exact matches of sentence spans measured by precision, recall, F1-score

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Text:  Physical Exam: obese gentleman, walks with cane. Pertinent Results:
Tags:  BIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIOBIIIIIIIIIIIIIIIIIII
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Text:  Prophylaxis: DVT: Heparin gtt Stress ulcer: PPI VAP: Chlorhexidine
Tags:  BIIIIIIIIIIIIOBIIIIIBIIIIIIIIIIIIOBIIIIIIIIIIIIIIIIIIIIOBIIIIIIIIIIIIIIIIIII
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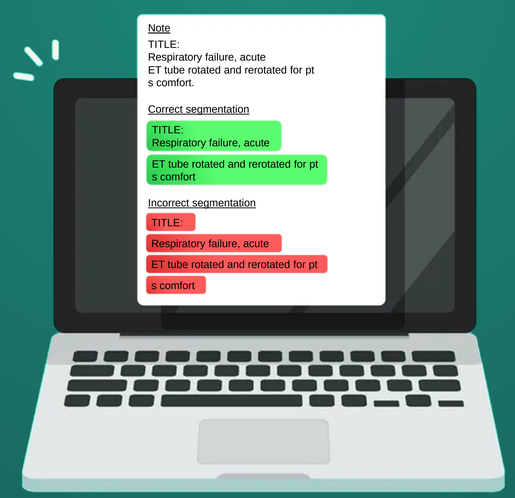
Results

Sentence Segmenter	Precision	Recall	F1-score
NLTK[1]	**0.6530**	0.3192	0.4288
spaCy[2]	0.0399	0.0917	0.0556
Syntok	0.6163	0.3207	0.4218
Gensim[3]	0.3232	0.6170	0.4242
Stanza[4]	0.6418	0.3422	0.4464
cTAKES[5]	0.6055	**0.6609**	**0.6320**

Decline in performance of sentence segmentation in **clinical notes**



Examples

Input

Pt. medicated w/ 1 mg Ativan for anxiety.

Correct

Pt. medicated w/ 1 mg Ativan for anxiety. SENT

Incorrect

Pt. SENT

medicated w/ 1 mg Ativan for anxiety. SENT

Error: periods after medical abbreviations, not common in well-formed English

Input

1. Evaluation of etiology of arrest
2. Neuroprotective strategies:
a) Therapeutic hypothermia
b) Avoid hyperglycemia

Correct

1. Evaluation of etiology of arrest SENT
2. Neuroprotective strategies: SENT
a) Therapeutic hypothermia SENT
b) Avoid hyperglycemia SENT

Incorrect

1. SENT
Evaluation of etiology of arrest 2. SENT
Neuroprotective strategies: a) SENT
Therapeutic hypothermia b) Avoid hyperglycemia SENT

Error: bullets and numbers separated from list items

Input

Non-invasive BP:
S: 109
D: 72
Temperature:
97.7

Correct

Non-invasive BP: SENT
S: 109 SENT
D: 72 SENT
Temperature: 97.7 SENT

Incorrect

Non-invasive BP: S: 109 D: 72 Temperature: SENT
97.7 SENT

Error: forms to fill by the practitioner have no clear boundaries

Ongoing work

- Adjusting predictions to follow our guidelines by post-processing sentence spans
- Extending metrics to penalize truncating sentences in ways that are harmful for downstream tasks
- Adding functionality to perform section segmentation
- Proposing an approach using transformer model with sliding window

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