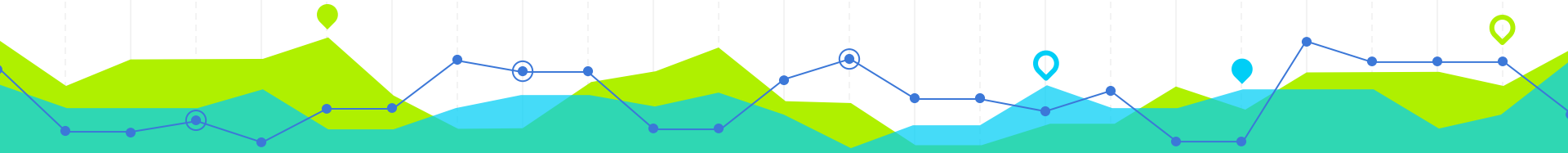
Multilingual Text Analytics for Healthcare by Terminators

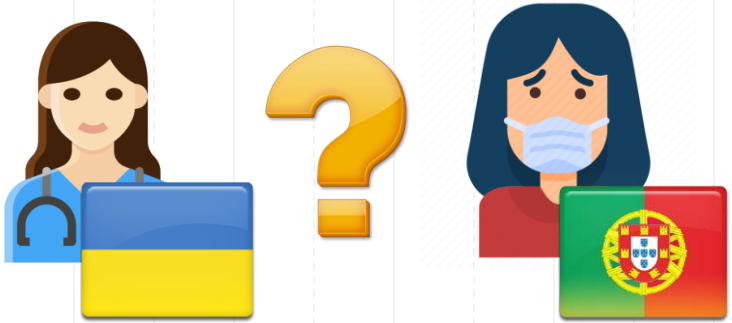


NoLIT

No(t as much) Loss in Translation

The Problem

- Doctor and patient might not share a common language



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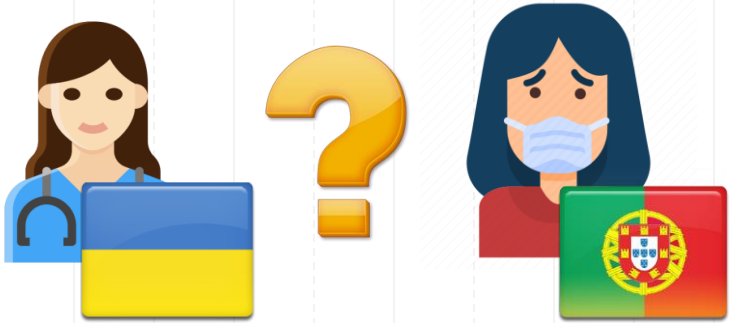
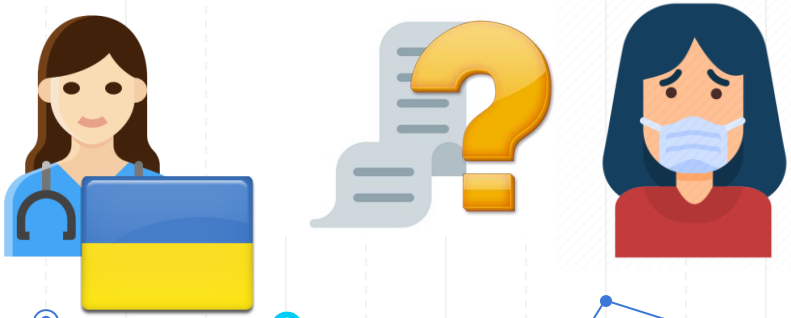
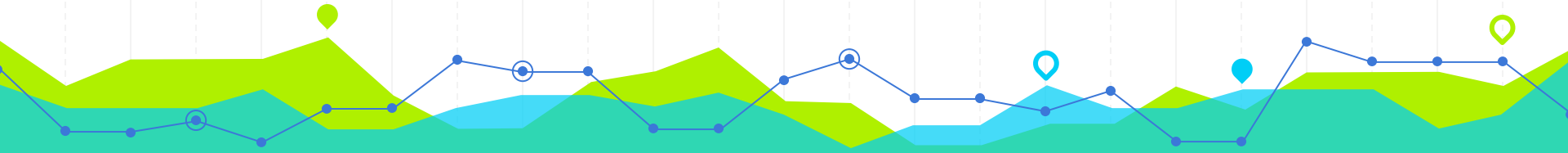


- Diagnosis might be overwhelmingly long and confusing



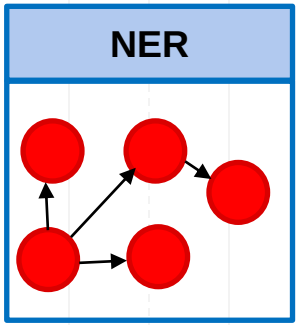


Baseline 1

Architecture as seen in the introduction

Baseline

Baseline



Extractive Summary

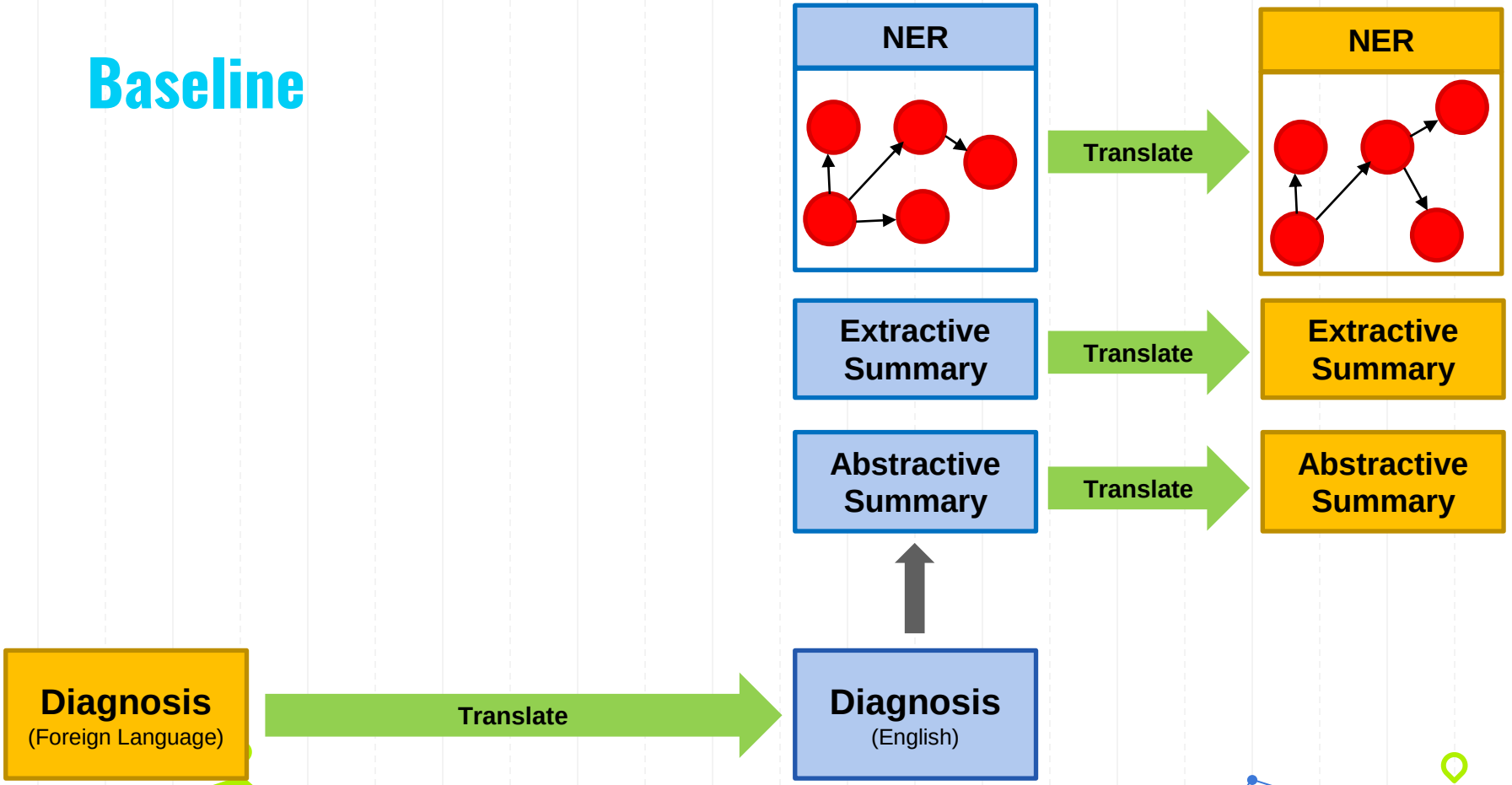
Abstractive Summary

Diagnosis
(Foreign Language)

Translate

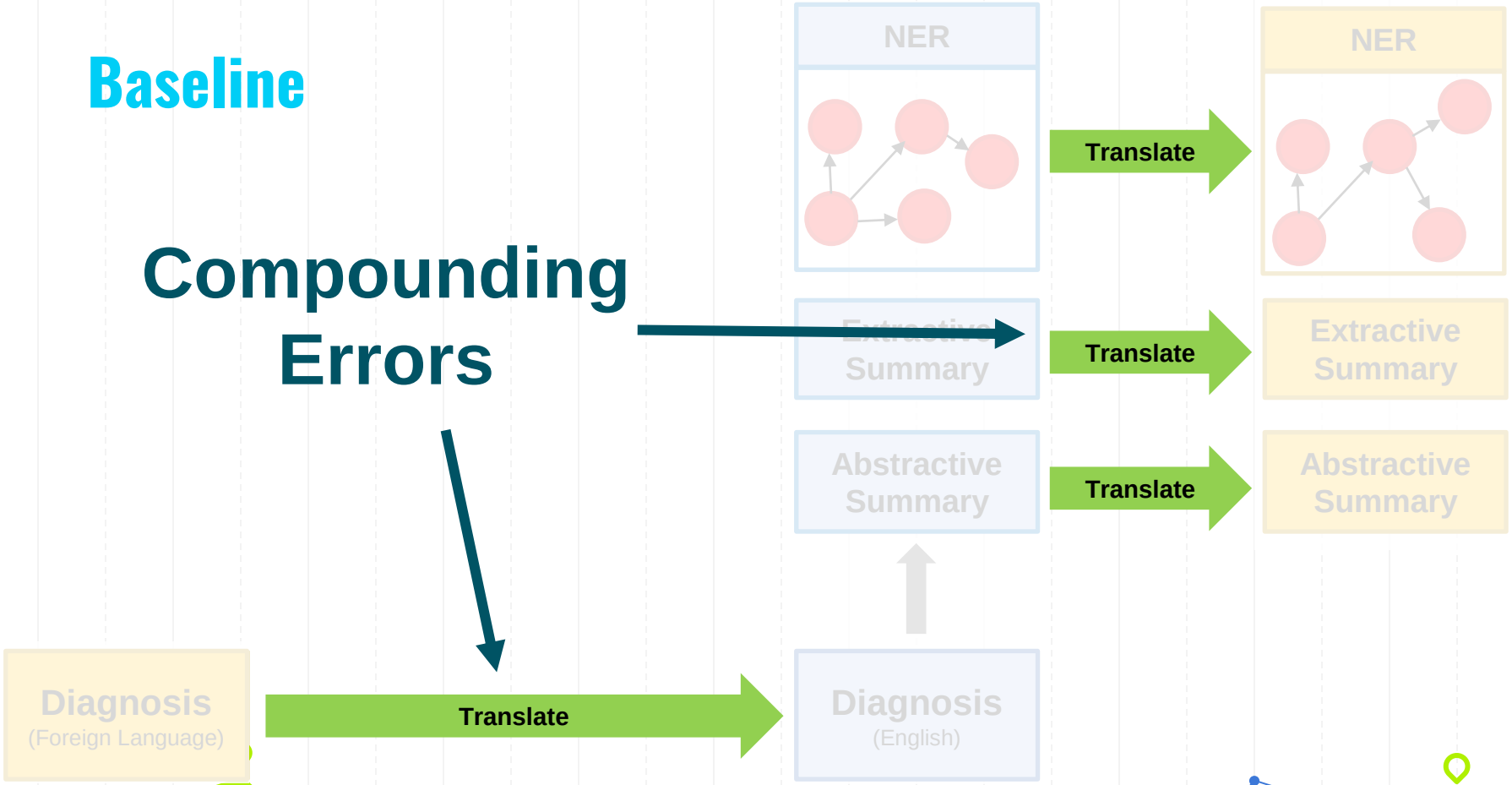
Diagnosis
(English)

Baseline


NER
Translate
NER
Extractive Summary
Translate
Extractive Summary
Abstractive Summary
Translate
Abstractive Summary
Diagnosis
(Foreign Language)
Translate
Diagnosis
(English)

Baseline

Compounding Errors

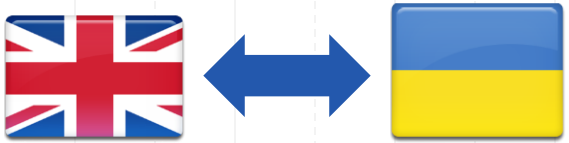


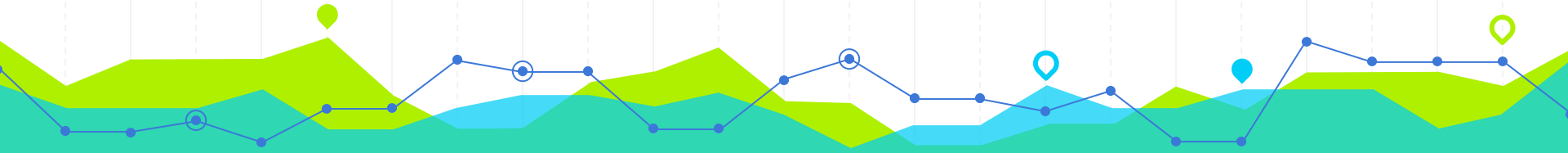
Our Goals

Reduce Error Compounding

Confidence Feedback

Improve Translation





NoLIT 2

Not as much **L**oss **I**n **T**ranslation!

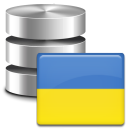
Observation

Extractive Summary

Abstractive Summary

Diagnosis
(Foreign Language)

Foreign language
Small / Non-existent Dataset



Extractive Summary

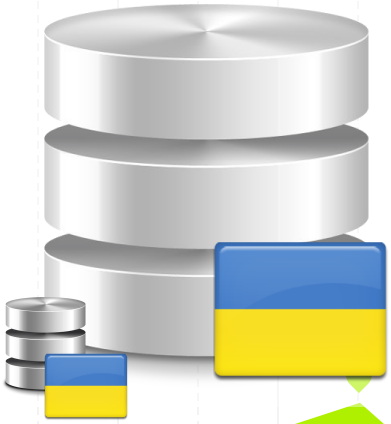
Abstractive Summary

Diagnosis
(English)

English
Large Dataset

Approach

Foreign language
Augmented Dataset



Extractive Summary

Abstractive Summary

Diagnosis
(Foreign Language)

Translate

Translate

Extractive Summary

Abstractive Summary

Diagnosis
(English)

English
Large Dataset

Approach

Foreign language
Augmented Dataset

Independent Translations

Translate

Translate

NER

Extractive Summary

Abstractive Summary

Diagnosis
(Foreign Language)

NER

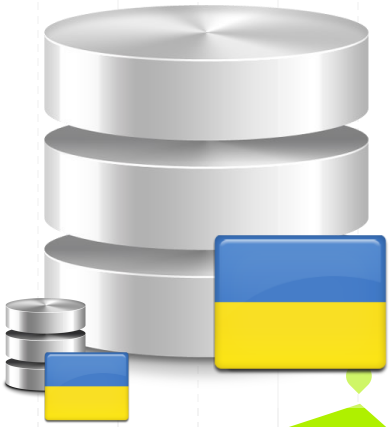
Extractive Summary

Abstractive Summary

Diagnosis
(English)

English
Large English

Foreign language
Augmented Dataset



Extractive Summary

Abstractive Summary

Diagnosis
(Foreign Language)

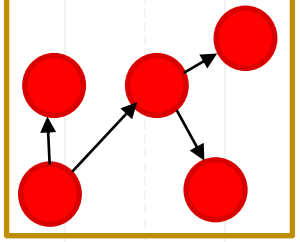
In Practice

Doctor

Emits

Diagnosis
(In Ukrainian)

NER



Extractive Summary

Abstractive Summary

Translate

(Short Text)

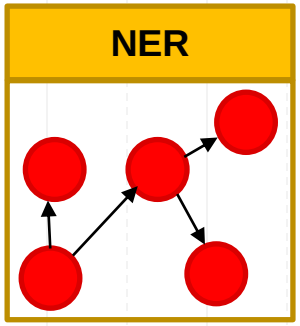
Translate

Translate

Patient

Dual Model

If correctness is a concern

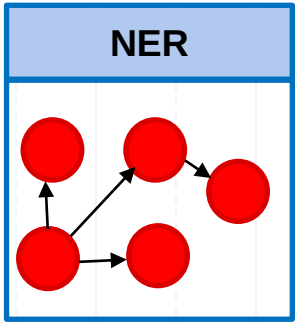


Extractive Summary

Abstractive Summary

Diagnosis
(Foreign Language)

Translate



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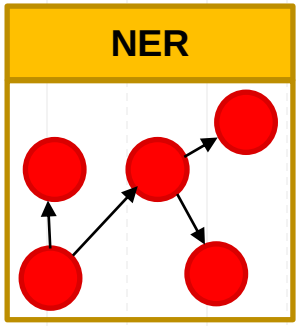


Extractive Summary

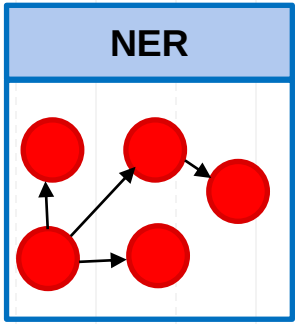
Abstractive Summary

Diagnosis
(Foreign Language)

Translate

Important Entities

5 mg
Dengue
Lorazepam
Chlordiazepoxide
Brucellosis



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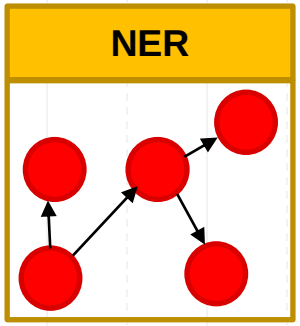

Extractive Summary

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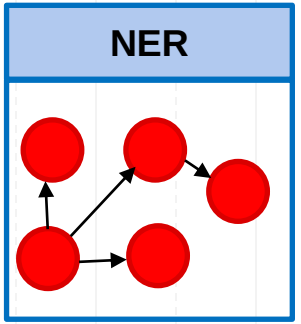
Diagnosis
(Foreign Language)

Translate

Database Lookup



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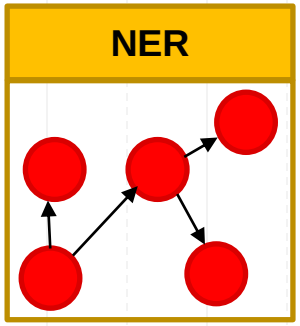
Diagnosis
(English)



Extractive Summary

Abstractive Summary

Diagnosis
(Foreign Language)

Important Entities

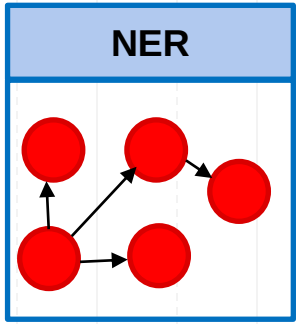
5 мг
лоразепам
Денге
Хлордиазепоксид
бруцеллёз

Important Entities

5 mg
Lorazepam
Dengue
Chlordiazepoxide
Brucellosis

Database Lookup

Translate



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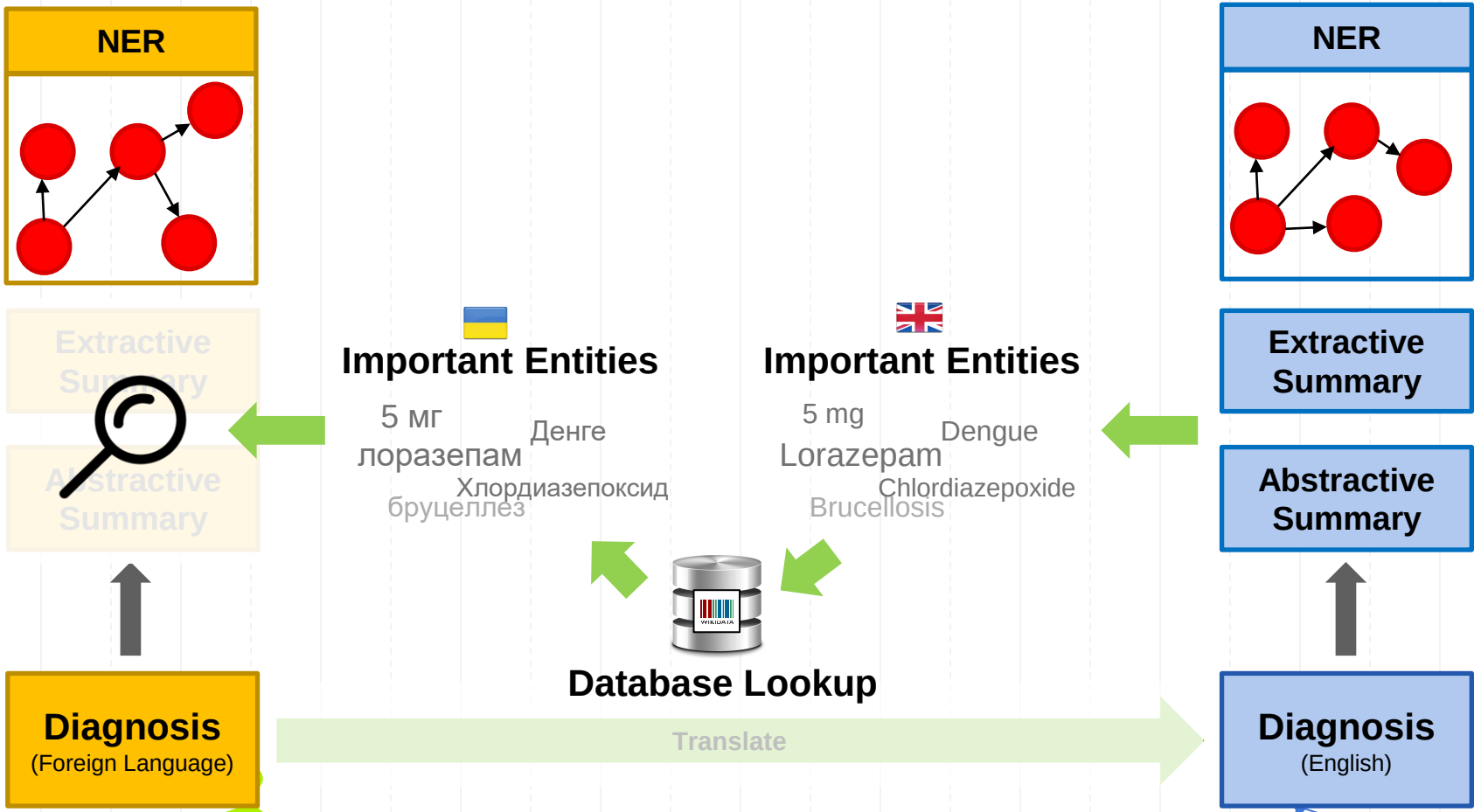
Abstractive Summary

Diagnosis
(English)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Dengue
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NER
Extractive Summary
Abstractive Summary
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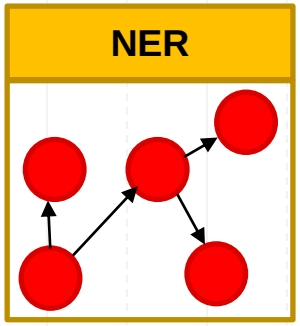
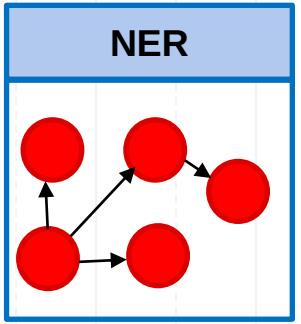
(English)

Confidence





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Chlordiazepoxide
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Database Lookup

Diagnosis
(Foreign Language)

Translate

Diagnosis
(English)

Confidence

Overlap coefficient

Confidence

Overlap coefficient

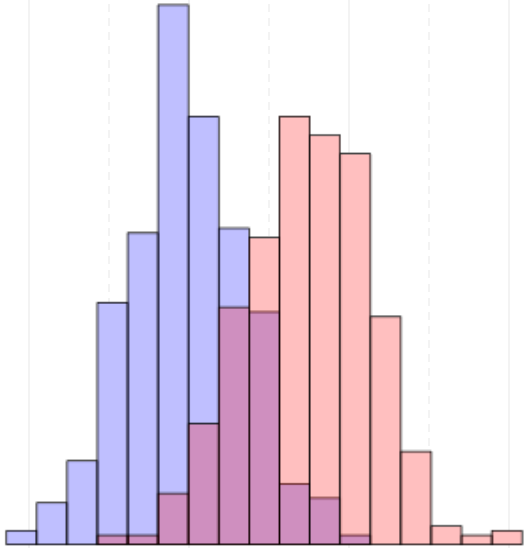
Low Confidence *High Confidence*

Request an expert review

Improve Translation

Entity Overlapping Percentage (EOP)

- Serves as overall quality insurance
  - Estimates quality of translation
  - Estimates improvement of fine-tuning summarization
- Highly accurate translation of entities
- Average EOP of translation ~70%

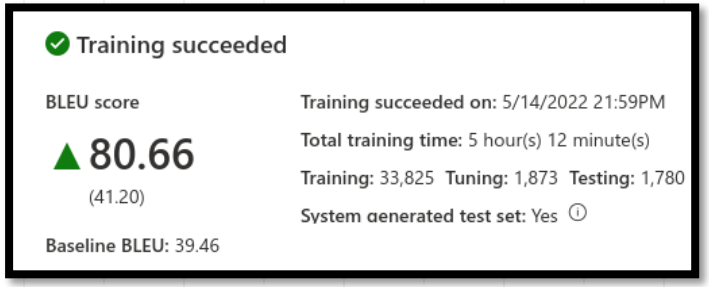


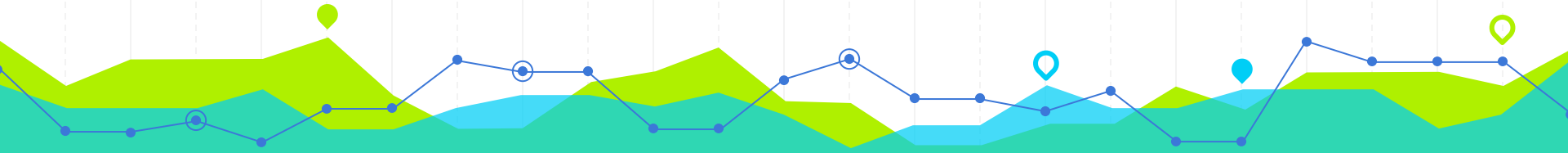
Overlap Example

Improve Translation

Fine-Tuning on Medical Domain

- **Tuning Set**
  Medical sentence pairs **(~40.000)**
- **Database Lookup**
  1 to 1 conversion of medical terms
- **BLEU** score from **39 to 81**
  (super-human performance)





Benefits of our Approach

3

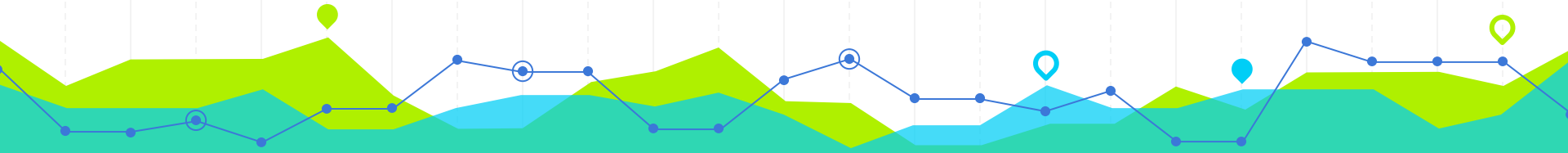
Taking a look at the closed feedback loop!

Biggest Benefits

- **Shorter Pipeline**
  - Less loss in translation
  - Lower inference costs (no back & forth translation)
- **Confidence Feedback**
  - Discover Weaknesses
  - Know when to seek expertise
- **Augmented Translation**
  - Enables models for low resource languages

10.000s of sentence pairs
&
1 dictionary for entity mapping

... is all you need!



Sebastien Foucher
Siddhant Ray
Rafael Sterzinger
Fatjon Zogaj

EXTRA RESOURCES

https://cutt.ly/PHlKnok, https://users.ugent.be