# Multilingual Grammatical Error Annotation: Combining Language-Agnostic Framework with Language-Specific Flexibility

http://open-writing-evaluation.github.io

## Multilingual GEC Annotation Framework

- **Goal:** Develop a consistent, reusable framework for grammatical error annotation across typologically diverse languages.
- **Inspired by** the dataset-agnostic design of `errant`; extend its core philosophy to multilingual settings.
- **Two-component architecture:** a shared architecture that applies across languages (`MRU`: `Missing`, `Replacement`, and `Unnecessary`), and optional extensions tailored to language-specific features
- **Structured templates** for common error types (e.g., spelling, word order, word boundary) facilitate reuse across related languages.
- **Built on** the `stanza` NLP toolkit for tokenization and POS tagging in 70+ languages.
- **Easily extensible:** New languages can be supported with minimal adaptation.
- **Available** at `https://github.com/open-writing-evaluation/jp_errant_bea`.

## Examples of Error Annotation for Czech and German

Without language-specific classification modules, our grammatical error annotation system remains capable of generating generic error annotations using the core `MRU` framework combined with POS labels.

| | |
|---|---|
| Czech | `S Mám velkou rodinu , tak nemohla jsem mít naději , že něco dostanu .` |
| Náplava et al. (2022) | `A 5 7\|\|\|R:WO\|\|\|jsem nemohla\|\|\|REQUIRED\|\|\|-NONE-\|\|\|0` |
| Ours | `A 5 7\|\|\|R:VERB AUX -> AUX VERB\|\|\|jsem nemohla\|\|\|REQUIRED\|\|\|-NONE-\|\|\|0`<br>('I have a big family, so I couldn't hope to get anything.') |
| German | `S Dagegen wieder , bekommen BA Studenten die ein extra Jahr oder mehr studiert haben , leichter Jobs .` |
| Boyd (2018) | `A 0 3\|\|\|R:OTHER\|\|\|Dahingegen\|\|\|REQUIRED\|\|\|-NONE-\|\|\|0`<br>`A 4 5\|\|\|U:PNOUN\|\|\|\|\|\|REQUIRED\|\|\|-NONE-\|\|\|0`<br>`A 5 6\|\|\|R:NOUN\|\|\|BA-Studenten\|\|\|REQUIRED\|\|\|-NONE-\|\|\|0` |
| Ours | `A 0 2\|\|\|R:ADV ADV -> ADV\|\|\|Dahingegen\|\|\|REQUIRED\|\|\|-NONE-\|\|\|0`<br>`A 2 3\|\|\|U:PUNCT\|\|\|\|\|\|REQUIRED\|\|\|-NONE-\|\|\|0`<br>`A 5 5\|\|\|M:PUNCT\|\|\|-\|\|\|REQUIRED\|\|\|-NONE-\|\|\|0`<br>('On the other hand, BA students who have studied an extra year or more find jobs more easily again.') |

## Language-Specific Error Annotation

**function** ErrorClassification ($\mathcal{S}$, $\mathcal{T}$):
  **if** (Sim (*phonetic*) $> \alpha_1$) $\wedge$ (Sim (*shape*) $> \alpha_2$) **then**
    **return** R:SPELL:PHONOGRAPHIC
  **else if** (Sim (*phonetic*) $> \alpha_1$) **then**
    **return** R:SPELL:PHONETIC
  **else if** (Sim (*shape*) $> \alpha_2$) **then**
    **return** R:SPELL:SHAPE
  **else if** (Set ($\mathcal{S}$) == Set ($\mathcal{T}$)) **then**
    **return** R:WO
  **else if** (Merge($\mathcal{S}$) == Merge($\mathcal{T}$)) **then**
    **return** R:WB
  **end if**
  **return** {R}

The algorithm above presents our proposed classification routine for Replacement errors. Given a pair of word sequences—the source ($\mathcal{S}$) and the target ($\mathcal{T}$)—the algorithm classifies the error into one of the following types: spelling errors (R:SPELL), word order errors (R:WO), or word boundary errors (R:WB). Spelling similarity is computed using two metrics: phonetic similarity and visual (shape-based) similarity. The thresholds $\alpha_1$ and $\alpha_2$ govern sensitivity to phonetic and visual matches, respectively.

The classification uses the following notation:

- $\mathcal{S}, \mathcal{T}$: word sequences in the source and target sentences.
- Sim(*phonetic*) and Sim(*shape*): similarity functions comparing pronunciation and visual form.
- Set($\mathcal{S}$): returns a bag-of-words representation of $\mathcal{S}$, disregarding word order.
- Merge($\mathcal{S}$): reconstructs a character sequence from the tokenized input (i.e., merging tokens without spaces) to test for boundary alignment.

Examples of Replacement error types: phonetic spelling error (R:SPELL:PHONETIC), word order error (R:WO), and word boundary error (R:WB):

| | |
|---|---|
| R:SPELL:PHONETIC | *their* → *there* |
| R:WO | *You can help me* → *Can you help me* |
| R:WB | *icecream* → *ice cream* |

OWE
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