Computational Linguistics-1

Text Pre-Processing

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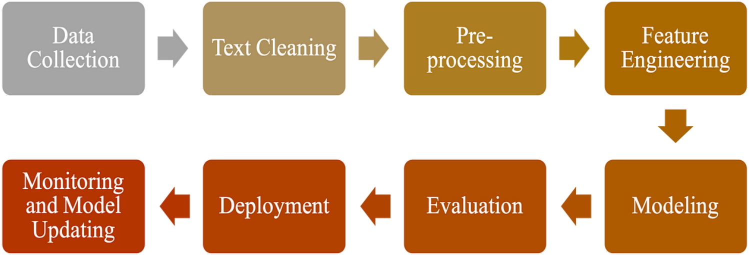
NLP Pipeline



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  - Ensuring data anonymization
  - Compliance with regulations (e.g., GDPR)
  - Securing data storage and transfer

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  - Ensuring the data is representative of the population
  - Avoiding sampling bias
  - Addressing any inherent biases in the data collection process

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  - Converting slang and abbreviations to their full forms ensures clarity and consistency.

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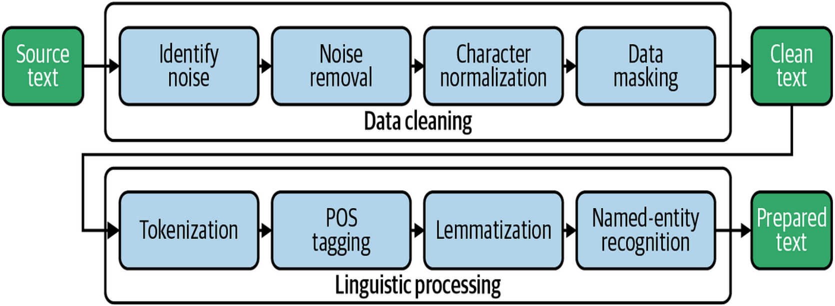

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- **Mitigates Bias:** Proper preprocessing can help in reducing biases present in the raw text.

Text Preprocessing Steps

- **Tokenization:** Split text into individual words or sentences.
- **Lowercasing:** Convert all text to lowercase to ensure consistency.
- **Stop Words Removal:** Eliminate common words (e.g., “and”, “the”) that add little value.
- **Normalization:** Convert text into a standardized format by addressing various inconsistencies and variations.
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Sentence tokenization

- **Original Text:** “Dr.Indhu, an expert in AI, visited Chennai. She gave a talk on Ph.D. research at IIT Madras. Her presentation was insightful, e.g., she discussed various algorithms. After the event, we went to 'Marina Beach' for a relaxing evening.”
- **Sentence Tokenized Text:**
  - “Dr. Indhu, an expert in AI, visited Chennai.”
  - “She gave a talk on Ph.D. research at IIT Madras.”
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Text Preprocessing: Word Tokenization

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Challenges:

- Can’t just blindly remove punctuation. Full stops (”.”) are ambiguous; Dr., m.p.h., Ph.D.
- Email addresses, URLs, etc. contain alphabets, numbers, as well as special characters (”@”, “/”, “-”, “_”)
- Languages like English use contractions (”we’re”, “I’m”) which, when tokenized by this approach, creates tokens ”re”, “m”, which are not meaningful.

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Lowercasing

Example

Original Text:

```
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Original Text:

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After Lowercasing:

`"the quick brown fox jumps over the lazy dog."`

- Consider a search engine querying for `"quick Brown fox"` in a database of documents.
- Lowercasing ensures that the search results match regardless of the case used in the query or the documents.

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- Multi-Word Expressions (MWEs); phrases like “fish and chips”, “kick the bucket” lose their meaning when stopwords (”and”/”the”) are removed.

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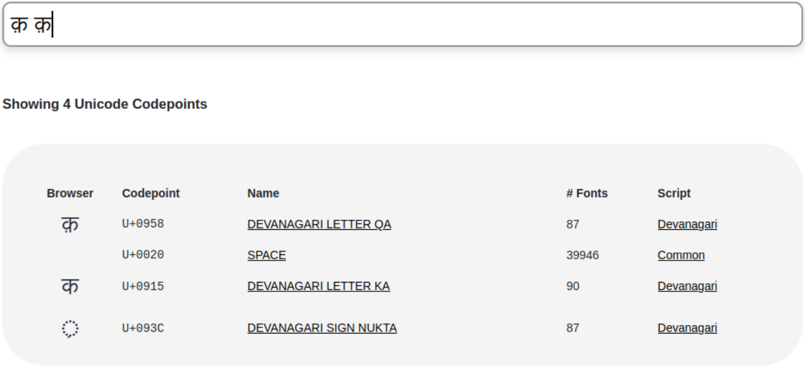
Example:

- **Original Text:** “LOL, that was the funniest joke ever!!!”
- **Normalized Text:** “Laugh out loud, that was the funniest joke ever”

Unicode Normalization

Normalizaiton in Hindi an Example:



क़ क़

Showing 4 Unicode Codepoints

Browser	Codepoint	Name	# Fonts	Script
क़	U+0958	DEVANAGARI LETTER QA	87	Devanagari
	U+0020	SPACE	39946	Common
क	U+0915	DEVANAGARI LETTER KA	90	Devanagari
◌़	U+093C	DEVANAGARI SIGN NUKTA	87	Devanagari

Figure: Devanagari Example for Normalization

Spelling Normalization

- A Telugu word can be written in different forms:
  taruvatā
  tarvatā
  taravatā
- Spellings of these kinds which might be valid and most frequent in corpus need to be normalized.

Stemming and Lemmatization

Stemming

Stemming is a process that removes suffixes from words to reduce them to a base form. It uses heuristic rules and does not always produce valid dictionary words.

Lemmatization

Lemmatization reduces words to their base or dictionary form (lemma) by considering the context and ensuring the root form is a valid word. It involves more complex analysis compared to stemming.

Stemming and Lemmatization

Stemming Example:

- **Original Words:** “flies”, “flying”, “flied”
- **Stemmed Form:** “fli/fly”

Lemmatization Example:

- **Original Words:** “flies”, “flying”, “flied”
- **Lemmatized Form:** “fly”

Stemming and Lemmatization

Key Differences

- **Approach:** Stemming uses heuristic rules to strip suffixes, while lemmatization uses a dictionary and context.
- **Output:** Stemming can produce non-words, while lemmatization produces valid words.
- **Complexity:** Lemmatization involves more sophisticated analysis and is more accurate but computationally more expensive than stemming.

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- Future Directions: As NLP continues to evolve, keeping up with advancements in preprocessing techniques and tools will be crucial for improving the accuracy and efficiency of text analysis.