

Tracing Linguistic Footprints of ChatGPT Across Tasks, Domains, and Personas

Brief Description

This repository contains the code and data supporting the research paper "Tracing Linguistic Footprints of ChatGPT Across Tasks, Domains and Personas in English and German." The project explores how the output of large language models like ChatGPT differs from human-generated text and analyzes the impact of task-specific prompting on linguistic features in both English and German texts.

Usage

Text generation directory

The script `generate.py` sends requests to the OpenAI-API. As input it takes a JSON file in the following form:

```
{
  "file1": {
    "title": "very interesting and engaging topic",
    "prompt": "part of the text to use for the prompt",
    "text": "the rest of the text"
  },
  "file2": {

  }
}
```

The `make_json.py` script can be used to create such a file from a collection of txt files (see below). From the input for every file in the JSON the API is called to generate a text of more than 500 tokens. After making sure that both the remainder of the human text (without the prompt) and the machine generated text are of the same length by truncating the shorter one, it saves them in two separate folders called `human` and `machine`. An example call looks like this:

```
generate.py gpt-3.5-turbo path_to_input_file.json de
```

In this example the model `gpt-3.5-turbo` is used. Additional positional arguments are the path to the input and the language of the document (needed for the tokenizer). This will create an output folder in the directory from which the script is run with two subfolders `human` and `machine`. Optionally the output directory can be specified with the flag `--outfolder`, for more info on the optional arguments see `generate.py --help`.

To **generate personas**:

```
bash call_generate_personas.sh calls generate_personas.py
```

`prompts.json` contains all the prompts and personas

Feature extraction directory

Sophistication

Step 1 Concatenate all corpus files into one txt file in the data folder `bash concatenate_files.sh`:
prompts_n_coherence/data/ --> feature_extraction/data

Step 2 Run the main script `bash sophistication.sh`: -->
feature_extraction/results/sophistication_scores.csv

Lexical richness

`bash lxr_scores.sh` prompts_n_coherence/data/

Morphology

Step 1 Extract vocabulary of most frequent words

`bash create_most_freq_vocs.sh` : prompts_n_coherence/data/ --> scripts/freq_voc/, scripts/lemmas/

Step 2 Run diversity analysis

for single file

```
python3 shannon_pairwise.py -f
~/switchdrive/IMAGINE_files/datasets/wmtnews21/wmtnews_test_de_A.txt -l de
-sys A_wmt -v freq_voc/wmtnews_test_de_A.freq_voc > test.txt
```

for multiple files in a directory if considering the top 1000 most frequent lemmas with more than 1 morphological form

lang = {"en", "de"}

```
bash shannon_1000_mostfrequent_script.sh
~/switchdrive/IMAGINE_files/chatGPT/project_2/final_files_simple_prompt/{c
orpus} lang
```

if choosing all lemmas with more than one morphological form

lang = {"en", "de"}

```
bash mrph_all.sh
~/switchdrive/IMAGINE_files/chatGPT/project_2/final_files_simple_prompt/{c
orpus} lang
```

Extract Features with TextDescriptives

features_list.py contains several dictionaries with feature names:

- **features_list** is a list of TextDescriptives features
- **features_custom** is a list of custom-added feature names
- **features_to_visualize_dict** is a dictionary with feature names used by textDescriptives and throughout the project as keys and modified feature names as values
- **features_raw_counts** is a list of features that are measured in raw counts

Extract features and sort results by feature, language and domain

bash run_extract_features.sh executes 3 python scripts:

1. **python3 extract_features.py --corpus \$corpus** iterates through all corpora and extracts features with TextDescriptives, includes custom formula for German Flesch Reading Ease
2. **python3 combine_results_per_lang_domain.py** iterates through `../results/per_corpus/{corpus}`.
The script restructures data to `../results/per_feature/{feature_to_extract}/{corpus}.csv`, `../results/per_language/{language}/{feature}.csv`, and `../results/per_domain/news/{language}/{feature}.csv`
3. **python3 transform_dataframe.py -f \$feature_type** adds morphological features from `../results/morphology/{corpus}.csv` and lexical features from `../results/lexical_richness/{corpus}.csv`
The results are written to `../results/per_feature/{feature_to_extract}/{corpus}.csv`, `../results/per_language/{language}/{feature}.csv`, and `../results/per_domain/news/{language}/{feature}.csv`

Feature Extraction and Data Organization

This section outlines the process of extracting features from the corpora and organizing the results by features, languages, and domains using a series of Python scripts.

Scripts and their Functions

1. Extract Features

- **Script:** `run_extract_features.sh`
- **Description:** Executes three Python scripts to extract linguistic features, reorganize results, and transform dataframes for further analysis.
- **Execution:**

```
bash run_extract_features.sh
```

2. Extract Linguistic Features

- **Script:** `extract_features.py`
- **Parameters:** `--corpus`
- **Function:** Iterates through all specified corpora to extract features using the TextDescriptives library, including a custom formula for German Flesch Reading Ease.

- **Usage:**

```
python3 extract_features.py --corpus $corpus
```

3. Combine Results by Language and Domain

- **Script:** `combine_results_per_lang_domain.py`
- **Function:** Restructures data into a more accessible format, sorting by individual features, language, and domain.
- **Output Directories:**
 - Per Feature: `../results/per_feature/{feature_to_extract}/{corpus}.csv`
 - Per Language: `../results/per_language/{language}/{feature}.csv`
 - Per Domain: `../results/per_domain/news/{language}/{feature}.csv`

4. Transform DataFrames

- **Script:** `transform_dataframe.py`
- **Parameters:** `-f $feature_type`
- **Function:** Enhances the dataframes by incorporating additional morphological and lexical features.
- **Sources:**
 - Morphological Features: `../results/morphology/{corpus}.csv`
 - Lexical Features: `../results/lexical_richness/{corpus}.csv`
- **Output Directories:**
 - Per Feature: `../results/per_feature/{feature_to_extract}/{corpus}.csv`
 - Per Language: `../results/per_language/{language}/{feature}.csv`
 - Per Domain: `../results/per_domain/news/{language}/{feature}.csv`

How to Run

To run these scripts sequentially and ensure all features are properly extracted and organized, execute the `run_extract_features.sh` script as mentioned above. Ensure all paths and dependencies are correctly set in your environment.

Citation

```
@article{YourLastName2024,
  title={Tracing Linguistic Footprints of ChatGPT Across Tasks, Domains
and Personas in English and German},
  author={Anastassia Shaitarova, Nikolaj Bauer, Jannis Vamvas, Martin
Volk},
  journal={Journal Name},
  year={2024},
  volume={xx},
  pages={xxx-xxx}
}
```