1. Data Cleaning Methodology

This report represents a spelling checker solution that detects and corrects spelling mistakes in the English language. The solution aims to improve the accuracy of spelling in a given text by suggesting the most probable correction for mistyped words. To make sure the correct spelling of the words the given input text '**corpus 3.txt**' goes through a methodology for data cleaning. The methodology is as follows.

- **Removing The Special Character:** All of the special characters except the apostrophes (') and hyphens (-) are removed from the given text. As they are unnecessary in terms of words.

- **Lowercase Each Word:** All the words in the **corpus 3.txt** will be converted into the lowercase format to ensure case-insensitive matching during the correction. So comparing them is no inconvenience.

- **Word Extraction:** The **re.findall() function** uses the regular expression pattern **'\w+'** to extract all the words from the cleaned text. This function matches alphanumeric characters and underscores and separates words from remaining punctuations and other symbols. It separates words effectively from the given corpus text

- **Word Counting:** The 'Counter' library is used to count the occurrences in cleaned text and it creates a dictionary where each word is assigned with its frequency.

2. An Approach To The Spell Checker

To solve the spell checker problem some steps are followed and the steps are described following:

- **Building Up The Dictionary:** Creating the dictionary from the given cleaned text file and returning a set of words that appear in the WORDS dictionary.

- **Applying The Correction:** The correction_1() and correction_2() functions generate all the possible corrections that are one and two edits away from the actual correct word. This function performs the following operation to generate the possible correction word.

    - **Deletion**: By deleting any character in the word.
    - **Transposition**: By swapping two consecutive characters.
    - **Replacement**: By placing a character with all the English character
    - **Insertion**: By inserting a new extra character somewhere in the string.

- **Candidate Word Generation:** For a given mistyped word, a set of probable corrections is generated by using the candidates() function. This function considers possible corrections that are one or two corrections away from the original word. While developing the possible correct word deletion of any letter, transposition between two letters, replacement of letter, and insertion of letter between letters is considered.

- **Returning The Most Probable Word:** To measure the performance of the spell checker, the probability of each word is determined using the probability() function which calculates the probability of a word based on its frequency in the corpus. The correction that has the highest probability is selected as the most probable spelling correction.

3. Experimental Results

A text that contains the four types of error described previously is experimented with in the code and it shows how accurate the model is. To evaluate the performance of the code an experiment with the sample is conducted. The correction function was applied to the misspelled word. Here is an example:

Text With Errors:

Thiss is a sample text with some incorrect speling and gramatical mistakes. I am testing the spelling correction function. Hopfully, it will corect the errors and improve the accuracy of the text.

Corrected Text:

hiss is a sample text with some incorrect speking and grammatical mistakes. a am testing the spelling correction function. hopfully, it will correct the errors and improve the accuracy of the text.

4. Accuracy Of The Correction:

The accuracy of the spelling correction solution was evaluated by comparing with the correct words in the test dataset. The accuracy was calculated in percentage. For the given dummy text the accuracy and the fail rate is following:

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Experimental Results:
Accuracy: 82.14%
Fail Rate: 17.86%
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The solution achieved a satisfactory level of accuracy, with an accuracy of 82%. This indicates that the spell correction algorithm is identifying the error and suggesting the accurate word.

5. Limitations And Possible Improvements:

Though the algorithm is working perfectly but also there is some limitations of this solution and they are described following

- **Out-of-dictionary words:** The solution strongly relies on the pre-existing dictionary of words. The solution might not work if the given word is out of the solution. By enlarging the corpus file this problem might be solved.

- **Contextual meaning:** The current solution does not consider the context of the text. Contextual analysis techniques can be used to overcome this problem.

- **Efficiency:** The process of correcting the misspelled word might be expensive while dealing with a large number of misspelled words. Precomputing the probability or efficient data structure can be used to solve this.

6. Possible Improvement and Future Work

- Adding a large number of datasets.
- Using language models.
- Using part of speech tagging.
- Using efficient data structure.

Future Work:

- User Feedback.
- Handling Multilingual text.
- Integration with text editors.