CEN 350 - Theory of Computation

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Assignment Report - Recommendation System

1 Abstract

This assigment had the topic of a recommendation system. We had an algorithm and a search topic randomly assigned to us and had to implement a recomendation system which would select 10 random websites and search for keywords related to that topic in those websites. I was assigned Aho Corasick as my algorithm and programming as my search topic.

2 Introduction

Aho-Corasick is pattern searching algorithm which uses finite automata as it's basis. It allows for multiple patterns to be searched at once by using a trie(keyword tree) of all the patterns. The complexity this algorithm is similar to finite automata. When using finite automata the complexity is $\mathcal{O}(n+m)$ where n is the length of the pattern and m is the length of the text we are searching on. The difference here is that we have multiple patterns that we go through at the same time so we need add those up like so $\mathcal{O}(n+m[1]+m[2]+...+m[k])$. So the time complexity of Aho-Corasick algorithm is $\mathcal{O}(n+\sum_{i=1}^{k} m[i])$.

3 Dataset

The dataset I used, i.e. the websites, are included with the code inside the folder 'files'. I selected some which I suspected would lead to a lot a results and some completely unrelated. The files are in html form. Most of them I download using the 'wget' command however some wouldn't allow me so I had to copy them using a web browser.

4 Experiments and Results

This assigment involved writing a program which would rank 10 websites based on how well they relate to a given search topic. I was to use Aho-Corasick algorithm to find occurences of keywords realted to the search topic. My search topic was 'programming' so I chose the keywords 'programming', 'algorithm', 'developer' and 'code'. To write the program I used the python programming language because it is simple and has quick to write in. I used the python module 'ahocorasick' for the algorithm implementation. I followed the doc's instructions to create an automaton and add keywords:

```python
A = ahocorasick.Automaton()
keywords = ["programming", "algorithm", "developer", "code"]
for idx, key in enumerate(keywords):
    A.add_word(key, (idx, key))
A.make_automaton()
```

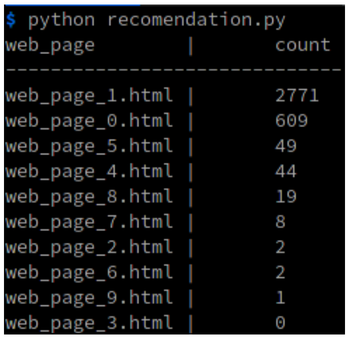
I then used a simple for loop which would run the algorithm through all the files in the directory:

```python
results = {}
for file_name in os.listdir("files"):
    # set all counters to 0
    counters = {}
    for key in keywords:
            counters[key] = 0

        # read file
        with open("files/"+file_name, 'r') as reader:
            # for each occurence of a word increment the corresponding counter
            for end_index, (insert_order, original_value) in A.iter(reader.read()):
                counters[original_value] += 1
        # append the counters to results
        results[file_name] = sum(counters.values())
```

All the counts are then in the results variable and so we only need to sort them and show them to the console:

```
# sort the results
result_sorted = dict(sorted(results.items(), key=lambda item: item[1],
    reverse=True))

# show the results
print("web_page\t|\tcount")
print("-" * 30)
for key in result_sorted:
    print("{0}\t|\t{1}".format(key, result_sorted[key]))
```

Here is what the result looks like:



```
$ python recomendation.py
web_page        |       count
------------------------------
web_page_1.html |       2771
web_page_0.html |       609
web_page_5.html |       49
web_page_4.html |       44
web_page_8.html |       19
web_page_7.html |       8
web_page_2.html |       2
web_page_6.html |       2
web_page_9.html |       1
web_page_3.html |       0
```