PROJECT 3 REPORT

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<u>Part (a): Experimenting on a large corpus of text</u>

The accuracy of the cosine similarity test, based on the descriptors built from the proper files, was 67.5%. The runtime on my laptop with pyzo, Word, and Chrome open, was 106.4 seconds for building the descriptor dictionary and 108.8 seconds total to compute the accuracy for each of the tests.

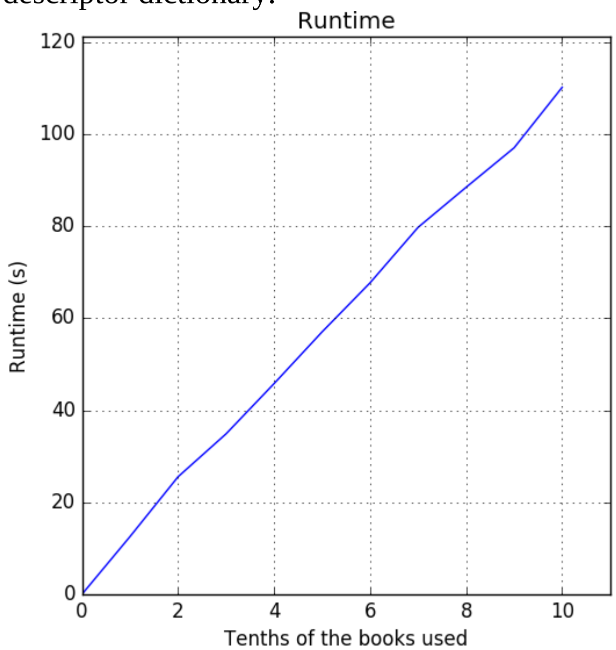
<u>Part (b): Experimenting with alternative similarity measures</u>

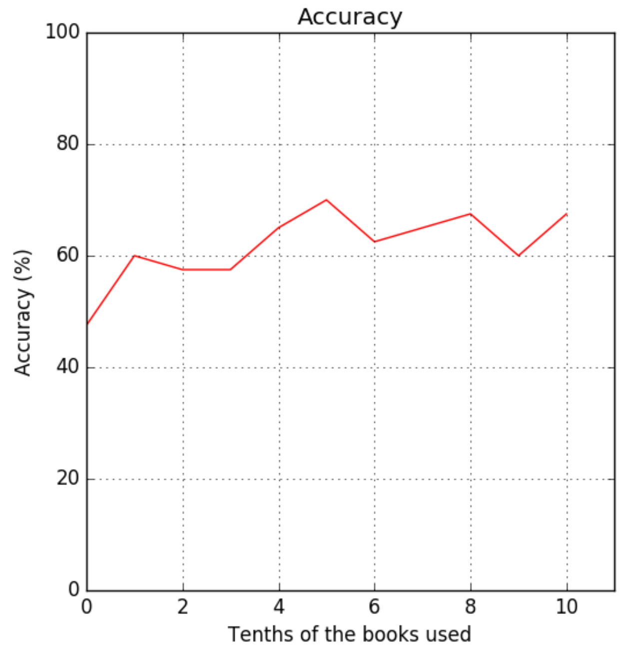
The accuracy of the Euclidean space similarity test was 30.0%.
The accuracy of the normalized Euclidean space similarity test was 67.5%.

The inaccuracy of the Euclidean similarity test comes from the fact that words which have exactly the same descriptor vectors, with one multiplied by some scalar constant, will give a dramatic distance. Normalizing each vector takes care of this issue.

<u>Part (c): Experimenting with smaller corpora of text: efficiency and performance</u>

Below are the graphs of runtime and accuracy over tenths of the books used to create the descriptor dictionary:





The code used to produce these results is shown below.

```python
import synonyms as s
import time
import matplotlib.pyplot as mpl

def test():
    start = time.time()
    descriptors = s.build_semantic_descriptors_from_files\
    (['SwannsWay.txt', 'WarAndPeace.txt'])  # Actually build descriptors
    print("Done.\nRuntime was %s seconds." %(time.time() - start))
        # Track runtime for building descriptors
    print("Cosine:", s.run_similarity_test('test.txt', descriptors,\
    s.cosine_similarity))
    print("Total runtime was %s seconds." %(time.time() - start))
    print("Standard:", s.run_similarity_test('test.txt', descriptors,\
    s.sim_euc))
    print("Normalized:", s.run_similarity_test('test.txt', descriptors,\
    s.sim_euc_norm))
        # Compute and display similarity scores for all three methods

def get_graph():
    runtime = []
    accuracy = []
    tenths = range(11)  # Run from 0 to 10 tenths of the files
    for i in tenths:
        print("Now working on %d tenth(s)." %(i))
        start = time.time() # Keep track of time for each run
        desc = s.build_semantic_descriptors_from_partial_files\
        (['SwannsWay.txt', 'WarAndPeace.txt'], i)
        accuracy.append(s.run_similarity_test('test.txt', desc,\
        s.cosine_similarity))   # Build accuracy list
        runtime.append(time.time() - start) # Build runtime list
    mpl.close()
    mpl.subplot(1,2,1)
    mpl.plot(tenths, runtime, 'b-')
    mpl.title("Runtime")
    mpl.xlim([0,11])
    mpl.ylim([0,1.1*max(runtime)])      # To ensure proper scaling
    mpl.xlabel("Tenths of the books used")
    mpl.ylabel("Runtime (s)")
    mpl.subplot(1,2,2)
    mpl.plot(tenths, accuracy, 'r-')
    mpl.title("Accuracy")
    mpl.xlim([0,11])
    mpl.ylim([0,100])
    mpl.xlabel("Tenths of the books used")
    mpl.ylabel("Accuracy (%)")
    mpl.show()

'''In synonyms.py:

def build_semantic_descriptors_from_partial_files(filenames, tenth):
    return build_semantic_descriptors(get_mult_part_texts(filenames, tenth))

def get_partial_text(filename, tenth):
     '''#Return a list of sentences, each formatted as a list of words, from
    # the given amount of the file filename
    #
    # Args:
    # filename: the file to be parsed
    # tenth: the number of tenths to be used of the text from filename
    '''

    text = open(filename, encoding='latin1').read()
    text = text[:(len(text)*tenth)//10]
    text = text.lower().replace(",", "").replace("-", "").replace("--", "")\
    .replace(":", "").replace(";", "").replace("!", ".").replace("?", ".")
    split = text.split(".")
```

```python
    for i in range(len(split)):
        split[i] = split[i].split()
    return split

def get_mult_part_texts(filenames, tenth):
    big_list = []
    for file in filenames:
        for list in get_partial_text(file, tenth)[:]:
            big_list.append(list[:])
    return big_list

def add_dicts(vec1, vec2):
    new_dict = {}
    for word in list(vec1.keys()):
        new_dict[word] = vec1[word]
    for word in list(vec2.keys()):
        if word not in list(new_dict.keys()):
            new_dict[word] = vec2[word]
        else:
            new_dict[word] += vec2[word]
    return new_dict

def get_negative_vector(vec):
    new_vec = {}
    for key in list(vec.keys()):
        new_vec[key] = -vec[key]
    return new_vec

def sim_euc(vec1, vec2):
    return -norm(add_dicts(vec1, get_negative_vector(vec2)))

def sim_euc_norm(vec1, vec2):
    norm_v1, norm_v2 = norm(vec1), norm(vec2)
    new_v1, new_v2 = {}, {}
    for i in range(2):
        vec = [vec1, vec2][i]
        for word in list(vec.keys()):
            [new_v1, new_v2][i][word] = vec[word] / [norm_v1, norm_v2][i]
    return sim_euc(new_v1, new_v2)

def norm(vec):
    '''# Return the norm of a vector stored as a dictionary,
    #as described in the handout for Project 3.
    '''

    sum_of_squares = 0.0
    for x in list(vec.values()):
        sum_of_squares += x**2
    return sum_of_squares**0.5
'''

if __name__ == '__main__':
    test()      # Parts a and b
    get_graph()     # Part c
```