12. Text Processing

By: Steve Krenzel

Finding Blurbs

Suppose you ran a search engine and someone searched for a three word phrase like "cheap pudding pops". Also suppose you've already solved the problem of finding relevant URLs. The problem you're solving now is showing a blurb from each of those websites on the results page. You want the shortest span of text in the document that contains all of the words you searched for.

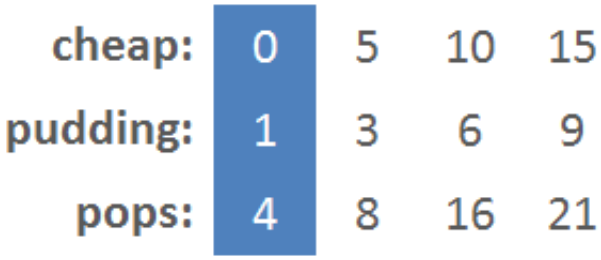
I used to know the name of this algorithm but it escapes me at the moment and despite my attempts at googling and asking around various channels on IRC, no one seems to know. The algorithm I'm going to describe uses a sliding window technique across the positions of the words in the document. It runs in O(N) time, where N is the number of occurences in the document of the word with the most number of occurences.

Here is the algorithm:

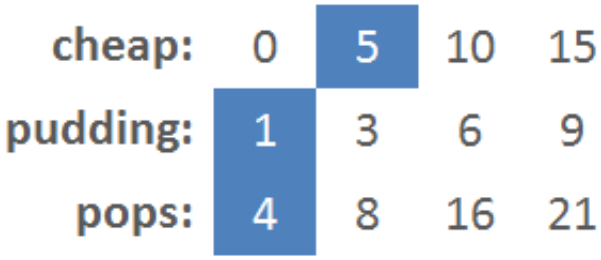
1. First, you need a list of all of the positions of the words searched for in the document. For example:

cheap:	0	5	10	15
pudding:	1	3	6	9
pops:	4	8	16	21

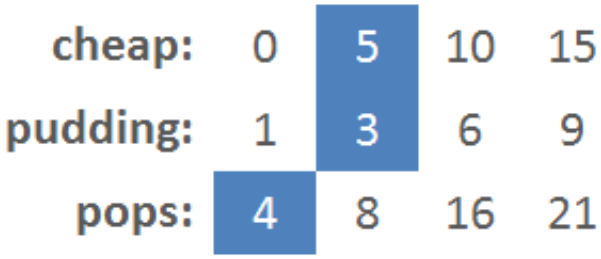
2. Then you keep track of our window, which initially starts at the beginning of each list:



3. At this point our smallest known blurb is the window [0, 1, 4] which has a range of 4. To see if we can do any better, we move forward the window of the word with the smallest position, in the case it's the list for the word "cheap" because it's position in the window is 0. We get:

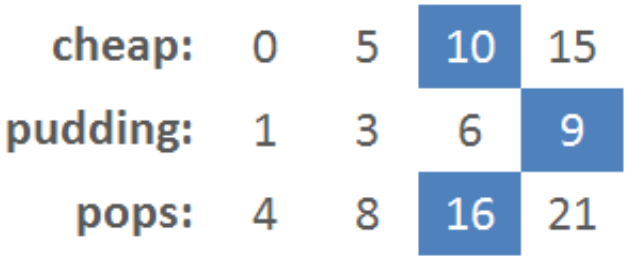


4. Our new window is [5, 1, 4] and has a range of 4 again. We repeat step 3, moving forward the window of the word with the smallest position. This time it is "pudding". We get:

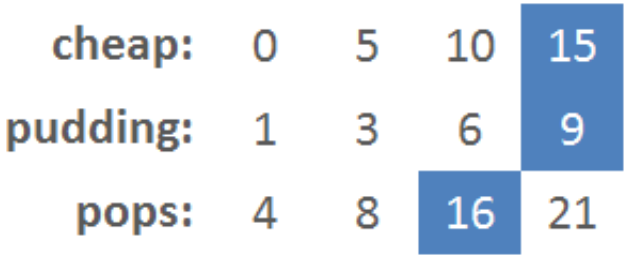


5. Now our window is [5, 3, 4] and has a range of 2. This is our new smallest window. It is also the smallest window possible, so we could stop if we wanted to, but we won't because I want to show you what to do when you

get a window that hits the end of the list. If we keep repeating step 3, we eventually get:



6. Our window with the smallest position is already at the end of it's respective list, so we can't move it forward any more. In this case we simply go to the next smallest and get:



7. When we repeat the process again, all windows will be at the end of their respective lists. At this point we simply return the window that had the smallest range, which we calculated all the way back in step 5. There are no more windows to try.

If the shortest span is still too long for your blurb you'll have to find some other way to split it up, which we won't cover here. You could also use the shortest span as a metric in ranking relevant documents since you probably want documents that contain the words close together.

The algorithm as presented can be optimized in a number of ways, but complicates its implementation slighltly. Doing so is left as an excercise.

Here is some simple code that implements this algorithm, it also has some basic

doctests included.

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Previous Next