

122COM: Boyer-Moore Searching

David Croft

Coventry University

david.croft@coventry.ac.uk

2017

String searching better

A

- Naive search works but is inefficient.
- Obvious solution is not always the best one.
- Think about the problem and what is being searched.
 - Can you be smarter?

Boyer-Moore string searching algorithm.

- 1977.
- Not going to talk about the whole algorithm here.
 - Gets complex.
- Right to left comparison.
- Can skip sections of the text.
 - Don't need to test every position.
 - How?

Boyer-Moore string searching algorithm.

- 1977.
- Not going to talk about the whole algorithm here.
 - Gets complex.
- Right to left comparison.
- Can skip sections of the text.
 - Don't need to test every position.
 - How?
- Pre-processes the search string.
 - Produce bad character rule table.
 - Will explain how in a minute.

Boyer-Moore algorithm

- 1 Preprocess the search string to create the “bad character table”.
 - Will explain how in a minute.

example \Rightarrow

a	e	l	m	p	x	*
4	6	1	3	2	5	7

- 2 Same as the naive search, position the search string at the start of the main text.
- 3 Compare the strings.
- 4 If strings don't match then in the bad character table lookup the character positioned at the end of the search string.
- 5 Move the search string by the number of positions specified in the table.
- 6 Repeat from step 3.

example \Rightarrow

a	e	l	m	p	x	*
4	6	1	3	2	5	7

text =	t	h	i	s		i	s		a	n		e	x	a	m	p	l	e
search =	e	x	a	m	p	l	e											

example \Rightarrow

a	e	l	m	p	x	*
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↓

text =	t	h	i	s	␣	i	s	␣	a	n	␣	e	x	a	m	p	l	e
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text =

t	h	i	s		i	s		a	n		e	x	a	m	p	l	e
---	---	---	---	--	---	---	--	---	---	--	---	---	---	---	---	---	---

 search =

e	x	a	m	p	l	e
---	---	---	---	---	---	---

7
↓

example \Rightarrow

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text =

t	h	i	s		i	s		a	n		e	x	a	m	p	l	e
---	---	---	---	--	---	---	--	---	---	--	---	---	---	---	---	---	---

search =

e	x	a	m	p	l	e
---	---	---	---	---	---	---

7
↓

t	h	i	s		i	s		a	n		e	x	a	m	p	l	e
---	---	---	---	--	---	---	--	---	---	--	---	---	---	---	---	---	---

	e	x	a	m	p	l	e
--	---	---	---	---	---	---	---

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t	h	i	s		i	s		a	n		e	x	a	m	p	l	e
---	---	---	---	--	---	---	--	---	---	--	---	---	---	---	---	---	---

search =

e	x	a	m	p	l	e
---	---	---	---	---	---	---

7
↓

4
↓

t	h	i	s		i	s		a	n		e	x	a	m	p	l	e
---	---	---	---	--	---	---	--	---	---	--	---	---	---	---	---	---	---

e	x	a	m	p	l	e
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t	h	i	s		i	s		a	n		e	x	a	m	p	l	e
---	---	---	---	--	---	---	--	---	---	--	---	---	---	---	---	---	---

search =

e	x	a	m	p	l	e
---	---	---	---	---	---	---

7
↓

4
↓

t	h	i	s		i	s		a	n		e	x	a	m	p	l	e
											e	x	a	m	p	l	e

t	h	i	s		i	s		a	n		e	x	a	m	p	l	e
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---	---	---	---	--	---	---	--	---	---	--	---	---	---	---	---	---	---

search =

e	x	a	m	p	l	e
---	---	---	---	---	---	---

7
↓

4
↓

t	h	i	s		i	s		a	n		e	x	a	m	p	l	e
											e	x	a	m	p	l	e

6
↓

t	h	i	s		i	s		a	n		e	x	a	m	p	l	e
										e	x	a	m	p	l	e	

Creating the bad character table.

- For each character.
 - Except the last.
- Just count number of places between it and end of search string.

example \Rightarrow a e l m p x *

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example \Rightarrow

a	e	l	m	p	x	*
						4

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example \Rightarrow

a	e	l	m	p	x	*
4	6					

Creating the bad character table.

- For each character.
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example \Rightarrow

a	e	l	m	p	x	*
4	6	1				

Creating the bad character table.

- For each character.
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example \Rightarrow

a	e	l	m	p	x	*
4	6	1	3			

Creating the bad character table.

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example \Rightarrow

a	e	l	m	p	x	*
4	6	1	3	2		

Creating the bad character table.

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example \Rightarrow

a	e	l	m	p	x	*
4	6	1	3	2	5	

Creating the bad character table.

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example \Rightarrow

a	e	l	m	p	x	*
4	6	1	3	2	5	7

Doesn't need to sort or modify the sequence being searched.

- Small amount of pre-processing on the search value.

Worst case.

- Linear time.

Average case

- Sub-linear.

Not the only improved string searching algorithm.

- Knuth-Morris-Pratt.
- Finite State Machine (FSM).
- Rabin-Karp.

The End