Summarizing Source Code using a Neural Attention Model

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Motivation

We present the first completely data driven method to generate high level summaries of the function of code.

C#
```
var input = "Hello";
var regEx = new Regex("World");
return !regEx.IsMatch(input);
```
→ Lookup a substring in a string using regex

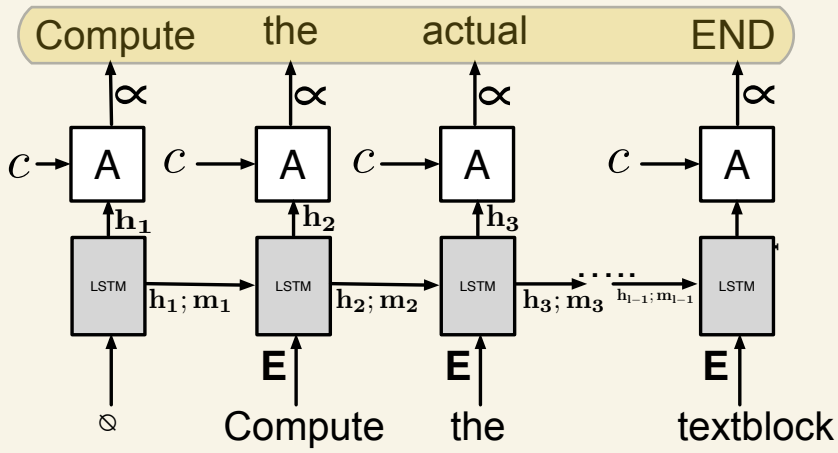
SQL
```
SELECT MAX(marks) FROM ATable
WHERE marks <
 (SELECT MAX(marks) FROM ATable)
```
→ Get the second largest value of a column

These auto-generated summaries have many Software Engineering applications:

Code Search · Documentation · Code Folding · Code Retrieval

Neural Attention Model

We use an end-to-end model that jointly performs content selection using an attention mechanism, and surface realization using Long Short Term Memory networks.

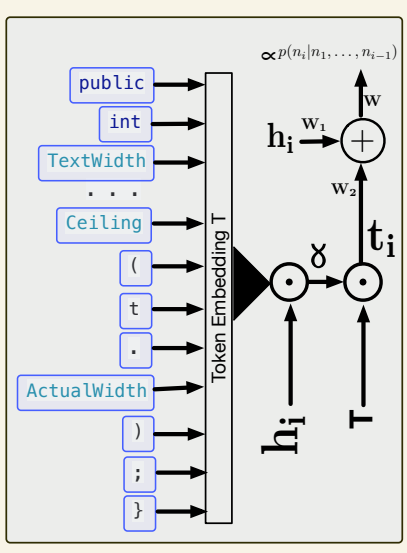


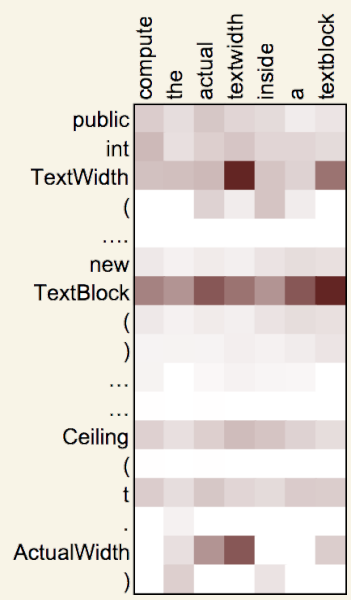
We model the conditional next-word probability as:

$$p(n_i|n_1,\ldots,n_{i-1}) \propto \mathbf{W}\ \tanh(\mathbf{W_1 h_i} + \mathbf{W_2 t_i})$$

$\mathbf{h_i}$ is the hidden state of the LSTM cell at the time step **i**

The attention model computes a weighted sum $\mathbf{t_i}$ of the token embeddings based on the LSTM hidden state. In this way, it selects the most useful tokens to generate the current word.





Code Summarization Dataset

NEW

We create a new dataset from programming QA websites containing 66K examples for C# and 33K for SQL.

stackoverflow

Compute the actual textwidth inside a textblock

1 Answer — active **oldest** votes

5

```
public int TextWidth(string text) {
  TextBlock t = new TextBlock();
  t.Text = text;
  return (int)Math.Ceiling(t.ActualWidth);
}
```

C#

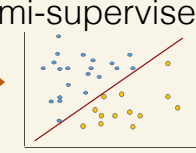
MSDN about ActualWidth.

share edit — answered Dec 31 '13 at 13:44

Code snippets in this dataset are non-trivial.

Loops	> 20%	> 2 Functions	50%	|Code|	38
Conditionals	> 22%	> 2 Statements	45%	|Summary|	12

Titles are cleaned using an semi-supervised classifier.

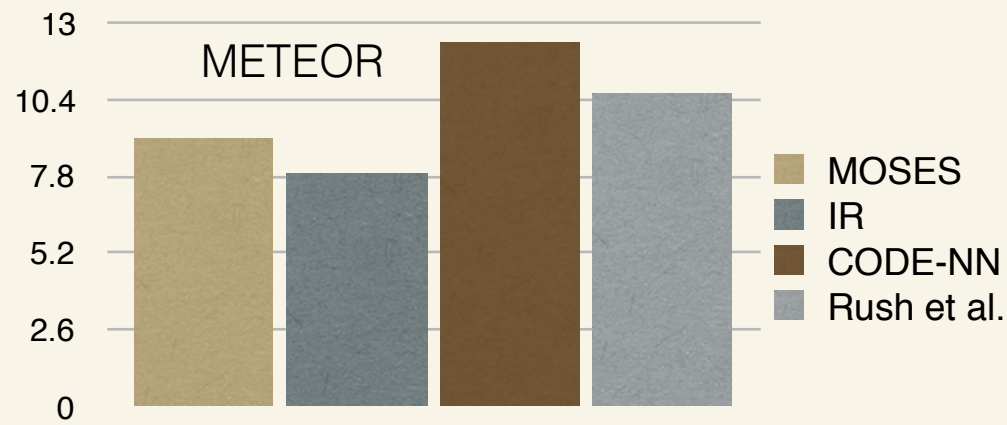
Difficult C# if then logic →  REJECTED

Human Annotations

We gather 2 additional references for 200 code snippets for more accurate development and testing.
Dataset/Code at: https://github.com/sriniiyer/codenn

Experiments

Our model beats competitive baselines on summarization metrics such as METEOR and BLEU-4.



Human evaluators prefer the output of our model too!