Paper: *Attention and Augmented Recurrent Neural Networks*

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Quote *"... we've seen a growing number of attempts to augment RNNs with new properties. Four directions stand out as particularly exciting- Neural Turing Machines, Attentional Interfaces, Adaptive Computation Time, Neural Programmer."*

Overview Recurrent Neural Networks (RNN) are no doubt a powerful approach to work with sequences learning tasks such as text processing, audio processing, image captioning etc. Moreover, Long Short-Term Memory (LSTM) is used as an additional gear which substantially improves the performance of the RNN working with longer sentences. With all of these capabilities, RNN is used ubiquitously in sequence processing tasks. In this blog, the authors discussed about RNN augmentation techniques which made RNN more powerful in terms of tackling various domains of natural language processing tasks. They enlisted four such augmentation techniques, namely- Neural Turing Machines, Attentional Interfaces, Adaptive Computation Time, Neural Programmer.

Neural Turing Machines provide the underlying RNN a memory bank so that read and write operations can be done on input sequences. These read and write operations occur with an "attention distribution" which has the description about the read and write operation in different locations. Attentional Interface is another technique where a particular portion of the input sequence gets additional attention to gain tailored information. Each step, the attention focuses on different parts of the input. Adaptive Computation Time provides RNN to carry multiple steps of calculations in each of its processing steps. This technique helps solve complex the information retrieval process. This computation is also managed with an attention distribution. The authors pointed that Neural Nets cannot do addition and multiplication tasks in themselves. To rescue, Neural Programmer provides the capability to generate programs which can process various tasks and also do calculations on transient data. These programs are sequence of operations and they operate on previous output. A similar approach as Neural Programmer is Neural Programmer-Interpreter.

Intellectual Merit The authors mentioned about four techniques that enhance the capabilities of a Recurrent Neural Network. RNNs with these augmentation can approach various problems like- Translation, Voice Audio Recognition, Parsing texts and also image captioning. The authors of this blog are from Google Brain team. Google has been showing numerous improvements in the text processing tasks. They have the access to a huge amount of text and audio data to work on these algorithms and improve them.

Broader Impact Recurrent Neural Networks provided a huge advantage to the natural language processing applications. RNN became more powerful to solve critical problems with augmentation. The authors mentioned about public repositories to access the codes of these models. Many researches refer to these repositories to use codes, improve process and discuss ideas.

Keywords Neural Turing Machines, Attentional Interfaces, Adaptive Computation Time, Neural Programmer

Discussion Questions

- The authors mentioned that the computation cost increases linearly when the memory is increased. However, they did not mention about why this happens in this blog. Moreover, how sparse attention could improve this problem was not discussed.
- Authors did not mention about how do any one decide which portion to give more attention.

Table 1: Grade deductions by section

Overview	Intellectual M.	B. Impact	Keywords	Questions	Is Online?