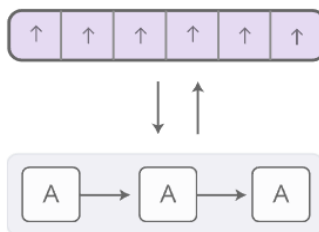


## (E) attention units:

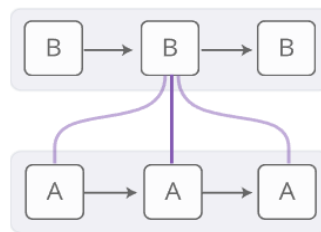
Ongoing research on LSTMs with attention units produced many different attempts at improving these units. We will focus on the Neural Turing machine, but will also review two additional types of attention unit to demonstrate their shared attributes:

1. Neural Turing machine
2. Attentional Interfaces
3. Adaptive Computation



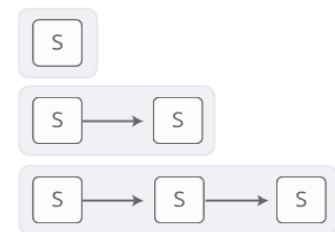
### Neural Turing Machines

have external memory that they can read and write to.



### Attentional Interfaces

allow RNNs to focus on parts of their input.

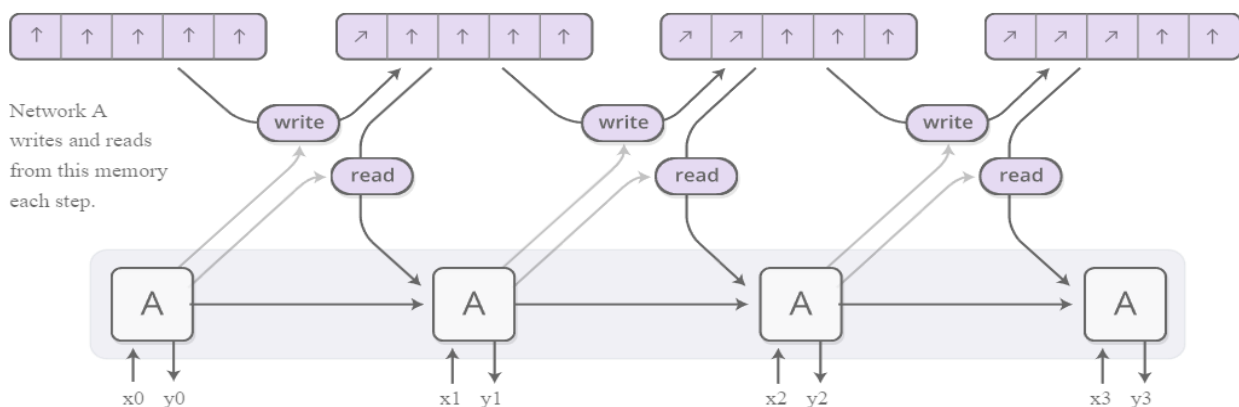


### Adaptive Computation Time

allows for varying amounts of computation per step.

## Neural Turing machine

Memory is an array of vectors.



The **Neural Turing Machine (NTM)** adds an external memory to the basic LSTM network, which it can write to and read from, allowing the network to better understand what it is doing (e.g. mimic a lookup table with key-value, learn to store a long sequence in memory and so on). The external memory is a vector array, the question arises where in the vector array should the network write to and read from?