QNLP Equations v1

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This is just the math stuff for https://github.com/tomiock/QNNs. You can see the equations and circuits used in the README.md file

I. COST FUNCTION:

Each circuit has a local cost function (Eq. 1) evaluated using the mean square error method:

$$C_{local} = \frac{1}{2m}\sum_{i=1}^{m}(\varphi_i - y_i)^2 \tag{1}$$

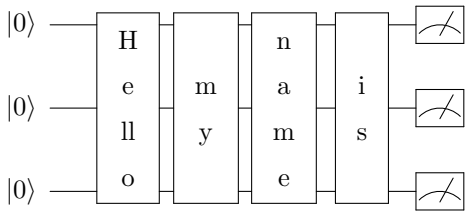
The global cost function is just the average of the local cost of all the circuit:

$$C_{global} = \frac{1}{M}\sum^{M}\frac{1}{2m}\sum_{i=1}^{m}(\varphi_i - y_i)^2 \tag{2}$$

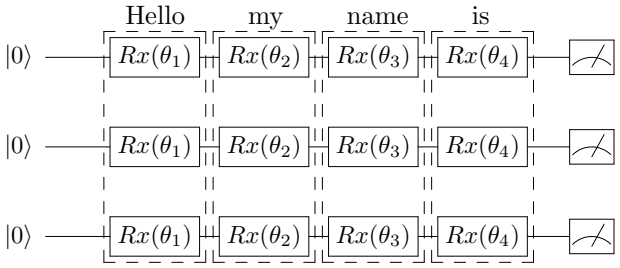
With M being all the circuits and m all the measurement taken to a circuit.

II. CIRCUITS:

The circuits are in the form:



With each word of the sentence as a quantum gate. We use Rx gates (parameterized Pauli-X gate), each word has its parameter (e.g. the word "Hello" has the parameter θ_1):



If we create QCs that are equivalent to sentences with the words as a quantum gates (with all the words except the last one), we could in theory optimize them in such a way that upon measuring we get a bitstring equivalent to the last word of the sentence the circuit will have learned how to complete sentences.