Brendan P Purdy

ABSTRACT

This thesis discusses measuring neural networks with measure theory. In particular, we show that finite artificial (recurrent) neural networks can be quantified by the theory of Lebesgue measure. Using measure theory to quantify neural networks is mathematically valid because of the following. First, using computation theory, neural networks are equivalent to finite automata, which are in turn equivalent to hidden Markov models. Next Markov models are valid on the discrete probability space by using measure theory and the axioms of probability. Finally since Markov models are equivalent to neural networks, then it is valid to measure these networks with measure theory. We call this measure of neural nets the McCulloch-Pitts Measure and denoted μ_N .

Once we have the McCulloch-Pitts measure, we apply it to a few examples. We then finish our discussion with a sketch of the proof showing that infinite neural networks can be measured by continuous probability space, possibilities for further research, and concluding thoughts.