E1-18: A Theoretical basis for weight initialization in neural networks

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Modeling of human behaviour is seen as one of the most interesting areas of Artificial Intelligence. The idea of Artificial Neural Networks is considered as one such attempt to modeling human behaviour. This technology has shown a great potential to address problems in a variety of fields including medicine, industry, business, etc. Despite its great popularity, Neural Network technology is frequently criticized for lack of a theoretical basis. Among other ad-hoc activities, the weight initialization is very crucial for training of Neural Networks. It is customary to select small initial weights without any theory.

This paper provides a theoretical justification why initial weights should be selected as small values and also explains how it can be done. For this purpose, we have exploited Buddhist theory of human mind. In Buddhism, human

thinking process is seen as a conditional flow of thoughts which operates in a probabilistic manner. Based on this view, we have shown that thinking process can be expressed in terms of a Markov chain. So thought processes are associated with limiting matrices showing very small values and also give row sums equal to one. Therefore, according to Buddhism, we conclude that selection of initial weights as small values and making row sums equal to one, provides a theoretical basis for weight initialisation in Neural Networks. Further, since limiting matrices are square, it supports the Network design principle that number of neurons in the input layer and the number of components of an input should be the same.