

Time Based Computation with Pulse Trains

Jose C. Principe

Distinguished Professor of Electrical Engineering

University of Florida

Numeric computation is at the core of man-made computation models and its mathematical foundations are very well understood. However, we humans very likely do not use the same principles. This talk describes efforts to think out of the digital computation box and searches for alternate computational methodologies with pulse trains. After a brief introduction, we describe the integrate-and-fire converter is presented to convert analog signals into pulse trains and discuss two approaches for processing information in pulse trains that can be implemented in ultra-low power digital hardware, preserving the asynchronous nature of the pulse domain representations. The first learns using machine learning the structure of the data in a training set, and implements an approximation directly in finite state machines. The other, less developed, shows that it is possible to perform addition, multiplication and convolution with pulse trains without using binary representations, with an accuracy compatible with IoT applications.