MICAI 2020- Tutorial Proposal

Title	Spiking neural networks: a practical approach for Spatio-temporal data classification
Speaker	Josafath Israel Espinosa Ramos PhD
Abstract	Inspired in the nervous system of the mammals, spiking neural networks - the third generation of neural networks- receive and send information through sequences of spikes. This encoding mechanism allows SNN to encode and process both spatial and temporal information, while most artificial neural networks lack timing dynamics. Additionally, the event-driven paradigm of SNN has been leveraged by novel neuromorphic platforms. These two advantages make SNN suitable for fast processing and classification of Spatio-temporal data, for example, continuous signals coming from diverse sources such as sensor networks. In this tutorial, we will learn the components and principles of SNN applied to static and Spatio-temporal data classification.
Topics	• **The third generation of neural networks**: During this section, we will introduce the concept and principles of spiking neurons • **Spike coding**: In this section, we will describe different approaches for the interpretation of spike trains. • **Spiking neuron models**: In this section, we will introduce some spiking neuron models feasible for machine learning. • **Encoding algorithms**: During this section, we will introduce the *Spiker*, a spike encoding tool for temporal data input to a spiking neural network. • **Learning algorithms**: Here, we will describe some algorithms for learning temporal patterns. • **Architectures**: In this section, we will present a demonstration of the *NeuCube* Cloud, a computational architecture for creating Brain-Like Artificial Intelligence and classification of Spatio-temporal data. We will also present a single neuron architecture for classification of static and temporal data. • **Hyperparameter optimisation**: In this section, we will explain how to use evolutionary computation for hyperparameter optimisation.
Audience/prerequisites	The tutorial is oriented to people interested in classification of Spatio-temporal data. It is preferable that attendants have basic knowledge in • Artificial neural networks • Machine learning • Evolutionary computation
CV	Dr Josafath Israel Espinosa Ramos holds an MSc in cybernetics from La Salle University, Mexico City, and a PhD in computer science at the Centre for Computing Research of the National Polytechnic Institute, Mexico City. His primary research interests are in the areas of computational neuroscience, evolutionary algorithms, and machine learning. Currently, he works as a

	Research Fellow for the SRIF 17 INTERACT project at KEDRI. The aim of his research is modelling multi-sensory and multivariate streaming data, and analysing the spatial and temporal relationships among the variables that describe the dynamics of a sensor network.
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Technical requirements (equipment, hardware, and software)	During the tutorial, we will access the cloud version of the NeuCube and we will perform a classification task over a Spatio-temporal dataset. Software: • Matlab • Matlab version of the *NeuCube* and *Spiker*. Both can be download from https://kedri.aut.ac.nz/R-and-D-Systems/neucube • NeuCube cloud which can be accessed to https://www.neucube.io/ Data • The Matlab version of the *NeuCube* has a Spatio-temporal dataset that can be used in both the Matlab and Cloud versions of the *NeuCube*.