Contribution ID: **14** Type: **Oral**

Quantum computing model of an artificial neuron with continuously valued input data

Wednesday, 30 September 2020 14:30 (15 minutes)

Artificial neural networks have been proposed as potential algorithms that could benefit from being implemented and run on quantum computers. In particular, they hold promise to greatly enhance Artificial Intelligence tasks, such as image elaboration or pattern recognition. The elementary building block of a neural network is an artificial neuron, i.e. a computational unit performing simple mathematical operations on a set of data in the form of an input vector. Starting from the design of a previously introduced quantum artificial neuron [1], which fully exploits the use of superposition states to encode binary valued input data, during the talk it will be shown how the implementation of the quantum neuron can be further generalized to accept continuous- instead of discrete-valued input vectors, without increasing the number of qubits [2]. This further step is crucial to allow for a direct application of gradient descent based learning procedures, which would not be compatible with binary-valued data encoding.

[1] Tacchino, F., Macchiavello, C., Gerace, D. et al. (2019). An artificial neuron implemented on an actual quantum processor. npj Quantum Inf 5, 26. https://doi.org/10.1038/s41534-019-0140-4
[2] Mangini, S., Tacchino, F., Gerace, D., Macchiavello, C. and Bajoni, D. (2020). Quantum computing model of an artificial neuron with continuously valued input data. Machine Learning: Science and Technology. https://doi.org/10.1088/2632-2153/abaf98

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Session Classification: Invited