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Future Internet: a bridge from Artificial Intelligence to Quantum Intelligence

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TIM - IEEE Industrial Distinguished Lecturer



Abstract

The transformative role of Computer Science and Information Communication Technologies (ICT) has always been witnessed as a precursor of scientific progress and economic growth in the modern world. Today, like never before, we are witnessing an increasing exploitation of ultra-broadband (fixed-mobile) infrastructures and Cloud-Edge Computing, for providing any sort of digital services for our daily life.

The so-called Digital Transformation is going to create a pervasive artificial nervous system embedded into the reality around us. As a matter of fact, a very large adoption of mobile terminals and devices and a pervasive distribution of the Internet of Things will allow collecting enormous big data sets, which will be communicated and transmitted by ultra-broadband, low latency network connections (e.g., 5G) to Cloud and Edge Computing Data Centers (DCs). These DCs, in turn, will store and elaborate the collected big data in order to infer decisions (with Big Data analytics and big data analytics methods) which will be then exploited, locally, by actuators. This is the typical closed loop of any autonomic or artificial nervous system (e.g., collect-analyze-decide-act). Therefore, big data analytics and AI will be at the center of this transformation.

Looking at the most promising Artificial Intelligence technological approaches, Deep Neural Networks (DNNs) are outperforming in several applications domains. Processing big data to infer patterns at high speeds and with low power consumption is becoming more and more a central technological challenge of the Digital Transformation. At the same time, electronics starts facing physically fundamental bottlenecks whilst nanophotonics technologies are considered promising candidates to overcome electronics limitations. In this direction, there are evidences of an emerging research an innovation field, rooted in quantum optics, where the technological trajectories of DNNs and nanophotonics are crossing each other. As a matter of fact, it is likely that one of the possible explanations of DNN outperforming is really deeply rooted in the principles of theoretical Physics, specifically Quantum Field Theory (QFT) and Gauge theory.

This is encouraging even more researches and experiments in the direction of a full exploitation of quantum computing and networking for the development of future internet and innovative ICT solutions. Given that QFT and Gauge theory have been already proposed for modelling the brain and biological nervous systems, this talk explores the intriguing possibility of exploiting quantum optics principles also for developing a future "nervous system" for the coming Quantum Society.



Bio

Antonio Manzalini is an Electronics Engineer and PhD employed in Telecomitalia from 1990. He participated in several international projects in the field of telecommunications, with particular interest on Synchronous Digital Hierarchy (SDH) and Wavelength Division Multiplexing (WDM). He also contributed to many standardisation activities, guiding several teams in ITU-T, IEEE and GSM. He is currently working on technologies and architectures for 5G networks, based on the integration of SDN, NFV and Artificial Intelligence systems. In 2019, he was awarded Industrial Distinguished Lecturer from IEEE. He is the author of more than 100 papers and seven patents.



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