Artificial Intelligence and Complex Dynamical systems

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Pioneering research contributions in Artificial Intelligence (AI) received two Noble prizes in Physics and two in Chemistry in 2024. John Hopfield and Geoffrey Hinton got the Physics prize while Demis Hassabis and John Jumper got the Chemistry prize all for work related to the development and applications in AI. In 2021 Giorgio Parisi received the Physics Nobel prize for work in Complex dynamical and statistical systems. Most recent developments in AI are founded on networks of artificial neurons that are themselves very complex and involved. On the other hand, complexity is typically thought to involve chaos, solitons, fractals and self-organization. Linking complex systems with AI is intriguing since it might provide clues on how to better deal with nonlinear systems using machine learning and similar techniques. At the same time, complex systems work may enable the deeper, possibly statistical, understanding of complicated AI networks. In this talk I will present ideas and results on how to apply machine learning in complex dynamical systems and learn something new about these systems. The basic question that underlies this talk is whether we can actually teach the computer to learn solutions of physical problems. We will present a number of results showing that the answer is generally affirmative, even though precise analytical foundations are lacking. We also address briefly the issue of whether there is a role for quantum computation in this search. Finally, we show that application of these new methods in medicine is very pertinent and could hopefully lead to a healthier and happier life for all of us that is of course the ultimate goal of science.

References:

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