About Conexinist Paradigma

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One of the dominant methods of artificial intelligence is the connectionist model. It introduces the concept of neuronal calculation that generated objective realization known and named "artificial neuronal networks" ("neuronal networks" for short).
Neuronal computation is now a fascinating research domain and a main intellectual and technological challenge. Through its applications for solving some difficult problems such as those of evaluation, founding and prediction of some complex optimization problems, neuronal networks gain an importance and an impact bigger and bigger, not only in science but also in social life domain. Neuronal networks can be powerful instruments for economic and even political decisions.
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In neuronal networks, information isn't memorized in precise areas, like in case of standard computers but is memorized diffuse, in the whole network. The memorization is made giving correspondent values for the weights of the sympathetic links between network's neurons.
Another important characteristic of neuronal networks is that they can learn using examples.
This, in traditional mode, for solving a problem, creation of a model (mathematical, logical, language model etc.) of it is necessary and than it is shown a chain of operations which represents the algorithm for solving that problem. Practice activity has demonstrated the existence of some complex problems where it's difficult or even impossible to make an algorithm using a traditional computer.
Neuronal network has the quality that, beginning with a particular manifold of examples (training examples), it is able to synthesize alone he algorithm for solving the problem. Thus it extracts information from training manifold (it learns from shown examples). Except work, the network will use information gained in next stage for solving situation like those from training manifold.
Within connectionist models, we must give only a consistent manifold of examples and a rule for change inter-neuronal weights, for each example. The training rule compares desired exit (given by example) with network's real exit and produce a change of the weights corresponding to a planning strategy. As a rule, founding weights is an iterative process.
The spectrum of applications is from character recognition systems (used in correspondence document management), sign recognition (used in banking system) and voice recognition, to automatic pilots and systems for a live control of some complex processes.
The beginning of connectionist models is about fifty years ago, sincerely in 1943, when first model of neuron appears in the work: "Logic of Ideas in Nervous Activity", made with collaboration between a neuro-psychologist (W.S. McCulloch) and a mathematician (W. Pitts).
Then, another works follow:
- 1943 – the monograph *"Nature of Explanations"*, de K.W.J. Craik;
- 1943 – the work *"Statistic Results of Logical Computation of Neuronal Networks"* by H.D. Landhal, W.S. McCulloch and W. Pitts;

Thus, neuronal network's domain is born. Another researchers have made the following steps.
- Wiener (1948) – in the work *"Cybernetic – Control and Communication between Man and Machine" has gained an approach between mathematics and neuro-dynamic.*

▪ D.O. Hebb (1949) – in the work *"Management of Behavior" gives the hypothesis that brain's links are continuously changing, like an organism that learns diversely functions.*
▪ A.L. Hodkin and A.F. Huxley (1952) – in the work "Passing of currents made by sodium and potassium ions" relying on the analogy of electric circuits with their mathematical models, have studied thoroughly and defined a model of a neuron which describes electric behavior of nervous cell. This model has also had diversely types made by R. FitzHugh (1962) – "Mathematical Models of Excitation and Propagation in Nerves" and J.P. Keener (1983) – "Analog Circuits for *van der Poland and FitzHugh – Naguno's* Equation*"*;
▪ R.L. Beurle (1956) – in the work "The Proprieties of a Manifold of Cells able of Regenerative pulses" has been first who has detailed the propagations of a large amount of brain activities, especially in what is now named neuronal activity approximation.
▪ F. Rosenblatt (1958) – in the work "The Perceptron, a stochastic model for Storing and Organizing Information in Brain", realizes an important approach to shape recognition problem and a short time after, in 1960 B. Widrow and M.E. Hoff in the work "Adaptive Switching Circuits" intend another neuronal network model, known as *ADALINE* (*ADAptive Linear Neuron*). These types of networks have been used for solving some problems like recognition of some specific features in EKG's or artificial feeling. The only difference between Perceptron and Adeline is training procedure.
▪ F. Rosenblatt (1961) – in the work "Neurodynamic Rules: The Perceptron and Brain Mechanism Theory" and S. Papert (1969) – in the work "Some Mathematical Models of Learning" produced a strong emotion in scientific world, the specialists taking an almost full agreement that also another processes linked to human intelligence and memory, can be simulated using such networks, eventually more sophisticated.
▪ M. Minski and S. Papert (1969) – in the work "Perceptron – a First Step in Analytic Geometry", make a rational analysis of possibilities and limits of neuronal models which existed then, showing main impossibility of one-layer neuronal networks to solve relatively easy problems (for example, logic function exclusive OR – XOR – cannot be calculated). Having dubious conclusions concerning multi-layer network's facility for overrun the problems of the perceptron keeping the characteristics which make it interesting (linearity, convergence of training procedure, conceptual simplicity as parallel computation process), the work has marked a dramatic decrease of interest for this research direction, even if Rosenblatt almost solved the back-propagation algorithm problem.
▪ A new rebirth has been in the year 1985, when Boltzmann's machine appeared. In D.H. Ackley's work "Learning Algorithm for Boltzmann Machine" this represents a neuronal network's model relied on some technologies between neuronal calculation and statistic physic.
▪ These successes made many researchers to realize a rigorous analysis of mathematical proprieties of neuronal networks, following two directions: the discovery of existence proves – building what we name "approximation problem global applicable " (for example, every continuous function may be approximated by a feed-forward (forward propagation) neuronal network as you desire - P. Baldi "About the Proprieties of Neuronal Networks" 1988 and the demonstration of limit number of neurons needed in evaluation problems - R.W. Brause; "The Complexity of Limit Error of Neuronal Networks" 1993.
▪ R. Hecht-Nielsen in the work: "Application of Kolmogorov's Theorem in Neuronal Networks' Computation" – 1987 and R.P. Lippmann "An Introduction in Neuronal Networks' Computing" – 1987 have been probably first who demonstrated existence of approximation proprieties of neuronal network. Thus, it has established the fact that neuronal network show a calculation instrument global valid with more or less restrictive conditions when connection variations are allowed.

▪ K.I. Funashi in the work "About Approximation Making of a Continuous Function using Neuronal Networks" – 1989 redefines Kolmogorov's theorem giving an approximate result for a two hidden layered network.
▪ K. Hornik, M. Stichombeandi H. White. Show in the work: "Approximation of an Unknown Function and its Derivate using a Multi-level Neuronal Network with Forward Propagation Algorithm" – 1990, that it is possible to obtain simultaneously an approximation both of the function and its derivate.
▪ K. Hornik in the work "Some New Results in Neuronal Networks' Approximation" – 1993 shows that weights can be limited to a small number
▪ M. Arai. In the work "Limits of Number of Hidden Binary Elements Three-level Neuronal Networks" demonstrated that *m*-1 hidden neurons are necessary for an arbitrary separability.

A study that tries somehow to join the two directions of research has been published by A. Bulsari in the work "Some Analytic Solutions of Main Problem of Approximation for Feed-forward Neuronal Networks" – 1993, in firs part presents the analytic solutions for general case of one-dimensioned feed-forward neuronal networks which needs an infinity of neurons. In second part he gives practical solutions for one-dimensioned cases, including an upper limit of the number of knots in hidden levels.

Neuronal calculation is now a fascinating research domain and a main intellectual and technological challenge. Neuronal networks changed both the image of calculation processes and algorithmic features of artificial intelligence, giving a model of brain processes to psychology.

Using its applications for solving difficult problems, like those of evaluation, founding and prediction of some complex optimization problems, neuronal networks give an importance and an impact greater and greater, not only in science but also in social life domain. Neuronal networks can be strong instruments for taking economical and even political decisions.

Fuzzy manifold's theory whose beginning can be situated in the year 1965 grace of the L.A. Zadeh's works, is a very strong mathematical instrument for the study of non-statistical doubt and for the modeling of gradate and approximate reasoning. Using fuzzy manifolds it's possible to make neuronal networks able to learn from incomplete training data, ambiguous or contradictory. Neuronal networks relied on such models have an increased degree of power and a greater intelligence

A new tendency is the usage of genetic and evolutional algorithms both for neuronal network's training and the establishing of network's architecture.

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