Connectionist theory of language acquisition

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Approach to Cognitive Science This article includes a list of general references, but remains largely unchecked because there are insufficient corresponding online citations. Please help us improve this article by introducing more precise quotations. (April 2014) (Learn how and when to remove this message template) Connectionism is an approach in the field of cognitive science that hopes to explain mental phenomena using artificial neural networks (ANNs).[1] Connectionism presents a cognitive theory based on simultaneous and distributed signal activity. through connections that can be represented numerically, where learning occurs by modifying the connecting forces based on experience.[2] Some advantages of the connection approach include its applicability to a wide range of functions, structural approximation to biological neurons, low requirements Inherent structure and graceful degradation capacity.[3] Some disadvantages include the difficulty of deciphering how NSAs process information, or of explaining the composition of mental representations, and the consequent difficulty of explaining phenomena at a higher level.[2] The success of deep learning networks in the last decade This approach has greatly increased the popularity of such networks, but the complexity and size of such networks have brought with them greater problems of interpretation[1]. Connectionism is seen by many as an alternative to classic thought theories based on symbolic calculus, but the extent to which the two approaches are compatible has been the subject of much debate since their inception.[1] Connectionist Model (ANN) with a hidden layer Basic Principles The central connectionist principle is that mental phenomena can be described by interconnected networks of simple and often uniform units. The shape of connections and units can vary from model to model. For example, the units in the network could represent neurons and the connections could represent synapses, as in the human brain. Activating diffusion Main article: Activating diffusion In most connectionist models, networks change over time. A closely related and very common aspect of connection models is activation. At any time, a unit in the network has an activation, which is a numerical value intended to represent an aspect of the unit. For example, if the units in the model are neurons, the activation could represent the probability that the neuron generates a peak of action potential. The activation typically spreads to all other units connected to it. Diffusion activation is always a feature of neural network models, and is very common in connectionist models used by cognitive psychologists. Neural Networks Main article: Artificial Neural Networks Neural networks are by far the most used connector model today. Although there is a wide variety of neural network models, they follow almost always two fundamental principles concerning the mind: Mind:Vector of numerical activation values on neural unit of a network. Memory is created by changing the strength of the connections between neural units. The connection forces, or Â «weights", are generally represented as a matrix nÃƒÂ-n. Most of the variety of neural network models derives from: interpretation of units: the units can be interpreted as neurons or groups of neurons. Definition of activation: activation can be defined in various ways. For example, in a Boltzmann machine, activation is interpreted as the probability of generating a peak of potential deed and is determined by a logistic function on the sum of the inputs of a unit. Learning algorithm: different networks modify their connections differently. In general, any mathematically defined change in the weight of the connections over time is indicated as Â «learning algorithm.â € The connectingists agree that the recurrent neural networks (direct networks in which network connections can form a direct cycle) are A better brain model with respect to neural power networks (direct networks without cycles, DAG calls). Many recurrent connexionist models also incorporate the theory of dynamic systems. Many researchers, such as Connectionist Paul Smolensky, claimed that Connectionist models will evolve towards completely continuous, high-size, non-linear and dynamic approaches. Organic realism Connexionist work in general does not need to be biologically realistic and therefore suffers from a lack of neuroscientific plausibility. [4] [5] [6] [7] [8] [9] [10] However, the structure of neural networks derives from that of organic neurons, and this parallel in the low-level structure is often supported as an advantage of the connection. Modeling cognitive structures compared to other approaches. [3] Area where the connexionist models are considered biologically implausible concerns the propagation networks of the necessary errors to support learning, [11] [12] but the propagation of the errors can explain part of the electrical activity generated biologically generated by the Scalp in potential events like N400 and P600, [13] and this provides biological support for one of the key hypotheses of connexionist learning procedures. Learning Weights in a neural network are set according to some rule or learning algorithm, such as Jewish learning. Thus, the connexions have created many sophisticated learning procedures for neural networks. Learning always involves changing link weights. In general, these involve mathematical formulas to determine the change in weights when data sets data consisting of activation carriers for a certain subset of neural units. Several studies focused on learning methods based on connectivity.[14] By formalizing learning in this way, connectionists have many tools. A very common strategy in the learning methods of connections consists in incorporating the gradient descent on an errorin a space defined by the weight matrix. All gradient descent learning patterns in connection patterns involve changing each weight by partial drift of the error surface compared to weight. Backpropagation (BP), first made popular in the 1980s, is probably the most commonly known connection gradient drop-down algorithm today. [12] The connection of the link can be traced to ideas more than a century, which were little more than speculation until the 20th century in the middle of the 20th century. Parallel distributed processing The prevailing approach of the link today was originally known as parallel distributed processing (PDP). It was an artificial neural network approach that underlined the parallel nature of neural processing and the distributed nature of neural representations. It provided a general mathematical framework for the researchers to operate. The framework involved eight main aspects: a series of machining units, represented by a set of whole numbers. An activation for each unit, represented by a vector of functions dependent on time. An output function for each unit, represented by a function vector on the activations. A scheme of connectivity between the units, represented by a matrix of real numbers that indicate the force of the connection. A propagation rule that spreads activations through connections, represented by a function on the output of units. An activation rule for the combination of inputs to a unit to determine its new activation, represented by a function on current activation and propagation. A learning rule to change connections based on experience, represented by a change in weights based on any number of variables. An environment that provides the system with experience, represented by sets of activation vectors for some subsets of units. A lot of research that led to the development of the PDP was done in the 1970s, but the PDP became popular in the 1980s with the release of books that are distributed parallel processing: explorations in the microstructure of cognition - Volume 1 (foundations) and Volume 2 (psychological and biological models), by James L. McClelland, David E. Rumelhart and the PDP research group. Books are now considered seminal linking works, and it is now common to fully equip the PDP and the link, although the term "connecticism" is not used in books. Following the PDP model, researchers have theoretical systems based on perpendicular distributed processing principles (PDP). The direct roots of earlier PDP work were the perceptron theories of researchers such as Frank Rosenblatt from the 1950s and 1960s. But the perceptron models were made very unpopular by the book perceptronsMarvin Minsky and Seymour Papert, published in 1969. He demonstrated the limitations on the types of functions that single perceptron perceptrons (without hidden layers) can compute, showing that even simple functions such as Exclusive Disjunction (XOR) cannot be handled properly. PDP books overcame this limitation by showing it by showing it Nonlinear neural networks were much more robust and could be used for a wide range of functions. [15] Many previous researchers have supported patterns of connection style, for example in the 1940s and 1950s, Warren McCulloch and Walter Pitts (MP neuron), Donald Olding Hebb, and Karl Lashley. McCulloch and Pitts demonstrated how neural systems can implement first-order logic: Their classic paper "A Logical Calculus of Ideas Immanent in Nervous Activity" (1943) is important in this development here. They were influenced by the important work of Nicolas Rashevsky in the 1930s. Hebb contributed a lot to speculations about neural functioning, and proposed a learning principle, ebbian learning, which is still used today. Lashley claimed for distributed representations because of his failure to find anything like a localized engram in years of injury experiments. Connection Apart from PDP Although PDP is the dominant form of connection, other theoretical works should also be classified as connectionist. Many connecting principles can be traced to early work in psychology, such as that of William James. [16] Psychological theories based on knowledge of the human brain were fashionable at the end of the 19th century. As early as 1869, neurologist John Hughlings Jackson supported distributed systems at multiple levels. Following this guide, Herbert Spencer's Principles of Psychology, 3rd edition (1872), and Sigmund Freud's Project for Scientific Psychology (composed 1895) proposed theories of connection or proto-connection. These tended to be speculative theories. But at the beginning of the 20th century, Edward Thorndike was experimenting on learning possessing a kind of connection network. Friedrich Hayek independently conceived the learning model of Ebbian synapse in a paper presented in 1920 and developed that model in the theory of the global brain consisting of Ebbian synapse networks that develop into larger systems of maps and memory networks [citation required]. Hayek's work was quoted by Frank Rosenblatt in his perceptory chart. Another form of connection model was the relational network structure developed by linguist Sydney Lamb in the 1960s. Relational networks have been used only by linguists and have never been unified with the PDP approach. As a result, they are now used by very few researchers. There are also hybrid connection models, mostly mixing symbolic representations with neural network models. The hybrid approach has been supported by some researchers (such as Ron Sun). Connection vs. Computerism Debate As the connection became increasingly popular in the late 1980s, some researchers (including Jerry Fodor, Steven Pinker and others) reacted against it. They argued that the as then development, threatened to annihilate what they saw as the progress made in the fields of cognitive science and psychology by the classic approach of computationalism. Computationalism is a specific form of cognitivism that supportsThe mental activity is computational, that is that the mind functions performing purely formal operations on the symbols, as a machine held. Some researchers claimed that the trend of connecticism represented a reversion towards the association and abandonment of the idea of a thought language, something they saw incorrectly. On the contrary, those very trends have made connection attractive for other researchers. The connection and compliciceism should not disagree, but the debate at the end of the 1980s and at the beginning of the 1990s led to the opposition between the two approaches. In all the debate, some researchers claimed that connection and computationalism are fully compatible, even if the complete consent on this problem has not been achieved. The differences between the two approaches include the following: Computationalists posed symbolic models structurally similar to the structure of the brain below, while the connections are committed to a "low level" modeling, trying to ensure that their models resemble neurological structures. Computationalists in general concentrates on the structure of explicit symbols (mental models) and syntactic rules for their internal manipulation, while connections focus on learning from environmental stimuli and preserving this information in a form of connections between neurons. Computationalists believe that internal mental activity consists in the manipulation of explicit symbols, while connections believe that the manipulation of explicit symbols provide a poor model of mental activity. Computationalists Posit Posit Posit Domain Symbol Systems Systems designed to support learning in specific cognition areas (for example, language, intentional, number), while connections position one or a small set of very general learning mechanisms. Despite these differences, some theorists have proposed that the architecture of the connection is simply the way the organic brain is to implement the symbol manipulation system. This is logically possible, since it is well known that the connection models can implement the type manipulation systems of the type used in computationalist models, [17] as they must be able whether they have to explain the human capacity to perform activity of Handling symbol. Several cognitive models have been proposed that combine both architecture of the symbol-manipulative and connection, in particular including the integrated link / symbolic cognitive architecture of Paul Smolensky / symbolic (ICS). [1] [18] But the debate rests if this symbol manipulation forms the foundation of cognition in general, so this is not a potential claim of complexionalism. Nevertheless, computational descriptions can useful high-level descriptions of logical knowledge, for example. The debate has been largely centred on logical arguments on whether connection networks could produce the syntactic structure observed in this type of reasoning. This was subsequently achieved, although using fast variable binding capacities outside thoseassumed in connection models. [17] [19] Part of the use of computational descriptions is that they are relatively easy to interpret, and therefore can be seen as contributing to our understanding of particular mental processes, while connection patterns are generally more opaque, to the extent that they can be described only in General Conditions (such as specifying the learning algorithm, number of units, etc.), or in unusedly low-level terms. In this sense, connection models can instigate and therefore provide evidence for, a broad theory of cognition (I.e., Connectionism), without representing a useful theory of the particular process that is modeled. In this sense, the debate could be considered waiting to reflect a simple difference in the level of analysis in which particular theories are framed. Some researchers suggest that the analysis gap is the consequence of the link mechanisms that give rise to emerging phenomena that can be described in computational terms. [20] The recent [when?] Popularity of dynamic systems in mind philosophy has added a new perspective on debate; Some authors [what?] Now they argue that any division between connectionism and computationalism is more conclusively characterized as a division between computationalism and dynamic systems. In 2014, Alex Graves and others of Deepmind published a series of documents that describe a new deep neural structure called the neural machine [21] that can read symbols on a tape and store symbols in memory. Relationship networks, another deep network module published by Deepmind, are able to create representations similar to objects and manipulate them to answer complex questions. The relational networks and neural machines of Turing are further evidence that the connection and computationalism should not be in disagreement. See also Association Artificial Intelligence Association catastrophic behavior Interference Calculation of relationships Cybernetics Eliminative Materials Materialism Feature Integration Theory Harmonic Grammatic Machine Learning Pandemonium Auto-Organization Map Notes map ^ a b c d Garson, James (27 November 2018). Zalta, Edward N. (ed.). Stanford's encyclopedia of philosophy. Research laboratory of metaphysics, University of Stanford - Stanford Street Encyclopedia of Philosophy. ^ a b Smolensky, Paul (1999). "Connectionist based on grammar approaches the language" (PDF). Cognitive science. 23 (4): 589 â € "613. DOI: 10.1207 / S15516709Cog2304_9. ^ a b Marcus, Gary F. (2001). The algebraic mind: by integrating the connection and cognitive science (learning, development and conceptual change). Cambridge, Massachusetts: MIT Press. pp.Â7 28. 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