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Neural Network Learning Paradigm with Applications

An Artificial Neural Network (ANN) is an information processing paradigm that is inspired by the way biological nervous systems, such as the brain, process information. The key element of this paradigm is the novel structure of the information processing system. It is composed of a large number of highly interconnected processing elements (neurons) working in unison to solve specific problems. ANNs, like people, learn by example. An ANN is configured for a specific application, such as pattern recognition or data classification, through a learning process. Learning in biological systems involves adjustments to the synaptic connections that exist between the neurons. This is true of ANNs as well.

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•(NN) neural network usually called •(Artificial Neural Network (ANN) An that is inspired by the computational model or mathematical model is a A neural biological neural networks structure and/or functional aspects of and it •artificial neurons network consists of an interconnected group of In most computation approach to connectionist processes information using a that changes its structure based on adaptive system cases an ANN is an external or internal information that flows through the network during the data modeling statistical non-linear learning phase. Modern neural networks are tools. They are usually used to model complex relationships between inputs ۳ .in data find patterns and outputs or to find pattern in data.

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- **Neural networks are not magic hammers.** Neural networks are still viewed by many as being magic hammers that can solve any machine learning problem, and as a result people tend to apply them indiscriminately to problems for which they are not well suited.

Neural networks are too much of a black box. This makes them difficult to train; the training outcome can be nondeterministic and depend crucially on the choice of initial parameters, e.g. the starting point for gradient descent when training back propagation networks; and their opaque nature makes it very hard to determine how they are solving a problem.

Neural networks are not probabilistic. For the most part, NNs have few if any probabilistic underpinnings, unlike their more statistical or Bayesian counterparts in the more general field of machine learning. It's incredibly useful to know how confident your classifier is about its answers, because that information allows you to better manage the cost of making errors. A neural network might give you a continuous number as its output (e.g. a score) but translating that into a probability is hard. Approaches with stronger theoretical foundations tend to give you those probabilities directly.

Neural networks are not a substitute for understanding your problem. Rather than using a neural net, you're almost always better off investing a little extra time studying, analyzing and dissecting your data first, then choosing some better grounded technique that you know will work well for your problem. For example, if you are building a classifier, rather than just throwing a neural network at your data and hoping for the best, spend time visualizing your dataset and selecting or creating the best input features using whatever domain-specific knowledge and expertise you have available to you. You might discover that you can clearly differentiate between your training classes using just three out of your original ten features, or that you need to develop a more sophisticated nonlinear derived feature to better separate your classes. Ultimately for example, you might end up using a Gaussian mixture model (GMM) to directly model the density function of your classes, which will allow you to use Bayes theorem to deduce class probabilities and give you a far better classifier than you could ever build using a neural network.

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