Chapter 1 : Competitive learning - Wikipedia

The concept that we wish to investigate is the one of compound learning, that is the fact that, in a complex environment, what and how much economic entities learn depends upon what has been learnt in other entities in an interactive fashion.

History[edit] Warren McCulloch and Walter Pitts [3] created a computational model for neural networks based on mathematics and algorithms called threshold logic. This model paved the way for neural network research to split into two approaches. One approach focused on biological processes in the brain while the other focused on the application of neural networks to artificial intelligence. This work led to work on nerve networks and their link to finite automata. Hebb [5] created a learning hypothesis based on the mechanism of neural plasticity that became known as Hebbian learning. Hebbian learning is unsupervised learning. This evolved into models for long term potentiation. Farley and Clark [6] first used computational machines, then called "calculators", to simulate a Hebbian network. Other neural network computational machines were created by Rochester , Holland, Habit and Duda With mathematical notation, Rosenblatt described circuitry not in the basic perceptron, such as the exclusive-or circuit that could not be processed by neural networks at the time. The first was that basic perceptrons were incapable of processing the exclusive-or circuit. Neural network research slowed until computers achieved far greater processing power. Much of artificial intelligence had focused on high-level symbolic models that are processed by using algorithms , characterized for example by expert systems with knowledge embodied in if-then rules, until in the late s research expanded to low-level sub-symbolic machine learning , characterized by knowledge embodied in the parameters of a cognitive model. Backpropagation distributed the error term back up through the layers, by modifying the weights at each node. Rumelhart and McClelland described the use of connectionism to simulate neural processes. However, using neural networks transformed some domains, such as the prediction of protein structures. To overcome this problem, Schmidhuber adopted a multi-level hierarchy of networks pre-trained one level at a time by unsupervised learning and fine-tuned by backpropagation. Once sufficiently many layers have been learned, the deep architecture may be used as a generative model by reproducing the data when sampling down the model an "ancestral pass" from the top level feature activations. Neural networks were deployed on a large scale, particularly in image and visual recognition problems. This became known as " deep learning ". Nanodevices [30] for very large scale principal components analyses and convolution may create a new class of neural computing because they are fundamentally analog rather than digital even though the first implementations may use digital devices. Their neural networks were the first pattern recognizers to achieve human-competitive or even superhuman performance [41] on benchmarks such as traffic sign recognition IJCNN , or the MNIST handwritten digits problem. Researchers demonstrated that deep neural networks interfaced to a hidden Markov model with context-dependent states that define the neural network output layer can drastically reduce errors in large-vocabulary speech recognition tasks such as voice search. Deep, highly nonlinear neural architectures similar to the neocognitron [44] and the "standard architecture of vision", [45] inspired by simple and complex cells , were pre-trained by unsupervised methods by Hinton. Learning is usually done without unsupervised pre-training. In the convolutional layer, there are filters that are convolved with the input. Each filter is equivalent to a weights vector that has to be trained. Such supervised deep learning methods were the first to achieve human-competitive performance on certain tasks. Please help us clarify the section. There might be a discussion about this on the talk page. April Learn how and when to remove this template message Neuron and myelinated axon, with signal flow from inputs at dendrites to outputs at axon terminals An artificial neural network is a network of simple elements called artificial neurons , which receive input, change their internal state activation according to that input, and produce output depending on the input and activation. An artificial neuron mimics the working of a biophysical neuron with inputs and outputs, but is not a biological neuron model. The network forms by connecting the output of

certain neurons to the input of other neurons forming a directed , weighted graph. The weights as well as the functions that compute the activation can be modified by a process called learning which is governed by a learning rule.

Chapter 2 : EconPapers: Compound Learning, Neural Nets And The Competitive Process

In this paper we try to assess the potential application of neural networks as a modelling tool for complex evolutionary processes. The concept that we wish to investigate is the one of compound.

Neural networks are especially well suited to perform pattern recognition to identify and classify objects or signals in speech, vision, and control systems. They can also be used for performing time-series prediction and modeling. Here are just a few examples of how neural networks are used: Power companies accurately forecast the load on their electric grids to ensure reliability and optimize efficiency of the power generators they operate. ATMs reliably accept bank deposits by reading the account number and deposit amount on your check. Pathologists rely on cancer detection applications to guide them in classifying tumors as benign or malignant, based on uniformity of cell size, clump thickness, mitosis, and other factors. Deep Learning Overview Deep Learning Neural networks that operate on two or three layers of connected neuron layers are known as shallow neural networks. Deep learning networks can have many layers, even hundreds. Both are machine learning techniques that learn directly from input data. Deep learning is getting lots of attention, and for good reason. Deep learning is especially well suited to complex identification applications such as face recognition, text translation, and voice recognition. Introduction to Deep Learning: A neural network combines several processing layers, using simple elements operating in parallel and inspired by biological nervous systems. It consists of an input layer, one or more hidden layers, and an output layer. The layers are interconnected via nodes, or neurons, with each layer using the output of the previous layer as its input. Typical neural network architecture. Techniques Used with Neural Networks Common machine learning techniques for designing neural network applications include supervised and unsupervised learning, classification, regression, pattern recognition, and clustering. Supervised Learning Supervised neural networks are trained to produce desired outputs in response to sample inputs, making them particularly well suited for modeling and controlling dynamic systems, classifying noisy data, and predicting future events. Regression Regression models describe the relationship between a response output variable and one or more predictor input variables. Pattern Recognition Pattern recognition is an important component of neural network applications in computer vision, radar processing, speech recognition, and text classification. It works by classifying input data into objects or classes based on key features, using either supervised or unsupervised classification. For example, in computer vision, supervised pattern recognition techniques are used for optical character recognition OCR , face detection, face recognition, object detection, and object classification. In image processing and computer vision, unsupervised pattern recognition techniques are used for object detection and image segmentation. Unsupervised Learning Unsupervised neural networks are trained by letting the neural network continually adjust itself to new inputs. They are used to draw inferences from data sets consisting of input data without labeled responses. You can use them to discover natural distributions, categories, and category relationships within data. Deep Learning Toolbox includes two types unsupervised networks: Clustering Clustering is an unsupervised learning approach in which neural networks can be used for exploratory data analysis to find hidden patterns or groupings in data. This process involves grouping data by similarity. Applications for cluster analysis include gene sequence analysis, market research, and object recognition. Get started quickly, create and visualize models, and deploy models to servers and embedded devices. MATLAB automates deploying your neural network models on enterprise systems, clusters, clouds, and embedded devices.

Chapter 3 : Artificial neural network - Wikipedia

Compound Learning, Neural Nets And The Competitive Process. Mario Calderini and John Metcalfe. Economics of Innovation and New Technology, , vol. 7, issue 4,

Taming your neural networks: Data Science Share this post: Businesses today are eager to harness machine learning and deep learning for competitive advantageâ€"yet few businesspeople realize that building a machine learning model or neural network is a marathon, not a sprint. Making the right choice among various flavors of recurrent, convolutional, or other network types can be crucial to achieving the right outcome, and some degree of trial-and-error is necessary for even an experienced data scientist to pick the best option. Selecting the right type of model or neural network is only the first step, thoughâ€"in practice, every machine learning problem is unique, and requires a uniquely customized model. Deep learning models, for example, can be composed of any number of layers, and each layer will have multiple settings known as hyperparameters that need to be adjusted to produce the best output. Models also tend to evolve over timeâ€"and the process of evolution tends towards sophistication, not simplicity. As an example, this blog visualizes how the convolutional neural networks used in state-of-the-art image recognition have grown in complexity over the past 15 years. By contrast, since they are generally under pressure from the business to get results quickly, commercial data scientists often need to balance quality and sophistication with expediency and speed to market. You try different combinations of layers and parameters, you start training several different models, you kill off the least promising candidates, and then you iterate on the best ones, until you find what seems to be the best available combination of layers and hyperparameters to deliver the results you need. In a typical machine learning workflow, the experimentation process is time-consuming and normally conducted overnight in batches of training runs. With 30 to 50 batches being executed to find an optimal model that meets the business requirements, the entire workflowâ€"from initial data exploration through to model deploymentâ€"can produce s of model variations over three to four months. Models need to keep evolving to remain relevant, and must be redesigned, retrained and redeployed regularly to maintain competitive advantage. Streamlining an iterative process As we have seen, model training is an inherently time-consuming processâ€"but there are several approaches that you can take to optimize it: Access elastic compute resources in the cloud to perform batch training overnight and focus daytime hours on analysis and planning. With hundreds of training runs to manage, track the hyperparameters and network configurations explored to avoid duplicating efforts. IBM Watson Data Platform aims to help with all three of these goals by enriching and streamlining the tooling that data scientists use to design, train, evaluate and deploy their models. Instead of using a disjointed set of different technologies to build, train and document your models, you can take advantage of a single, coherent ecosystem of well-integrated tools. For example, IBM Watson Machine Learning enables you to create an updated version of a model, set its hyperparameters, and initiate the training process in just a few mouse-clicks. All the settings and results will be saved and stored together with the model, so it will be easy to compare performance between iterations and select the best candidate for production deployment. Encouraging experimentation Critically, the solutions that we are building within IBM Watson Machine Learning are designed to encourage a more experiment-centric approach to model development. As a result, it should be possible to develop better models in less time, and to continuously monitor, evaluate and retrain them to evolve with the business problems that they are designed to solve. To learn more about the latest features and our roadmap for the future, please click here to visit our website.

Chapter 4 : Artificial Neural Network Learning and Adaptation

In this paper we try to assess the potential application of neural networks as a modelling tool for complex evolutionary processes. The concept that we wish to investigate is the one of compound learning, that is the fact that, in a complex environment, what and how much economic entities learn.

As stated earlier, ANN is completely inspired by the way biological nervous system, i. The most impressive characteristic of the human brain is to learn, hence the same feature is acquired by ANN. Basically, learning means to do and adapt the change in itself as and when there is a change in environment. ANN is a complex system or more precisely we can say that it is a complex adaptive system, which can change its internal structure based on the information passing through it. Why Is It important? Classification It may be defined as the process of learning to distinguish the data of samples into different classes by finding common features between the samples of the same classes. For example, to perform training of ANN, we have some training samples with unique features, and to perform its testing we have some testing samples with other unique features. Classification is an example of supervised learning. Hence, a method is required with the help of which the weights can be modified. These methods are called Learning rules, which are simply algorithms or equations. It is a kind of feed-forward, unsupervised learning. If there is any difference found, then a change must be made to the weights of connection. It is kind of supervised learning algorithm with having continuous activation function. Delta rule updates the synaptic weights so as to minimize the net input to the output unit and the target value. The connections between outputs are inhibitory type, shown by dotted lines, which means the competitors never support themselves. Hence, the main concept is that during training, the output unit with the highest activation to a given input pattern, will be declared the winner. This rule is also called Winner-takes-all because only the winning neuron is updated and the rest of the neurons are left unchanged. This clearly shows that we are favoring the winning neuron by adjusting its weight and if there is a neuron loss, then we need not bother to re-adjust its weight. Outstar Learning Rule This rule, introduced by Grossberg, is concerned with supervised learning because the desired outputs are known. It is also called Grossberg learning. It is specially designed to produce a desired output d of the layer of p neurons.

Chapter 5 : Compound Learning, Neural Nets And The Competitive Process

In April Manchester eScholar was replaced by the University of Manchester's new Research Information Management System, Pure. In the autumn the University's research outputs will be available to search and browse via a new Research Portal.

Chapter 6 : What Is a Neural Network? - MATLAB & Simulink

In this paper we try to assess the potential application of neural networks as a modelling tool for complex evolutionary processes. The concept that we wish to investigate is the one of compound learning, that is the fact that, in a complex environment, what and how much economic entities learn depends upon what has been learnt in other entities in an interactive fashion.

Chapter 7 : EconPapers: Search

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