

Development Environment for Adaptive Systems

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Abstract

Adaptive systems constitute an emerging interdisciplinary field that deals with distributed, nonlinear systems. They complement present engineering design principles and are suitable to interface directly with the real world. When applied correctly, such systems can considerably outperform more traditional methods. Adaptive systems can be applied in many important engineering applications, such as signal enhancement, noise cancellation, classification of input patterns, system identification, prediction, and control. The main characteristic of adaptive systems is their ability to dynamically construct a model. Instead of being built a priori from a pre-existing model, adaptive systems use external data to automatically set their parameters. In doing so their generic parametric structure becomes not only a computational model but also a model for the physical system. The non-linear nature of adaptive systems such as neural networks gives the system designer the power of modeling very complex phenomena. It can be shown that neural networks are universal function approximators. In theory they can with an arbitrary accuracy approximate any function. Furthermore adaptive systems have strong generalization capabilities. Due to these appealing features it is easy to make the mistake of believing that they are complete black-box systems that can without any effort map any input-output relationship. In reality however the problem of defining a good model is moved from writing equations to making an efficient systems design and most importantly to choose and pre-process the right data. This can be accomplished by knowing how the different types of adaptive systems train and operate, or by using software that incorporates that knowledge. In this article we will look at the second approach and look at an integrated development environment, called *Synapse*, which is currently being developed by Peltarion. It fully encapsulates the whole development process, from the initial data mining to the final deployment of the designed system.