

Medical Multivariate Signal Reconstruction using Recurrent Artificial Neural Network

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This work proposes a method for reconstruction of multivariate signals with missing parts of the data. The proposal consists in employing an artificial neural network (ANN), specifically recurrent multilayer perceptron (RMLP), to restore the missing intervals of the multivariate signals. In RMLP network, every neuron receives inputs from every other neuron in the network.

In this approach, a RMLP was trained for each multivariate signal in dataset. The network input patterns consist of a number of attributes which is number of channels available, except for the channel with missing data. At each discrete time sample RMLP has input patterns and one desired output that is the channel with missing data. For that channel with missing data, the input pattern contribution is the previous output from RMLP. The time variable ranges from the beginning to just before the missing data. Each pattern is presented to ANN more than once, as an iteration process. After training, this ANN is used to predict the missing values, with time within the missing part of the signal.

The training was done in several situations, varying the number of iterations for training and the learning rate. Looking at results obtained from testing dataset, in general, optimal results were observed for good quality signals. On the other hand, signals which most of the channels are low quality, with low SNR, it was observed that when missing data channel had a moderate quality, the reconstruction was still good. However, if missing data channel was noisy, the reconstruction, in general, was not good. This could be explained by the fact that ANN is strongly dependent on the desired output channel, getting to learn with certain efficiency even when some of the inputs are noisy.