

Abstract, extended

The analysis of radio frequency transmission channels is of great interest in the field of communication technology since its physical properties determine the transmissible amount of information.

To use channel capacity at its best it is necessary to adapt each transmitting and receiving device to these properties that include echos, attenuation, interferences and many more.

Upon the so called channel state information (CSI) the devices equalize received signals, adapt transmit power, receiving gain, the modulation scheme and so on. Further the CSI can be used to derive information on the state of the environment namely its spatial dimensions and to a certain degree its constituents. Since RF frequencies used in consumer communication systems (CS) are way lower than the frequencies of light or similar, the degree of resolution is also way lower.

This is because CS RF behave differently in terms of reflections and scattering in different materials. For example biological matter is nearly transparent to those frequencies, while light spectrum RF gets reflected and scattered to a great extend. Also the captured noise, i.e. other sources signals, introduces lots of difficulties.

Nevertheless certain effects also occur in the CS RF spectra, but the resulting imagery is only partly analyzable with analytical models and thus in the early past machine learning gets applied more and more due to its ability to find highly nonlinear dependencies and structures in any sort of data.

In this paper we present introductory experiments and thoughts in how to apply certain neural networks, multilayer perceptrons (MLP) and convolutional neural networks (CNN), to this exciting field of research.

We build up on topics including digital signal processing, communication systems and deep learning to perform a step by step introduction from the basics of signals and systems theory to the advanced field of autoencoders used to extract features of ideal channel transfer functions.