Electrocardiography (ECG or EKG) is a simple, painless and noninvasive medical procedure, which measures the electrical activity of the heart over a period of time, by placing a number of metal electrodes on the skin in specific locations. These electrodes, which are connected to a device called electrocardiograph, are able to detect the tiny electrical impulses that the heart produces in order to trigger its contraction. The ECG signals are sent to the electrocardiograph, they are processed and they are displayed on a voltage-time graph, known as electrocardiogram.

An ECG lead is the tracing of the electrical difference between two points: a pair of electrodes of opposite polarity (bipolar lead) or of one positive electrode and a reference point (unipolar lead). Each lead is a different point of view of the same electrical stimulus, so they should not be analyzed separately, but as a whole. The standard ECG has 12 leads that are derived from 10 electrodes: 6 limb leads from 4 electrodes placed on the arms and the legs of the patient and 6 precordial or chest leads from 6 electrodes placed on the torso. The limb leads, which are divined in standard and augmented, belong to bipolar leads, while the chest leads are unipolar.

The ECG process is the most common and useful diagnostic test used by doctors in order to check the condition of the heart. After the procedure, the doctor compares the exported electrocardiogram to a typical, normal ECG in order to get as much information as possible for the status of the heart. An ECG, if it’s held properly and on time, can detect irregular heart rhythms, underlying cardiac disorders, prior or evolving heart attacks, impairments to blood flow to the heart, adverse effects on the heart from various systemic diseases, such as thyroid, or from certain lung conditions, such as emphysema, and congenital heart abnormalities. Consequently, an ECG could be held both as a part of yearly medical examination for prudential reasons and in case that there are symptoms of irregular heartbeats or chest pain. Moreover, it is suggested to individuals with family history of heart diseases.

Over the last years, a part of the research has focused on detection and classification of ECG signals using artificial neural networks, as they process information in the same way as the human brain does or, even better, they are able to extract patterns and features, which are so complicated to be recognized by humans. Although classification of ECG signals is proved to be a challenging problem due to the dissimilarity of ECG features, this technique turns out to be a substantial contribution to the confirmation of the diagnosis.

More specifically, ECG signals may contain noise, which can be removed by using a denoising autoencoder, an artificial neural network that is trained to recover the undistorted input and keep only the important information of a feature. Afterwards, a convolutional neural network seems to be useful. Convolutional neural networks (CNNs) belong to deep, feed-forward artificial neural networks and have been utilized in computer vision since the early 21th century. In contrast with the classic neural networks, CNN has the property to reduce the size of the input, so that multilayer perceptons can be safely applied. As a result, CNNs can handle with large arrays of data. Furthermore, it is proved that CNNs lead to a great success rate in the medical field, approaching a percentage of 95%.