

# ECG Arrhythmia Classification based on Convolutional Autoencoders and Transfer Learning

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## ABSTRACT:

An Electrocardiogram (ECG) is a test that is done with the objective of monitoring the heart's rhythm and electrical activity. It is conducted by attaching a specific type of sensor to the subject's skin to detect the signals generated by the heartbeats. These signals can reveal significant information about the wellness of the subjects' heart state, and cardiologists use them to detect abnormalities. Due to the prevalence of heart diseases amongst individuals around the globe, there is an urgent need to design computer-aided approaches to automatically analyze ECG signals. Recently, computer vision-based techniques have demonstrated remarkable performance in medical image analysis in a variety of applications and use cases. This paper proposes an approach based on Convolutional Autoencoders (CAEs) and Transfer Learning (TL). Our approach is an ensemble way of learning, the most useful features from both the signal itself, which is the input of the CAE, and the spectrogram version of the same signal, which is fed to a convolutional feature extractor named MobileNetV1. Based on the experiments conducted on a dataset collected from 3 well-known hospitals in Baghdad, Iraq, the proposed method claims good performance in classifying four types of problems in the ECG signals. Achieving an accuracy of 97.3% proves that our approach can be remarkably fruitful in situations where access to expert human resources is scarce.

**KEYWORDS:** Electrocardiogram (ECG), Deep Learning, Transfer Learning, Convolutional AutoEncoders, EfficientNet, Heart Arrhythmia Classification.

## 1. INTRODUCTION

ECG is a two-dimensional plane that continually displays the electrical activity of the human heart (Electrocardiogram) [1]. Analyzing this impulse provides a range of physiological data to examine

cardiac activity [2]. Heart-related illnesses are serious issues for people around the globe. Obesity, diabetes, smoking, drinking alcoholic beverages, and other modern lifestyle choices are the primary causes of heart-related illnesses [3]. A variety of causes might impact a