# CLASSIFICATION OF CARDIOVASCULAR DISEASES BASED ON ECHOCARDIOGRAM DATA

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**Annotation**

In particular, the aim of the thesis is to learn common algorithms used in machine learning and review selected applications in cardiovascular medicine.

## Introduction

Artificial intelligence and machine learning are making an positive influence nearly every aspect of the human diseases, and cardiology is not an exception to this trend. Nowadays cardiovascular diseases (CVDs) are the main reason of mortality around the world. According to the World Health Organization, CVDs claim the lives of around 17.9 million people each year, accounting for an estimated 31 per cent of all fatalities globally. 85 per cent of these deaths result from a heart attack or a stroke. People with cardiovascular disease or at high cardiovascular risk require early identification and quick prevention because it only takes seconds to avert mortality. In modern life , technical advancements in Artificial Intelligence have pushed the use of algorithms in medical activities such as prevention, diagnosis, risk assessment, and therapy selection.

Artificial Intelligence makes it possible to monitor people with heart diseases and detects signs of severe heart failure or cardiac arrest. Researchers have proposed using a deep-learning algorithm to analyse electrocardiography (ECG) recordings and make early detection of possible heart failure most likely. This algorithm was

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able to predict the cardiac history of patients, detect the difference between arrhythmia and a normal heartbeat onset, and predict the risk of the onset of chronic heart failure.

Neural networks are machine learning models inspired by the organization of the human brain. The earliest application of neural networks in cardiology dates to at least 1995. Deep learning is a powerful method premised on learning complex hierarchical representations from the data that constitute multiple levels of abstraction. Clinicians should understand that deep learning models are quickly becoming the state-of-the-art method and will enable the coming future applications of AI. In contrast to other technological fields, deep learning in health care is still developing, and its applications thus far to cardiology are rather limited. The earliest commercial applications of deep learning were for computer vision, or the computational analysis of images. Similarly, many of the initial biomedical applications of AI have been in the domain of image processing. For example, Gulshan et al. harnessed a CNN to detect diabetic retinopathy from a database of 128,00 retinal images. These investigators obtained a sensitivity of 97.5% and specificity of 96.1% when compared with a gold standard classification by 7 to 8 ophthalmologists. Esteva et al. used a CNN on 129,000 of dermatological lesions to classify whether the lesion was a benign seborrheic keratosis versus a keratinocyte carcinoma or a benign nevus versus a malignant melanoma. This group found that their CNN performed about as well as a panel of 21 board-certified dermatologists. Importantly, these 2 papers demonstrate an important drawback of deep learning: it takes an enormous amount of data to train a deep learning model because of the vast number of parameters that must be estimated. The expense and difficulty of acquiring biomedical data compared with other fields are limiting factors for the application of AI in some circumstances.

Despite its nascence, deep learning applied to the domain of cardiology shows great potential. For example, in 2016, citizen-scie ntists participated in the Second Annual Kaggle Data Science Bowl, “Transforming How We Diagnose Heart Disease.” The bowl challenged scientists to create a method to measure end-systolic and end-diastolic volumes in cardiac magnetic resonance images from more than 1,000 patients automatically. The top performing team had no prior background in medicine. In fact, they were data scientists who worked for a financial institution. In addition, at the beginning of 2016, the first paper was published applying CNNs for electrocardiographic anomaly detection . The method consisted of a 2-stage learning process, first finding an appropriate feature representation per patient and then using the first learned features for anomaly detection at later time points for the same patient.

## Conclusion

Artificial Intelligence is transforming the way cardiologists diagnose and treat patients. It offers new opportunities for early detection and risk assessments and helps physicians select the best treatment for their patients. AI algorithms can detect adverse events, track cardiac events in real-time, and monitor patients in their homes without the need for frequent physician visits.

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