

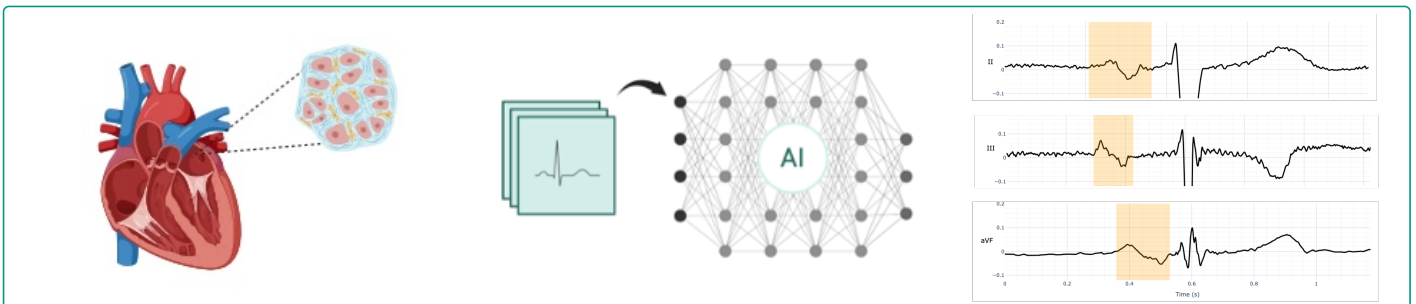
# Improving AI-based Amplified P-wave Morphology Detection

## Bachelor Thesis

### Motivation

Atrial cardiomyopathy (AtCM) is associated with slow-conducting low-voltage areas and therefore prolonged total atrial conduction time. Jadidi et al. demonstrated that total atrial conduction time correlates with amplified P-wave (APW) duration. Furthermore, APW morphology has been demonstrated to assist in staging AtCM. These findings suggest that APW duration and morphology measured in a 12-lead-ECG enables the non-invasive diagnosis of AtCM.

Despite its diagnostic value, manual annotation of APW morphology is time-consuming, subjective, and not scalable, rendering it impractical for large-scale screening or retrospective cohort studies. To overcome these limitations, we aim to develop an automated, AI-based algorithm that can annotate APW morphology reliably and reproducibly.



### Student Project

The research questions we aim to answer are: *Can an AI-based algorithm detect and classify amplified P-wave morphology from ECG signals more accurately than a rule-based approach? Can APW morphology in addition to APW duration contribute to the diagnosis and risk stratification of atrial cardiomyopathy?*

This project continues existing work on a **CNN-based model** for **multi-label classification**. P-wave morphology labels are: Biphasic P-wave in lead II, III, aVF, and late P.

The project will be structured in three stages:

1. **Dataset expansion & retraining:** the existing model will be retrained on an increased and cleaned dataset
2. **Architecture exploration:** model modifications and alternative architectures will be investigated and compared against a rule-based baseline
3. **Predictive Power Assessment:** the predictive power for AtCM will be analyzed in combination with an existing APW duration model

ECG data will be sourced from open datasets and the University Heart Center Freiburg - Bad Krozingen.

### Notes

The weighting of individual elements can be customized according to your preferences.

### Research Area

Machine Learning, ECG Analysis, Cardiac Research

### Course of Studies

BME, ETIT, Computer Science, Natural Sciences

### Contact Person

**Silvia Becker, M.Sc.**  
silvia.becker@kit.edu  
+49 721 608 - 45478



[www.ibt.kit.edu](http://www.ibt.kit.edu)

