

# ECG Time Series Analysis and Prediction: A Data-Driven Approach

C S Chandra Sekhar Azad

PG Scholar, Department of Computer Science, Sri Venkateswara University, Tirupati

**Abstract**— *Electrocardiography (ECG) serves as a vital diagnostic tool in cardiology, capturing the electrical activity of the heart over time. In this study, we analyze a univariate ECG time-series dataset with over 17,000 data points. By exploring patterns in the data using descriptive analytics and visualizations, we aim to identify trends, anomalies, and insights for potential predictive modeling. This paper elaborates on the methodology, data analysis, results, and implications for cardiovascular monitoring systems.*

## I. INTRODUCTION

Cardiovascular diseases are a leading cause of death worldwide, with ECG monitoring being pivotal for early detection and management. The ability to interpret ECG signals using computational tools has immense clinical value. This study aims to analyze a time-series ECG dataset to understand its statistical characteristics and visualize heartbeat dynamics over time.

## II. LITERATURE REVIEW

Recent advancements in time series analysis and deep learning have significantly impacted ECG signal interpretation. Traditional techniques like Fourier analysis have been complemented by modern approaches, including LSTM and CNN models, for real-time ECG classification. Previous studies have focused on noise filtering, peak detection, and arrhythmia classification. However, descriptive analytics also play a crucial role in initial exploration and model preprocessing.

## III. METHODOLOGY

1. **Data Collection:** A 1D ECG time-series dataset was obtained, formatted as time-value pairs.
2. **Preprocessing:** Parsed and split the combined string column into numerical time and ecg\_value columns.
3. **Exploratory Data Analysis (EDA):** Descriptive statistics and visualization of signal characteristics.
4. **Visualization:** Time series plot and statistical analysis to identify regularity and anomalies.

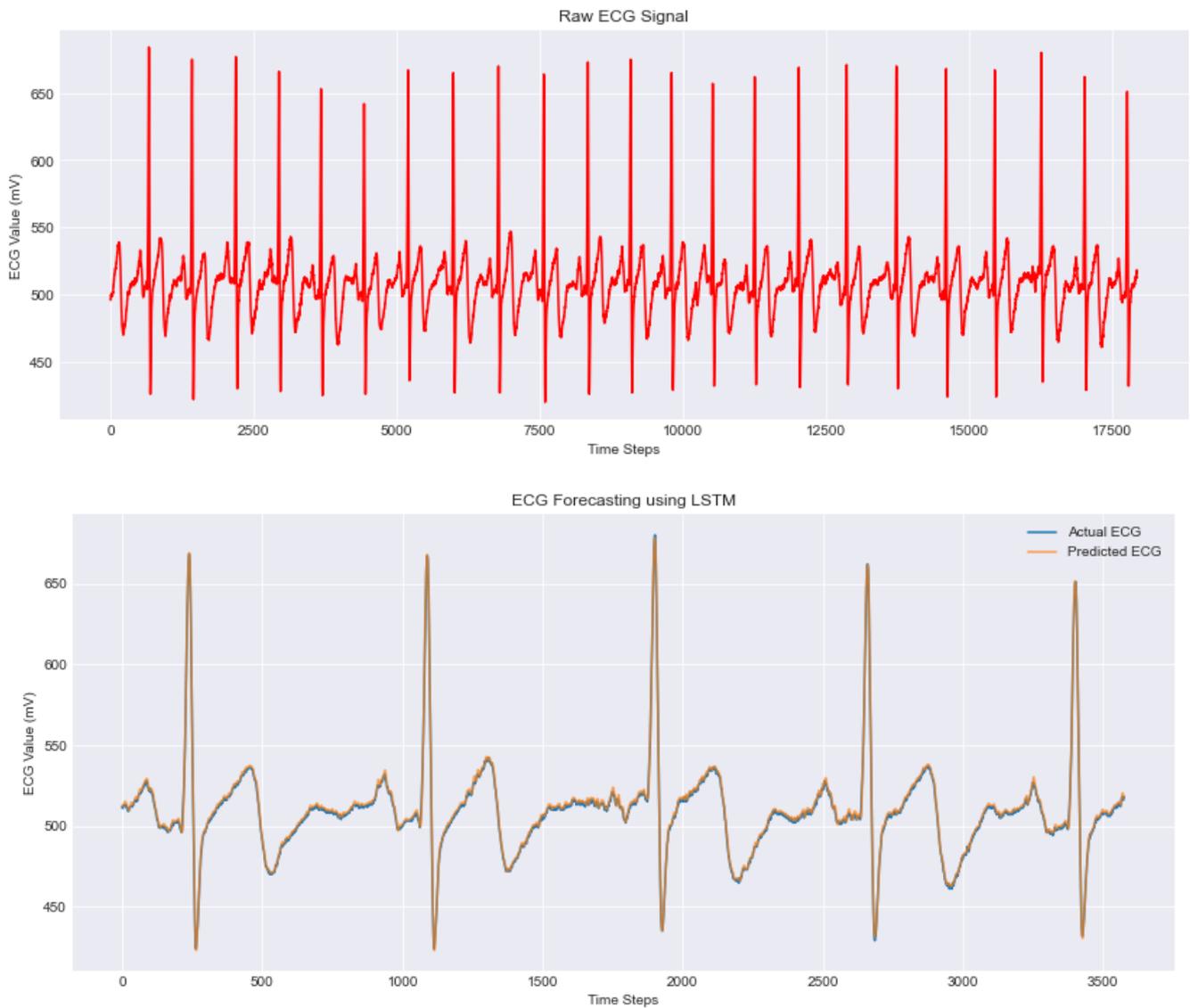
## IV. DATASET DESCRIPTION

- **Name:** ECG 1D Time Series Prediction Dataset
- **Size:** 17,935 entries
- **Features:**
  - time (float): Time in seconds
  - ecg\_value (int): Voltage reading corresponding to heart electrical activity

**Summary Statistics:**

Statistic	Time	ECG Value
Count	17935	17935
Mean	8.967 s	509.32 mV
Std Dev	5.18 s	28.96 mV
Min	0.000 s	420 mV
Max	17.934 s	684 mV

**V. RESULTS & DISCUSSION (PYTHON VISUALIZATIONS)**



The distribution resembles a Gaussian curve with a slight right skew, indicating some higher voltage values possibly representing anomalies or peaks.

**VI. CONCLUSION**

This study provides an in-depth exploratory analysis of ECG data using a 1D time-series dataset. The visualizations help in identifying heartbeat patterns and outliers, which could be foundational for advanced anomaly detection or real-time

monitoring systems. Future work could involve predictive modeling using LSTM or hybrid neural networks to forecast arrhythmias.

### REFERENCES

- [1] Acharya, U. R., Fujita, H., Lih, O. S., et al. (2017). "Automated detection of arrhythmias using different intervals of tachycardia ECG segments with convolutional neural network." *Information Sciences*, 405, 81–90.
- [2] Goldberger, A. L., et al. (2000). "PhysioBank, PhysioToolkit, and PhysioNet: Components of a New Research Resource for Complex Physiologic Signals." *Circulation*, 101(23), e215–e220.
- [3] Moody, G. B., & Mark, R. G. (2001). "The impact of the MIT-BIH Arrhythmia Database." *IEEE Engineering in Medicine and Biology Magazine*, 20(3), 45–50.