

# ML Medicine: Labwork Report

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## I. LABWORK 1: ECG HEARTBEAT

### A. Introduction

The dataset utilized is the **ECG Heartbeat Categorization Dataset**, a collection of heartbeat signals sampled at 125Hz. The study combines four CSV files, resulting in a total of 123,998 samples. Each sample contains 188 columns: 187 time-series features and one target label.

### B. Preprocessing and Methodology

To ensure a robust baseline, the following steps were taken:

- **Data Partitioning:** A `train_test_split` and `stratify` were used to maintain class distribution between sets.
- **Normalization:** We applied `StandardScaler` so the Logistic Regression model treats all 187 time-step features with equal weight.
- **Model Configuration:** Logistic Regression was implemented with `max_iter=1000` to allow model to find optimal weight.

### C. Results

The model achieved a total accuracy of **84.1%** but performance varied significantly across the five classes (0–4).

TABLE I  
MODEL PERFORMANCE PER CLASS

Class	Recall	F1-Score
Class 0 (Normal)	0.97	0.91
Class 1	0.19	0.29
Class 2	0.34	0.43
Class 3	0.29	0.39
Class 4	0.87	0.90

### D. Discussion

While Classes 0 and 4 show high F1-scores (0.91 and 0.90 respectively), Classes 1, 2, and 3 exhibit low recall (0.19, 0.34 and 0.29 respectively). This indicates that the model frequently misses specific abnormal heartbeats, a direct result of significant class imbalance within the dataset.

## II. LABWORK 2: ULTRASOUND

### A. Introduction

This labwork introduces a second project using an **ultrasound-derived tabular dataset** of pre-extracted image features. The prediction target is the image *pixel size (mm)* for each sample.

### B. Preprocessing and Methodology

- **Features and Target:** Numerical image-level features were used as predictors; the target variable is pixel size (mm).
- **Data Split:** The dataset was partitioned using an 80/20 train–test split
- **Modeling Approach:** LinearRegression is applied
- **Evaluation:** Mean Absolute Error (MAE) was selected

### C. Results

TABLE II  
ULTRASOUND — OUTLIER SUMMARY

Measure	Value
Number of outliers	63
MAE	0.02

### D. Discussion

Labwork 2 uses a linear regression model on ultrasound-derived features to predict pixel size in millimeters. The model achieves a low MAE of **0.02**, indicating that the predicted values are very close to the true measurements. However, **63** detected outliers highlights the importance of careful data preprocessing, as linear models can be sensitive to abnormal samples