# CNN-LSTM Based Model for ECG Arrhythmias and Myocardial Infarction Classification

Name :ANJALYKRISHNA A S
Batch:A
Roll No:22
Project Guide:Ms.Joice T

# OBJECTIVE

- Develop an automated system to classify ECG signals into Myocardial Infarction (MI), Abnormal Heartbeat, and Normal signals with high precision.
- Implement a 1D CNN-LSTM model to extract spatial features (CNN) and capture temporal patterns (LSTM) for comprehensive ECG signal analysis.
- Enhanced Medical Diagnostics Provide a reliable, scalable tool to assist cardiologists in detecting and monitoring heart conditions, reducing human error and improving diagnostic accuracy.

# EXISTING SYSTEM

- **Manual Diagnosis:**ECG analysis by cardiologists is time-consuming, error-prone, and depends on expert availability.

- **Limited Use of Advanced Models:** Many systems rely on traditional machine learning or basic Autoencoder models that may not capture complex ECG patterns effectively.

- **Single-Method Approaches**:Existing models use either CNNs or LSTMs, limiting comprehensive analysis of both spatial and temporal features.

- **Suboptimal Accuracy:** Existing methods may struggle to provide high precision and reliability, particularly for diverse arrhythmia types.
    I. Standalone CNN Models: ~88-94% (effective in feature extraction but lacks temporal understanding)
    II. Standalone LSTM Models**:** ~86-93% (captures temporal dependencies but may miss spatial features

# PROPOSED SYSTEM

- **Hybrid CNN-LSTM Approach**:

I. The proposed system integrates CNNs for spatial feature extraction

II. LSTMs for capturing temporal dependencies

providing a comprehensive analysis of both the structure and time-based changes in ECG signals.

- **High Accuracy:**CNN-LSTM method can improve the accuracy rates

I. 98.1% accuracy for Myocardial Infarction (MI) classification.

II. 98.66% accuracy for arrhythmia classification.

- **Real-Time Predictions**: The system enables real-time ECG signal analysis, allowing for immediate detection and classification of arrhythmias and myocardial infarction, facilitating timely medical intervention.

# SYSTEM DESIGN

## Data Processing Module

- Preprocess raw ECG data by handling missing values, normalizing amplitudes, and segmenting signals into uniform lengths.
- Extract key features like waveforms, peaks, and intervals, or format the data directly for model input.

## Training Module

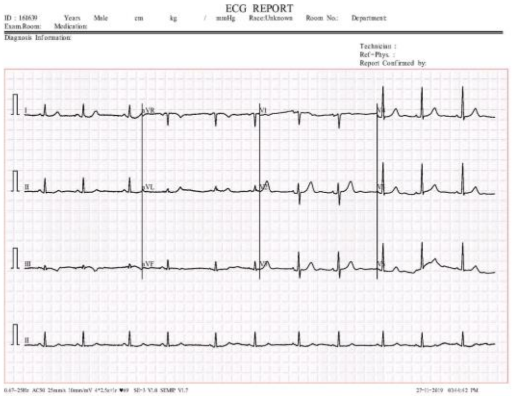
- Train the 1D CNN-LSTM model on ECG data for classifying conditions such as Myocardial Infarction, Abnormal Heartbeat, and Normal.
- Split data into balanced training and testing sets, using CNN for spatial feature extraction and LSTM for temporal dependencies

## Testing Module

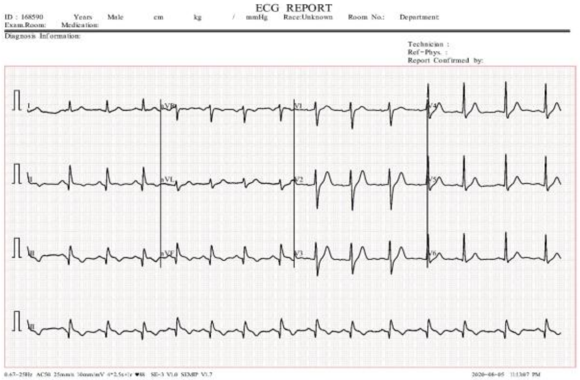
- Test the CNN-LSTM model on unseen ECG data and calculate performance metrics like accuracy, precision, recall, F1-score, and AUC-ROC.
- Analyze the confusion matrix to identify misclassified cases and refine the model as necessary.

## Classification Module

- Classify new ECG signals into one of three categories: Myocardial Infarction, Abnormal Heartbeat, or Normal.
- Input new ECG data into the trained model and output predictions in real time.




NORMAL




ABNORMAL


Myocardial Infarction

# TOOLS AND TECHNOLOGIES

**Programming Language:** Python

**Libraries:** NumPy, Pandas, Scikit-learn, Matplotlib, Seaborn, TensorFlow, Keras

**Algorithms:** 1D Convolutional Neural Networks (CNN), Long Short-Term Memory (LSTM)

**Deployment:** Flask or FastAPI for building the real-time ECG classification interface

**Dataset:** cardiovascular ECG Images dataset(Kaggle)

# REFERENCES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# THANK YOU