**Project Design Phase-I**

**Proposed Solution Template**

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| Date | 8 October 2022 |
| Team ID | PNT2022TMID41315 |
| Project Name | Classification of Arrhythmia by Using Deep Learning with 2-D ECG Spectral Image Representation |
| Maximum Marks | 2 Marks |

**Proposed Solution Template:**

Project team shall fill the following information in proposed solution template.

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| **S. No.** | **Parameter** | **Description** |
| 1. | Problem Statement (Problem to be solved) | ECG signals is crucial for precise diagnoses of patients' acute and chronic heart conditions. In this study, we propose a two-dimensional (2-D) convolutional neural network (CNN) model for the classification of ECG signals into eight classes; The one-dimensional ECG time series signals are transformed into 2-D spectrograms through short-time Fourier transform. Our proposed methodology is evaluated on a publicly available MIT-BIH arrhythmia dataset. We achieved a state-of-the-art average classification accuracy of 99.11\%, which is better than those of recently reported results in classifying similar types of arrhythmias. |
| 2. | Idea / Solution description | we propose a two-dimensional (2-D) convolutional neural network (CNN) model for the classification of ECG signals into eight classes;  The one-dimensional ECG time series signals are transformed into 2-D spectrograms through short-time Fourier transform. The 2-D CNN model consisting of four convolutional layers and four pooling layers is designed for extracting robust features from the input spectrograms. Our proposed methodology is evaluated on a publicly  available MIT-BIH arrhythmia dataset. We achieved a state-of-the-art average classification accuracy of 99.11%. The performance is significant in other indices as well, including sensitivity and specificity, which indicates the success of the proposed method. |
| 3. | Novelty / Uniqueness | We achieved a state-of-the-art average classification accuracy of 99.11%, which is better than those of recently reported results in classifying similar types of arrhythmias. |
| 4. | Social Impact / Customer Satisfaction | 1. Upgradeable Software  2. Works well with Unstructured Data  3. Better Self-Learning Capabilities  4. Supports Parallel and Distributed Algorithms.  5. Cost Effectiveness  6. Low cost maintenance |
| 5. | Business Model (Revenue Model) | Drivers of medical device growth -India  •Higher disposable incomes  •Increase in public spend on healthcare  •Increase in penetration of health insurance |
| 6. | Scalability of the Solution | In this study, we proposed a 2-D CNN-based classification model for automatic classification of cardiac arrhythmias using ECG signals. Deep CNN has proven useful in enhancing the accuracy of diagnosis algorithms in the fusion of medicine and modern machine learning technologies. Using 2-D images, can classify eight kinds of arrhythmia, namely, NOR, VFW, PVC, VEB, RBB, LBB, PAB, and APC, and it achieved 97.91% average sensitivity, 99.61% specificity, 99.11% average accuracy, and 98.59% positive predictive value (precision). The proposed scheme can help experts diagnose CVDs by referring to the automated classification of ECG signals. The present research uses only a single-lead ECG signal. |