Software Requirements and Specifications

**Project Name: WACM-Waveform Analysis for Classification via Machine learning**

**Aligned SDG: 9. Industry Innovation and Infrastructure**

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**Contents**

[1. Introduction 3](#_Toc141781869)

[1.1 Purpose and Intended Audience 3](#_Toc141781870)

[1.2 Project Scope 3](#_Toc141781871)

[1.3 Terms, Definitions, and Acronyms 4](#_Toc141781872)

[1.4 References 4](#_Toc141781873)

[2. Overall Description 4](#_Toc141781874)

[2.1 Product Perspective 4](#_Toc141781875)

[2.2 Product Features 4](#_Toc141781876)

[2.3 User Classes and Characteristics 5](#_Toc141781877)

[2.4 Operating Environment 6](#_Toc141781878)

[2.5 Design and Implementation Constraints 6](#_Toc141781879)

[2.6 Assumptions 6](#_Toc141781880)

[3. Specific Requirements 6](#_Toc141781881)

[3.1 Functional Requirements. 6](#_Toc141781882)

[3.2 Non-Functional Requirements 7](#_Toc141781883)

[3.3 External Interface Requirements 7](#_Toc141781884)

[3.3.1 User Interfaces 7](#_Toc141781885)

[3.3.2 Hardware Interfaces 7](#_Toc141781886)

[3.3.3 Software Interfaces 7](#_Toc141781887)

[3.3.4 Logical Database Requirements 8](#_Toc141781888)

**References**

# Introduction

The subsections under this section are a brief overview of the Software Requirements and Specifications (SRS) document for the application program titled “WACM – Waveform Analysis for Classification via Machine Learning”. The document highlights various tools, methodologies, techniques and approaches that have been used for the completion of the program.

## Purpose and Intended Audience

This document provides a software requirements specification (SRS) for above mentioned project. The purpose of waveform analysis for classification via Machine Learning is to leverage machine learning techniques to extract meaningful information from waveform data and use it to classify or categorize different patterns, events, or signals. The main objective is to automatically recognize and categorize various events or patterns within these waveforms, facilitating more accurate and efficient data analysis.

It is made with the intention of it being:

* A provision containing a brief overview of the application to individuals.
* A means of communication between the team members and the mentor.
* A documented assistance with frontend, backend, software design and quality control tasks.
* A document highlighting the validating system testing activities.
* A document that visualizes supporting Verification and Validation activities.

## Project Scope

Our project would have an innovative platform designed to empower individuals from diverse backgrounds to effectively analyze and classify waveform data using advanced machine learning techniques. Whether you're a student, professor, employee, employer, or any other professional, our project offers a unified solution to harness the power of waveform analysis for your specific needs.

* With the usage of this project, classification of waveform data becomes much simplified and can be used in various sectors such as Industrial Automation and its Health monitoring, Seismic and Geophysical Studies, Medical Signal Processing, Precision Agriculture and many more.

## Terms, Definitions, and Acronyms

This document is prepared according to the IEEE SRS Standards and uses technical terminology, different formats of text and abbreviations to provide clarity and distinction to its readability.

* **Bold** text refers to headings
* **SRS:** Software Requirement Specification
* **WACM:** Waveform Analysis for Classification via Machine Learning
* **Predictive analytics:** Predicting future outcomes can be added as a feature to our project, for example, Condition Monitoring of Automobile Engines, recognizing similar patterns in real-time arterial pressure waveforms providing early alerts for medical involvement.

## References

* IEEE Recommended Practice for Software Requirements Specifications by IEEE Computer Society (20 October 1998)
* [IEEEXplore-SRS-template.pdf](file:///C:\Users\hi\Downloads\IEEEXplore-SRS-template.pdf)

# Overall Description

## Project Perspective

* With the use of modern methods of machine learning, we hope to create an intelligent system in this project that can identify various signals according to their waveform characteristics. We want to build a robust model capable of precisely recognizing and classifying various signal types, such as audio, medical, or seismic signals, by extracting suitable characteristics from the waveforms and applying classification algorithms.
* The giveaway of this segment is that it uses Predictive Analytics to perform its main functionality, which is to help the user save a certain amount of money for a stipulated period of time, at the end of which he/she will end up with expected amount of savings.

Payment

Processing

## Project Features

This section discusses some of the features that define the many functionalities of the project. They are listed as:

* Consists an interactive user interface:
* The interfaces shall involve a Graphics User Interface, which contains
* Checkboxes
* Textboxes
* Pushbuttons
* The language of the User Interface will be English and English transcript to represent numerical figures.
* Users can input waveforms and receive classification results.
* Consists of visualization tools like Matplotlib, NetworkX, SciPy and NumPy libraries powered by Python to make the data easy to understand.
* Implementing real-time classification via a trained model which could be useful for applications like Anomaly Detection.
* Applying data augmentation techniques to increase the diversity of training a dataset and enhance model generalization.
* Any type of Personal Computer/ Laptop compatible with Python Libraries.

## User Classes and Characteristics

There are two main classes of users for the application program, while keeping in mind its expansion to an enterprise level.

1. Administrators: Administrators or admins can use the project to train and test different datasets to improve its accuracy and efficiency. They can also view reports and data of the users that are a part of their organization. The admin has all the functionalities of that of the user.

2. Users: Users are responsible for inputting their waveform data into the project. After processing, classified data will be shown.

## Operating Environment

The operating environment for this project would be a personal computer/desktop with internet access. The data classification project would need to be installed in the above devices. The application shall run with any OS compatible with Python.

## Design and Implementation Constraints

* Requires a well-fitted broadband/internet connection always.
* Interface is available only in English.
* Can operate and provide its functionalities solely on the waveform data provided by the user.
* Has compatibility restrictions wherein it is compatible only with OS supporting Python and its libraries.

## Assumptions

* Every user shall be having the appropriate hardware and software components as per the requirements.
* Every user shall provide only waveform data.

# Specific Requirements

The specific requirements for your project on Waveform Analysis for Classification via Machine Learning in Python will depend on the specific needs of user type of data.

## Functional Requirements.

Functional requirements for a project on Waveform Analysis for Classification via Machine Learning could include the following:

* The system should be able to read and analyze waveform data.
* The system should be able to classify the waveform data into different categories.
* The system should be able to identify patterns in the waveform data.
* The system should be able to predict future waveform data based on past data.
* The system should be able to provide visualizations of the waveform data.

## Non-Functional Requirements

Non-functional requirements for a project on Waveform Analysis for Classification via Machine Learning could include the following:

* The system should be able to handle large amounts of data.
* The system should be able to provide accurate results in real-time.
* The system should be able to handle different types of waveforms and data formats.
* The system should be able to work with different types of hardware and software supporting Python libraries.
* The system should be secure and reliable.

## External Interface Requirements

While keeping in mind the possibility of the application being enterprise-appropriate, each individual, belonging to either of the user classes, shall have a distinctive access to this platform, paired with unique IDs or user accounts to access. Other interfaces described below are:

### User Interfaces

\*Refer to section 2.2 Product Features\*

### Hardware Interfaces

\*Refer to section 2.2 Product Features\*

### Software Interfaces

There are various tools and techniques that shall be used for the creation of this project. The tools that will be using majorly are:

* Python 3 and a local programming environment set up on your computer.
* Jupyter Notebook or any python console.
* JAVA: to provide functionality to the user-interface
* Modules to be installed: Pandas, Scikit-learn, Librosa, SciPy and NumPy, Matplotlib/NetworkX, TensorFlow/pyTorch, Kaldi, OpenSmile.
* Audacity: A free and open-source digital audio editor and recording application software which has features like noise reduction.

### Logical Database Requirements

The database used in above project are: (examples)

* Microsoft Excel
* MySQL
* SQLite
* PostgreSQL
* MongoDB
* Amazon S3
* Big Query

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