Architecture Design

# CREDIT CARD DEFAULT PREDICTION

**Document Control**

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**Abstract**

Machine Learning is a category of algorithms that allows software applications to become more accurate in predicting outcomes without being explicitly programmed. The basic premise of machine learning is to build models and employ algorithms that can receive input data and use statistical analysis to predict an output while updating outputs as new data becomes available. These models can be applied in different areas and trained to match the

expectations of management so that accurate steps can be taken to achieve the

organization’s target. In this project, we will estimate the amount of insurance premium on the basis of personal health information. Taking various aspects of a dataset collected from people, and the methodology followed for building a predictive model.

# Introduction

## What is Architecture Design?

The goal of Architecture Design (AD) is to give the internal design of the actual program code for the ‘Health Insurance Premium Prediction’. AD describes the class diagrams with the methods and relation between classes and program specification. It describes the modules so that the programmer can directly code the program from the document.

## Scope

Architecture Design (AD) is a component-level design process that follows a step-by-step refinement process. This process can be used for designing data structures, required software, architecture, source code, and ultimately, performance algorithms. Overall, the data organization may be defined during requirement analysis and then refined during data design work. And the complete workflow.

## Constraints

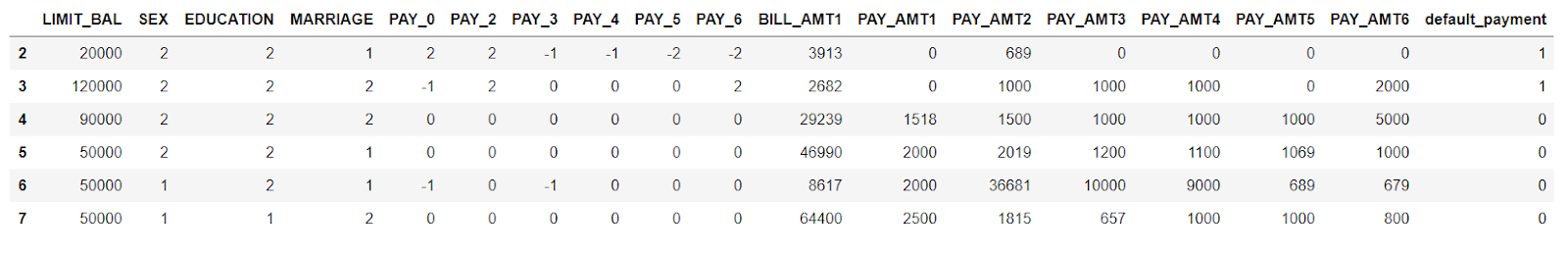
We predict the expected estimating cost of expenses customers based on some personal health information.

# Technical Specification

## DATA INJECTION

The dataset containing verified historical data, consisting of the aforementioned information and the Data of the Credit card default prediction is available on the Kaggle or UCI repository. The data contains 30000 instances with the following 25 attributes. The prediction task is to determine whether the person shall consider default in the credit card payment or not.

. The dataset looks like as follow:



Pre-processing of this dataset includes doing analysis on the independent variables like checking for null values in each column and then replacing them with supported appropriate data types so that analysis and model fitting is not hindered from their way to accuracy. Shown above are some of the representations obtained by using Pandas tools which tells about variable count for numerical columns and model values for categorical columns. Maximum and minimum values in numerical columns, along with their percentile values for median, plays an important factor in deciding which value to be chosen at priority for further exploration tasks and analysis. Data types of different columns are used further in label processing and a one-hot encoding scheme during the model building.

Data Description

Features:

0.           ID: customer

1. LIMIT\_BAL: continuous. Credit Limit of the person.

2. SEX: Categorical: 1 = male; 2 = female

3. EDUCATION: Categorical: 1 = graduate school; 2 = university; 3 = high school; 4 = others

4. MARRIAGE: 1 = married; 2 = single; 3 = others

5. AGE-num: continuous.

6. PAY\_0 to PAY\_6: History of past payment. We tracked the past monthly payment records (from April to September, 2005)

7. BILL\_AMT1 to BILL\_AMT6: Amount of bill statements.

8. PAY\_AMT1 to PAY\_AMT6: Amount of previous payments.

Target Label:

Whether a person shall default in the credit card payment or not.

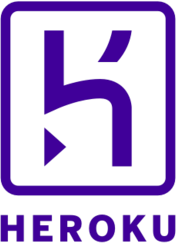
## Logging

We should be able to log every activity done by the user

* + - The system identifies at which step logging require.
    - The system should be able to log each and every system flow.
    - The system should be not be hung even after using so much logging. Logging just because we can easily debug issuing so logging is mandatory to do.

## Deployment

For the deployment of the project, we will use Heroku.



## Technology Stack

|  |  |
| --- | --- |
| **Front End** | HTML |
| **Backend** | Python |
| **Deployment** | Heroku |

1. **Proposed Solution**

We will use performed EDA to find the important relation between different attributes and will use a machine-learning algorithm to estimate the cost of expenses. The client will have to fill the required feature as input and will get results through the web application. The system will get features and it will be passed into the backend where the features will be validated and pre-processed and then it will be passed to a hyperparameter tuned machine learning model to predict the final outcome.

## Architecture

Start

Model

Building

Model

Testing

Data

Fetching

Feature

Engineering

Streamlit

API

EDA

Data

Cleaning

Deployment

### Data Gathering

Data source: <https://www.kaggle.com/datasets/uciml/default-of-credit-card-clients-dataset> Dataset is stored in .csv format.

### Raw Data Validation

After data is loaded, various types of validation are required before we proceed further with any operation. Validations like checking for zero standard deviation for all the columns, checking for complete missing values in any columns, etc. These are required because the attributes which contain these are of no use. It will not play role in contributing to the estimating cost of the premium.

### Exploratory Data Analysis

Visualized the relationship between the dependent and independent features. Also checked relationship between independent features to get more insights about the data.

### Feature Engineering

After pre-processing standard scalar is performed to scale down all the numeric features. Even one hot encoding is also performed to convert the categorical features into numerical features. For this process, pipeline is created to scale numerical features and encoding the categorical features.

### Model Building

After doing all kinds of pre-processing operations mention above and performing scaling and encoding, the data set is passed through a pipeline to all the models, Linear Regression, Decision tree, Random Forest, Gradient boost, KNN. It was found that SUPPORT VECTOR CLASSIFIER performs best with the smallest RMSE value i.e., 4506.364127 and the highest R2 score equals 0.848976 on test data So ‘Gradient boosting’ performed well in this problem.

### Model Saving

Model is saved using pickle library in pickle format.

### GitHub

The whole project directory will be pushed into the GitHub repository.

### Deployment

The project was deployed from GitHub into the Heroku platform.

# User Input / Output Workflow.