# Defined Architecture of ANN Model

## 1. Model Overview

The Artificial Neural Network (ANN) model is developed to predict customer churn by analyzing key customer attributes such as demographics, service usage, and account status. It allows businesses to identify high-risk customers and take proactive retention actions.

This is a feed-forward neural network built using TensorFlow and Keras, enabling efficient definition, training, and evaluation of the model. By optimizing layer sizes and activation functions, the model effectively captures patterns in the data to support accurate churn prediction.

## 2. Input Layer

- Number of Input Nodes: 40  
- Input Features: Includes all preprocessed categorical and numerical variables, such as encoded service types, contract terms, and standardized usage metrics. These features are typically one-hot encoded or normalized to ensure consistent input scale.  
- Shape: (40,)   
- Each input node corresponds to a specific feature variable.

## 3. Hidden Layers

The model contains two hidden layers:  
- First Hidden Layer:  
 - Number of Neurons: 40  
 - Activation Function: ReLU  
- Second Hidden Layer:  
 - Number of Neurons: 15  
 - Activation Function: ReLU  
  
The layer configuration is chosen experimentally to balance performance and overfitting.

## 4. Output Layer

- Number of Neurons: 1  
- Activation Function: Sigmoid  
- Function: Outputs a probability between 0 and 1 for customer churn prediction.

## 5. Compilation Settings

- Optimizer: Adam  
- Loss Function: Binary Crossentropy  
- Evaluation Metric: Accuracy

## 6. Optimization Strategies

The number of neurons and activation functions in each layer were selected through empirical tuning to balance model complexity and performance.

Regularization techniques such as Dropout can be optionally applied to mitigate overfitting, especially when working with smaller or imbalanced datasets.

A Sigmoid activation function is used in the output layer to generate probabilities for binary classification tasks, specifically to distinguish between churn and non-churn customers.

## Summary

The model achieved strong performance with a Test Accuracy of 97.16%, and F1 Score of 94.57%, showing that the ANN architecture and optimization choices were effective in capturing the patterns associated with customer churn.