# ARTIFICIAL NEURAL NETWORK BASED CUSTOMER CHURN PREDICTION SYSTEM

ANSHIKA (RA1911003030294)

ATHARVA YAWALKAR (RA1911003030279)

VIVEK SINGH (RA1911003030285)

SHIVANGI TRIPATHI (RA1911003030260)


Guide Name : Dr. Juhi Singh
CSE-I

MAY 2023

# ABSTRACT

A significant concern in the telecommunication sector is the analysis and forecasting of customer churn. For this, machine learning and deep learning algorithms and approaches are essential for firms in the present business environment because acquiring new clients is more expensive than retaining existing ones. The creation of a system for predicting client churn is the major objective of this project. The six phases of the methods used for this are as follows.  Business needs, data understanding, data pre-processing, and feature selection are completed in the first three phases. In upcoming 2 phases **Artificial Neural Network** implementation and other strategies are used to assess prediction accuracy. Additionally some machine learning models, such as logistic regression, random forest, K nearest neighbour, and others, have also been put into practise. Finally, after evaluating the findings, Streamlit is used to deploy the model.

# INTRODUCTION

Membership-based services are one of the outcomes of the world's growing digitalization

Due of this, it is important for businesses to monitor client behaviour to know about Churn

Churn prediction is the process of predicting which consumers are likely to abandon a business or cancel their membership to a service

One of the key goals of customer churn prediction is developing strategies for client retention

The probability of customer churn grows exponentially along with the level of competition in the industries for services. As a result, developing ways to monitor devoted clients (non-churners) has become essential

# MOTIVATION

Competitiveness in the markets is increasing, which motivates businesses to focus not only on new business but also on maintaining existing consumers

Hence the motivation behind building the churn prediction model is to solve the problem of customer leaving the business and sustaining them for long run

So through churn prediction model we will predict the customers who are leaving the business and start giving awards and benefits

# LITERATURE REVIEW

| Paper Details | Author | Literature Survey |
|---|---|---|
| Neural Network approach for Predicting Customer Churn | Sharma, A. and Panigrahi, D.P.K. (2020) | The dataset contains 20 variables and data from about 2,427 users. The neural network was built using the SPSS Inc. Clementine data mining software tool. Clementine supports two kinds of supervised neural networks: Multilayer Perceptron (MLP) and Radial Base Function Network (RBFN). |
| Customers Churn Prediction in Financial Institution | Kamorudeen A. Amuda, Adesesan B. Adeyemo (2021) | Employed observational and predictive data mining approaches to analyse subscriber calling behaviour and identify subscribers with a high likelihood of churn in a telecommunications firm. During the descriptive stage, consumers were grouped based on their usage behavioural characteristics, and the clustering techniques employed were K-Means and Expected Maximization (EM). |

# LITERATURE REVIEW

| Paper Details | Author | Literature Survey |
|---|---|---|
| Prediction of Customer Attrition of Commercial Banks based on SVM Model | Benlan Hea,b*,Yong Shic,Qian Wand ,Xi Zhaoc (2019) | The SVM technique was used, due to the unbalanced qualities of the dataset, the Random sampling approach was used to improve SVM since it has a greater degree of recognition. The findings showed that incorporating random sampling and the support vector machine method boosted predictive power and properly forecasted churning rate. |
| User churn behavior model of rural public digital cultural services | Meng Wang, Yuwen Hua, Honglei Lia Sun (2018) | The study's goal was to identify clients who were likely to abandon the advertising platform. Based on its actions in search advertisements, the ensemble model of gradient boosting decision tree (GBDT) was utilized to forecast customers who may churn in the near future. |

# PROBLEM STATEMENT

Telecom businesses must either retain current customers or attract new customers.

However, acquiring new customers is difficult because the chances of this occurring are low.

This leaves us with the main choice of retaining existing customers, and in order to do so, the Telecom Company must consider various marketing strategies.

The predictive models can help telecom companies identify loyal customers, allowing them to launch retention campaigns to attract new and keep current loyal customers.

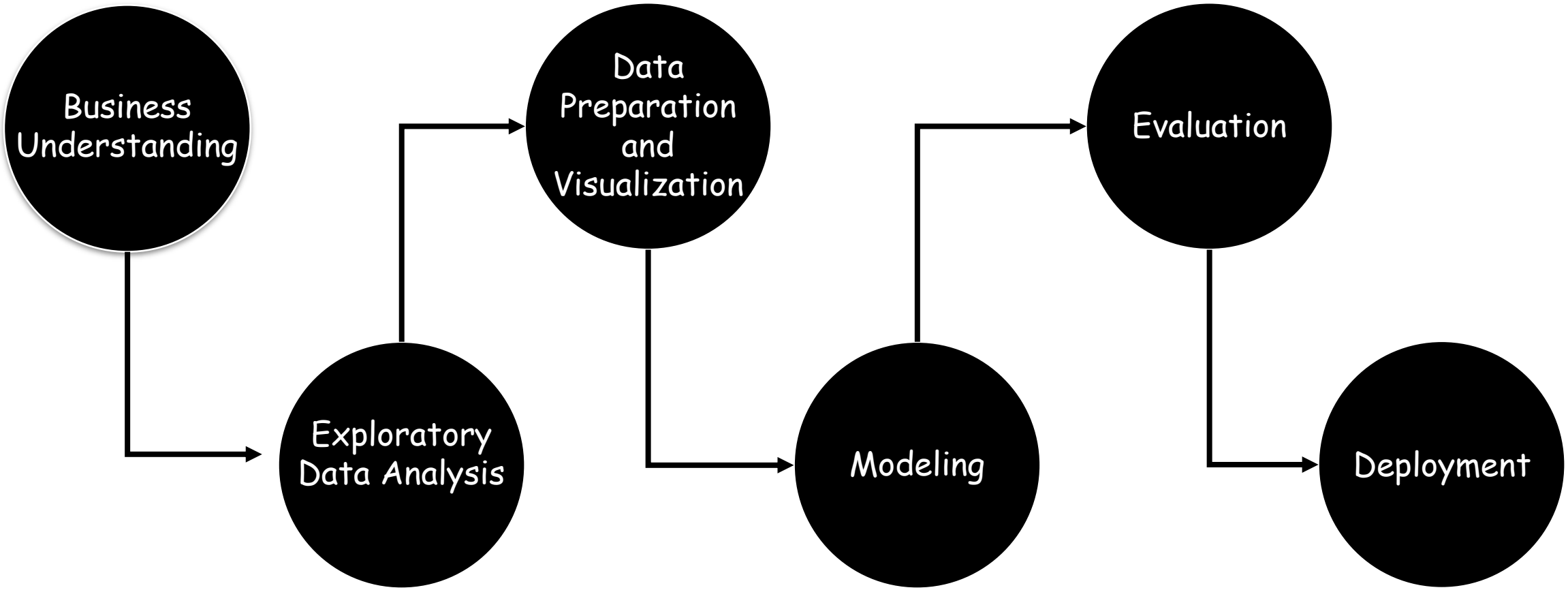
# PROPOSED SOLUTION

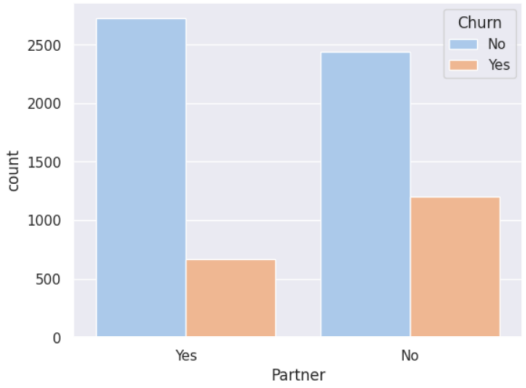
The answer to the provided issue statement is to create a forecast system that can determine whether or not an individual is likely to churn.

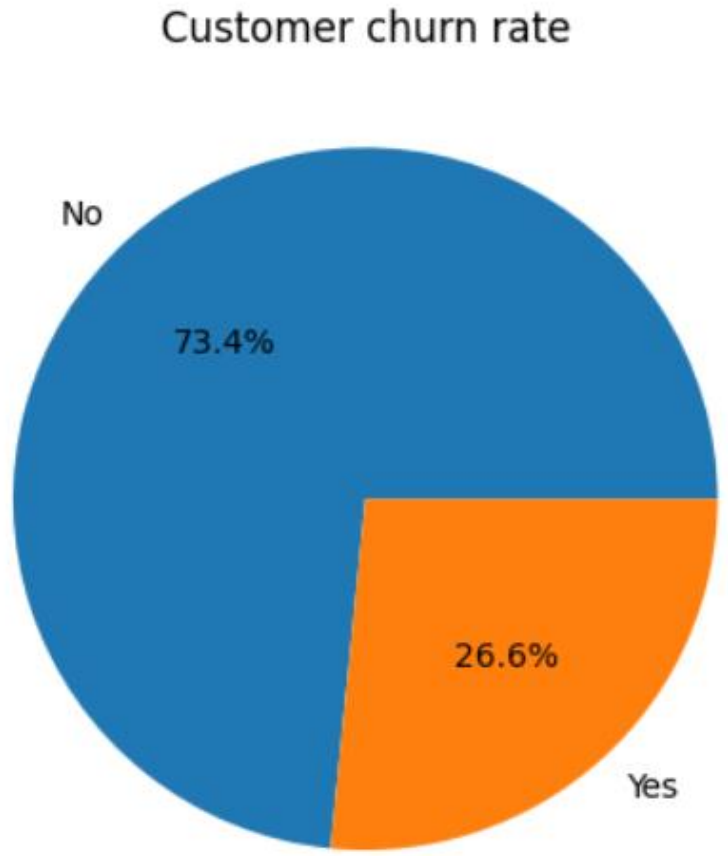
This can help to provide extra advantages to customers while looking for reasons why they are not loyal to the business.

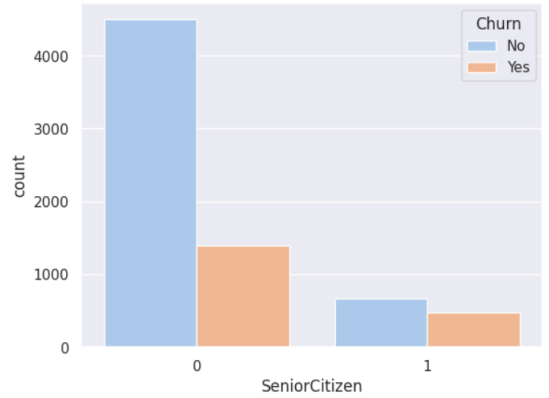
This can be accomplished by employing an artificial neural network model that predicts the likelihood of turnover.

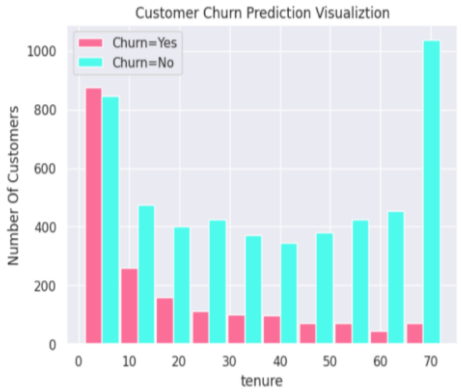
# METHODOLOGY

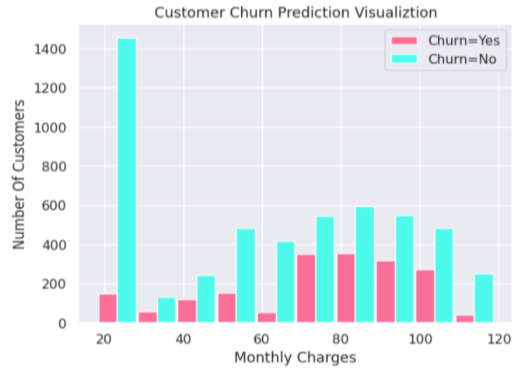


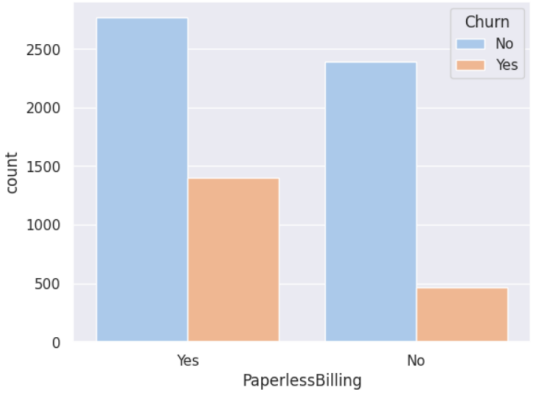



# DATA VISUALIZATION

# MODEL BUILDING

### Training the ANN

```
[ ] ann.compile(optimizer= 'adam', loss= 'binary_crossentropy', metrics= ['accuracy'])

[ ] ann_history = ann.fit(x_train, y_train, batch_size= 32, epochs= 100, validation_split= 0.3)
```

```
Epoch 1/100
124/124 [==============================] - 2s 5ms/step - loss: 0.7979 - accuracy: 0.6175 - val_loss: 0.6761 - val_accuracy: 0.7014
Epoch 2/100
124/124 [==============================] - 0s 3ms/step - loss: 0.6330 - accuracy: 0.7209 - val_loss: 0.5972 - val_accuracy: 0.7387
Epoch 3/100
```

### Visualizing Confusion Matrix

```
[ ] from sklearn.metrics import confusion_matrix, accuracy_score, ConfusionMatrixDisplay

[ ] # Predicting the Test set results
    y_pred = ann.predict(x_test)
    y_pred = (y_pred > 0.5)

    # Making the Confusion Matrix
    cm = confusion_matrix(y_test, y_pred)

    # Calculate the Accuracy
    accuracy = accuracy_score(y_pred,y_test)
```

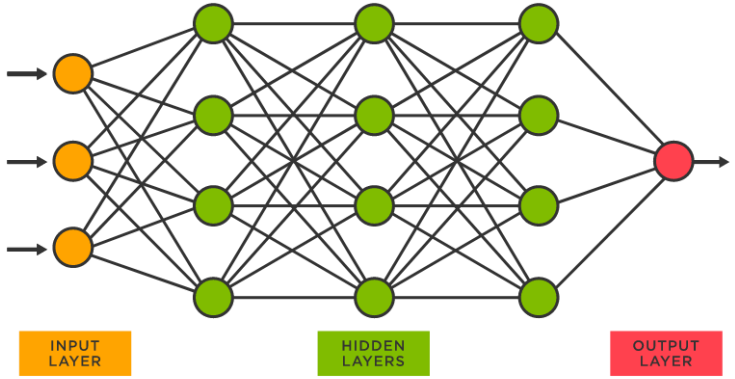
```
44/44 [==============================] - 0s 1ms/step
```

```
[ ] cm
```

```
array([[929, 109],
       [171, 198]])
```

```
[ ] print('Accuracy for ANN:', (accuracy)*100,'%')
```

```
Accuracy for ANN: 80.09950248756219 %
```



# CROSS VALIDATION AND HYPERPARAMETER TUNING

Cross-validation involves dividing the dataset into k equally sized parts or "folds" and training the model k times, each time using a different fold as the test set and the remaining folds as the training set.

Many machine learning models have hyperparameters that need to be tuned to achieve optimal performance. This involves selecting the best values for the hyperparameters using techniques such as grid search or random search.

**Evluating the ANN (Cross Validation)**

**Wrapping k-fold cross validation into keras model**

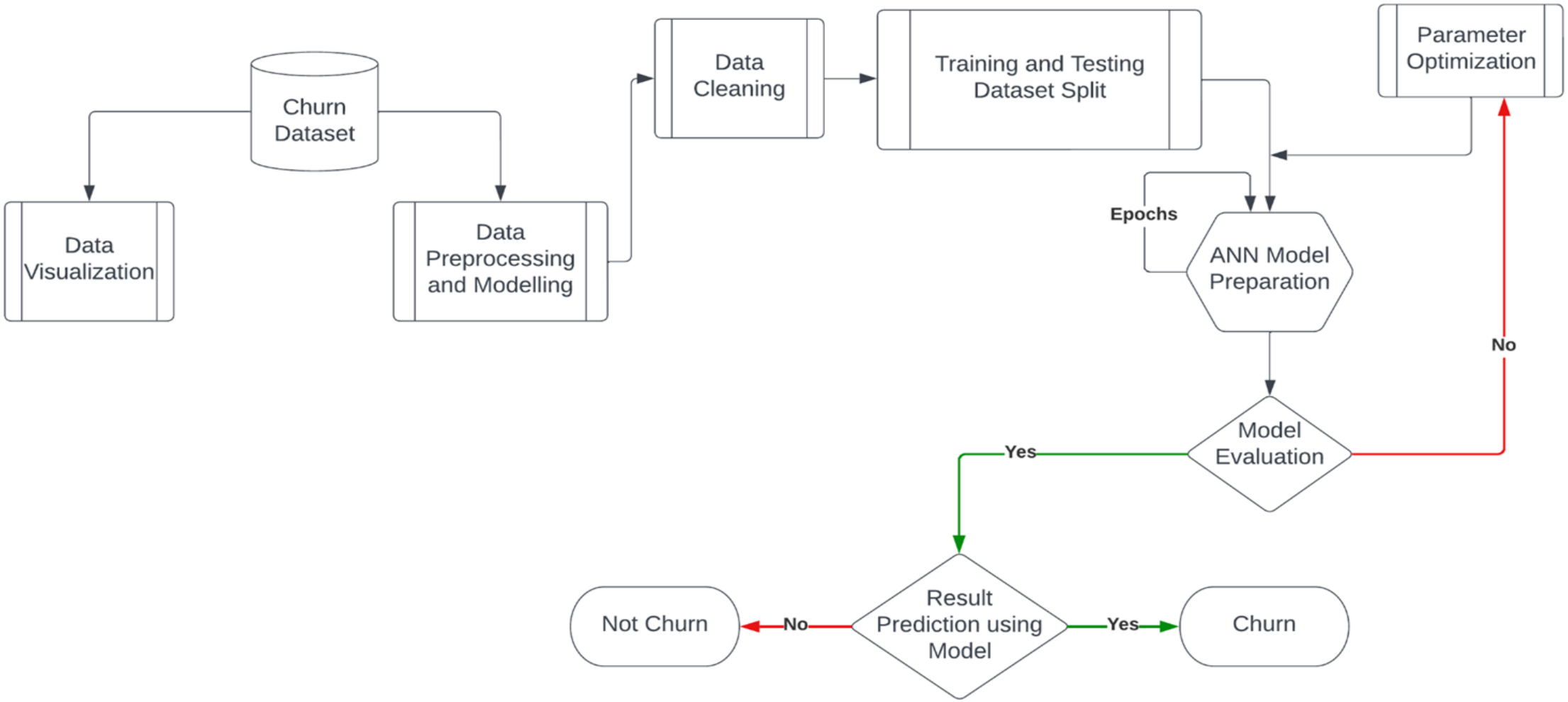
```
[ ] from keras.wrappers.scikit_learn import KerasClassifier
    from sklearn.model_selection import cross_val_score

[ ] # Builing the function
    def ann_classifier():
        ann = tf.keras.models.Sequential()
        ann.add(tf.keras.layers.Dense(units= 8, kernel_regularizer=l2(0.01), bias_regularizer=l2(0.01
        ann.add(tf.keras.layers.Dense(units= 8, kernel_regularizer=l2(0.01), bias_regularizer=l2(0.01
        tf.keras.layers.Dropout(0.6)
        ann.add(tf.keras.layers.Dense(units= 1, activation='sigmoid'))
        ann.compile(optimizer= 'adam', loss= 'binary_crossentropy', metrics= ['accuracy'])
        return ann
```

**Running the ANN again based on parameters obtained above**

```
# defining the layers
ann = tf.keras.models.Sequential()
ann.add(tf.keras.layers.Dense(units= 8, kernel_regularizer=l2(0.01), bias_regularize
ann.add(tf.keras.layers.Dense(units= 8, kernel_regularizer=l2(0.01), bias_regularize
tf.keras.layers.Dropout(0.6)
ann.add(tf.keras.layers.Dense(units= 1, activation='sigmoid'))
ann.compile(optimizer= 'adam', loss= 'binary_crossentropy', metrics= ['accuracy'])
ann.fit(x_train, y_train, batch_size= 32, epochs= 150)
```

```
[ ] # Predicting the Test set results
    y_pred = ann.predict(x_test)
    y_pred = (y_pred > 0.5)

    # Making the Confusion Matrix
    cm = confusion_matrix(y_test, y_pred)

    # Calculate the Accuracy
    accuracy = accuracy_score(y_pred,y_test)

    44/44 [==============================] - 0s 2ms/step

[ ] print('Confusion Matrix after tuning the ANN:\n', cm)

    Confusion Matrix after tuning the ANN:
     [[933 105]
     [170 199]]

[ ] print('Accuracy after tuning the ANN:', (accuracy)*100,'%')

    Accuracy after tuning the ANN: 80.45486851457001 %
```

# UML DIAGRAM


Churn Dataset
Data Visualization
Data Preprocessing and Modelling
Data Cleaning
Training and Testing Dataset Split
Parameter Optimization
Epochs
ANN Model Preparation
Model Evaluation
No
Yes
Result Prediction using Model
Not Churn
No
Yes
Churn

Some general conclusions that can be drawn from a customer churn analysis are:

- Understanding the reasons behind customer churn is critical to improving customer retention and reducing churn rate.
- Identifying the key drivers of customer churn can help companies develop targeted strategies and tactics to reduce churn and improve customer satisfaction.
- Analyzing customer behavior, demographics, and preferences can help companies tailor their products, services, and marketing efforts to better meet customer needs and preferences.
- Regularly monitoring and analyzing customer churn can help companies identify trends and patterns in customer behavior and adjust their strategies and tactics accordingly.

# FUTURE SCOPE

Integration of more data sources

Increased use of Deep learning

Real-time customer churn prediction

Use of explainable AI

More focus on customer experience

# REFERENCES


[1] Sharma, A. and Panigrahi, D.P.K. (2020) .Neural Network approach for Predicting Customer Churn. In: Pant, M., Sharma, T., Verma, O., Singla, R., Sikander, A. (eds) Soft Computing: Theories and Applications. Advances in Intelligent Systems and Computing, vol 1053. Springer, Singapore. https://doi.org/10.1007/978-981-15-0751-9_9

[2] Kamorudeen A. Amuda, Adesesan B. Adeyemo (2012). Customers Churn Prediction in Financial Institution In: Macintyre, J., Iliadis, L., Maglogiannis, I., Jayne, C. (eds) Engineering Applications of Neural Networks. EANN 2019. Communications in Computer and Information Science, vol 1000. Springer, Cham. https://doi.org/10.1007/978-3-030-20257-6_25

[3] Benlan Hea,b*,Yong Shic,Qian Wand ,Xi Zhaoc (2014),Prediction of Customer Attrition of Commercial Banks based on SVM Model Third International Conference on Inventive Research in Computing Applications (ICIRCA), Coimbatore, India, 2021, pp. 895-902, doi: 10.1109/ICIRCA51532.2021.9544785

[4] Meng Wang, Yuwen Hua, Honglei Lia Sun (2018)User churn behavior model of rural public digital cultural services Using Artificial Neural Network (Version 1). arXiv. https://doi.org/10.48550/ARXIV.1912.11346

# THANK YOU