# Predicting Bank Loan Approval using Artificial Neural Networks (ANN)

## 1. Executive Summary:

This project employs Artificial Neural Networks (ANN) to predict the likelihood of bank loan approval based on customer attributes. Utilizing Python libraries such as pandas, numpy, seaborn, matplotlib, TensorFlow/Keras, and scikit-learn, the analysis delves into the Universal Bank dataset. The journey unfolds through data exploration, preprocessing, model development, and evaluation.

## 2. Introduction:

This project aims to develop an Artificial Neural Network (ANN) model for predicting bank loan approval. Leveraging Python libraries such as pandas, numpy, seaborn, matplotlib, and TensorFlow/Keras for neural network development, the analysis centers on the 'UniversalBank.csv' dataset. This dataset encompasses customer attributes like age, income, credit card usage, personal loan status.

## 3. Data Source:

The dataset used for this project is sourced from [*Kaggle*](https://www.kaggle.com/) and is provided by [*Srihari Promod*.](https://www.kaggle.com/sriharipramod) It is designed for predictive modeling tasks related to bank loan approval. The dataset comprises customer attributes and loan approval indicators, providing a valuable resource for developing machine learning models, particularly classification algorithms.

**Dataset Information:**

* **ID:** Unique identifier for each customer.
* **Age:** Age of the customer.
* **Experience:** Number of years of professional experience.
* **Income:** Annual income of the customer.
* **ZIP** **Code:** ZIP code of the customer's residence.
* **Family:** Number of family members.
* **CCAvg:** Average credit card spending per month.
* **Education:** Education level of the customer (1: Undergraduate, 2: Graduate, 3: Advanced/Professional).
* **Mortgage:** Value of house mortgage, if any.
* **Personal Loan:** Binary indicator of whether the customer accepted a personal loan (1) or not (0).
* **Securities Account:** Binary indicator of whether the customer has a securities account (1) or not (0).
* **CD Account:** Binary indicator of whether the customer has a certificate of deposit (CD) account (1) or not (0).
* **Online:** Binary indicator of whether the customer uses online banking services (1) or not (0).
* **CreditCard:** Binary indicator of whether the customer owns a credit card issued by the bank (1) or not (0).

**Dataset Link:** [*Bank Dataset on Kaggle*](https://www.kaggle.com/datasets/sriharipramod/bank-loan-classification)

## 3. Data Exploration and Preprocessing:

* **Dataset Overview:** The dataset is loaded and explored using pandas functions like pd.read\_csv(), info(), and describe().
* **Exploratory Data Analysis (EDA):**
  + Descriptive statistics and visualizations with seaborn and matplotlib offer insights into feature distributions.
  + Key features, including age, income, education, credit card ownership, and personal loan status, are visualized to understand the dataset's characteristics.

## 4. Data Visualization:

* Matplotlib and Seaborn are employed for visually interpreting different aspects of the dataset. This includes count plots for categorical variables, histograms for numerical variables, and a heatmap for the correlation matrix.

## 5. Data Preprocessing:

* Data preprocessing involves handling missing values, scaling numerical features using StandardScaler from sklearn, and creating two dataframes for approved and unapproved personal loans.
* One-hot encoding is used for the target variable ('Personal Loan'), and the dataset is split into training and testing sets using sklearn's train\_test\_split().

## 6. Neural Network Model:

* A sequential Keras model is constructed, incorporating input, hidden, and output layers.
* Dropout layers are introduced to mitigate overfitting.
* Model compilation utilizes categorical crossentropy loss, the Adam optimizer, and custom metrics (including F1 score).
* Scikit-learn's StandardScaler is utilized for feature scaling.

## 7. Model Training:

* The ANN model is trained using the training dataset.
* The training process is monitored and visualized through the loss across epochs using Matplotlib.

## 8. Model Evaluation:

* Predictions on the test set are made, and sklearn's metrics module calculates various metrics, including F1 score, precision, recall, and accuracy.
* A confusion matrix, visualized with seaborn, provides an understanding of the model's performance in class differentiation.

## 9. Conclusion:

* The project offers a comprehensive approach to bank loan prediction using ANN, incorporating data exploration, preprocessing, model building, and evaluation.
* Visualizations and analyses facilitate a deeper understanding of the dataset and loan approval factors.

## 10. Recommendations and Future Work:

* Feature engineering and hyperparameter tuning, facilitated by sklearn, could enhance model performance.
* Further segmentation analysis could offer insights for targeted marketing strategies.

## 11. Acknowledgments and Credits:

* This report is submitted by **Rounik Mondal**, a B.Tech Computer Science and Engineering Student at Lovely Professional University, under the guidance and support of **Ayan Kumar Ghosh**. This Project was completed as a part of the coursework for the **“**ArtificialIntelligence**”** course offered by [InternsElite](https://internselite.net/).
* For a detailed walkthrough and implementation of the Bank Loan Prediction, please refer to the associated Google Colab notebook: <https://colab.research.google.com/drive/1BAst31bILBskDsrERiZZnlutg7lITGHD>

## 11. References:

* <https://pandas.pydata.org/docs/>
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* <https://matplotlib.org/stable/index.html/>
* <https://www.tensorflow.org/api_docs/python/tf/all_symbols>
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