PREDICTING INCOME FROM ADULT CENSUS DATA USING NEURAL NETWORKS

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AGENDA

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2 Methodology

3 Preprocessing

4 Modelling

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INTRODUCTION

Adult Census Dataset

The Adult census data is a dataset containing information on individuals in the United States, including their demographic and socio-economic characteristics, and whether their income is above or below $50,000 per year.

Problem Statement

Can we predict an individual's income based on their characteristics?

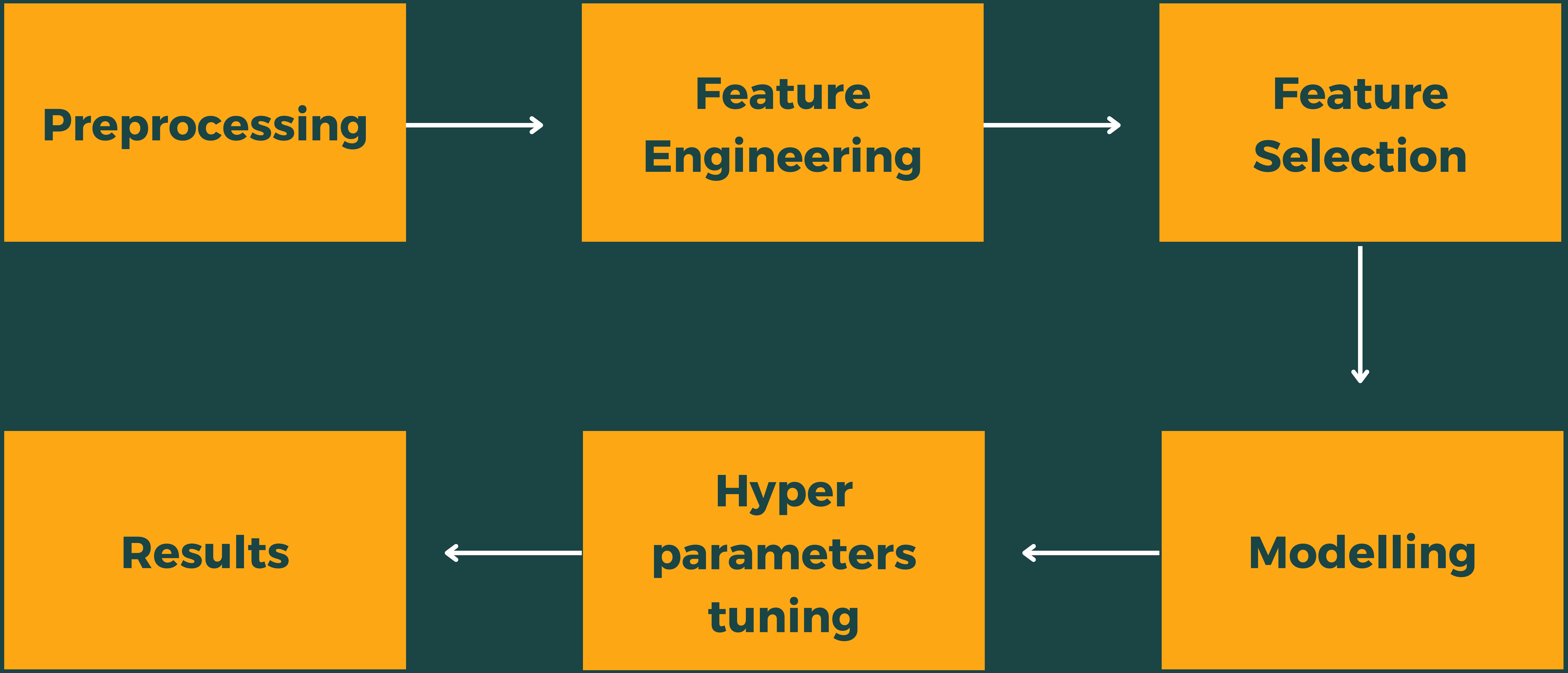
Objectives

It is significant because it can help researchers better understand the factors that contribute to income inequality in Society.

Solution

Demonstrate an effective methodology for predicting income from the Adult census data and provide insights into contributing factors.

METHODOLOGY



Preprocessing

Feature Engineering

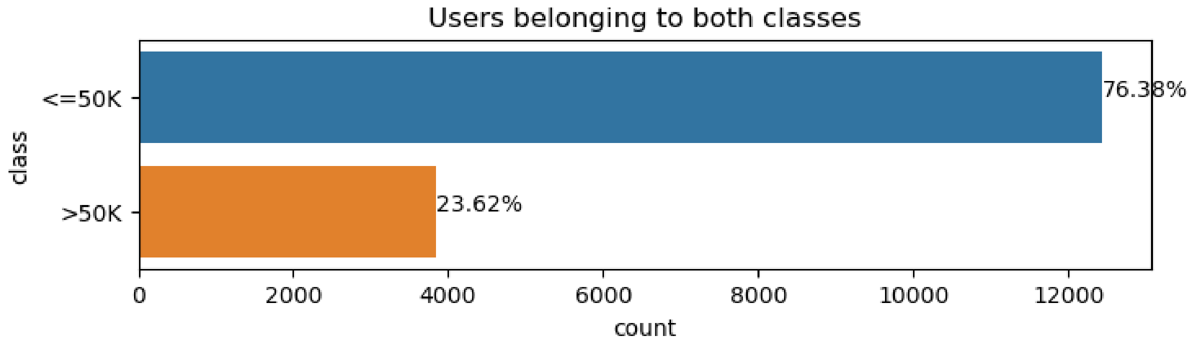
Feature Selection

Modelling

Hyper parameters tuning

Results

PREPROCESSING



IMBALANCED CLASSES IN ADULT CENSUS DATA

Handling Missing Values

The Adult census data contains missing values, which need to be handled before the data can be analyzed. Rows with missing data were dropped and some redundant columns were dropped.

Categorical Variables

The Adult census data contains several categorical variables, such as race and occupation, that need to be converted into numerical variables before they can be used in predictive models. This can be done using techniques such as one-hot encoding or label encoding.

Feature Engineering

We modified some features in the data to reduce complexity and make more balanced

Feature Selection

Some Algorithms such as Random Forest, Chi-square Feature Selection were done to select the most important features for the model.

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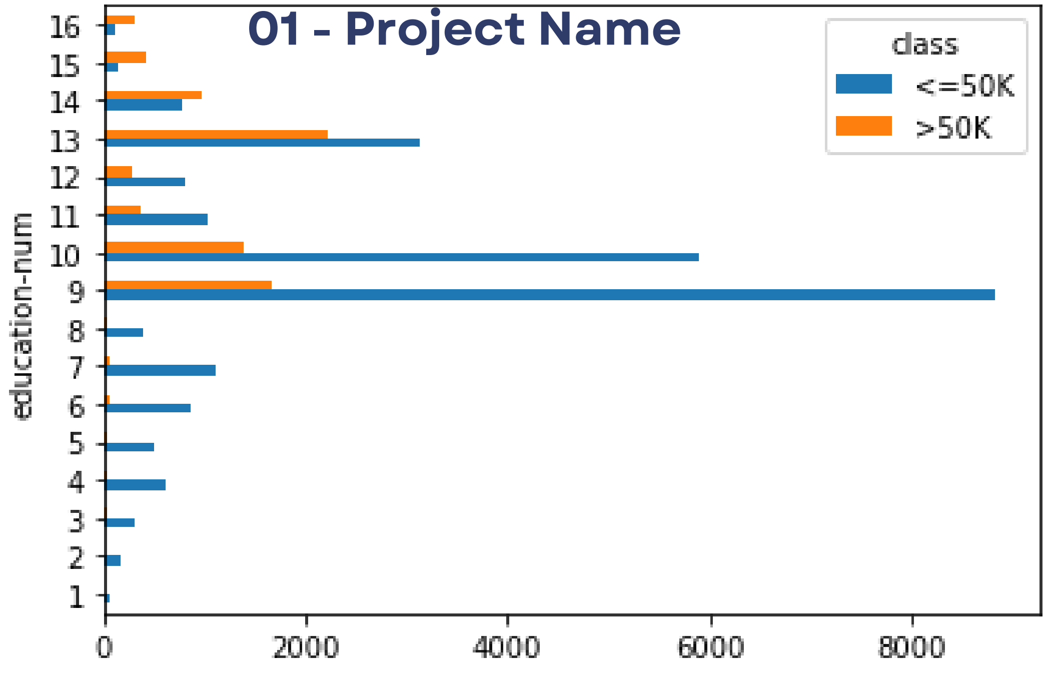
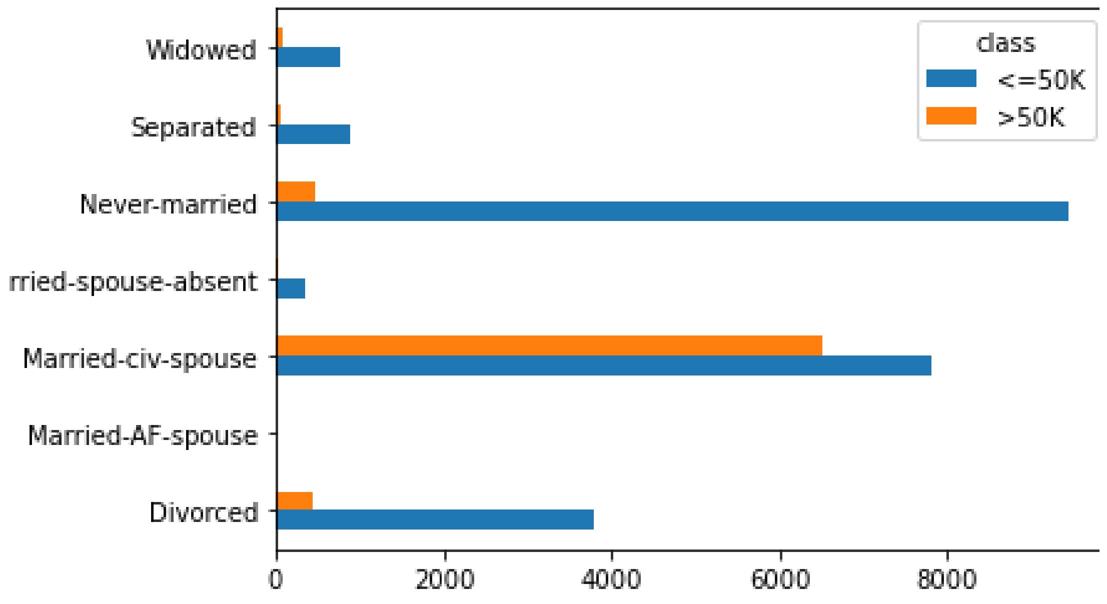
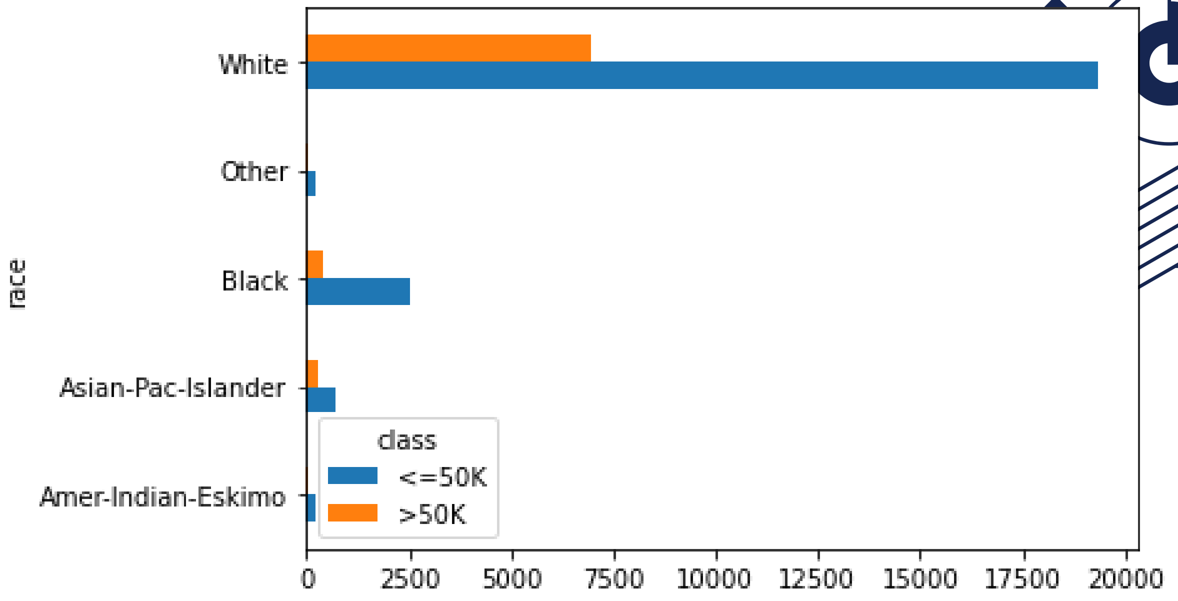
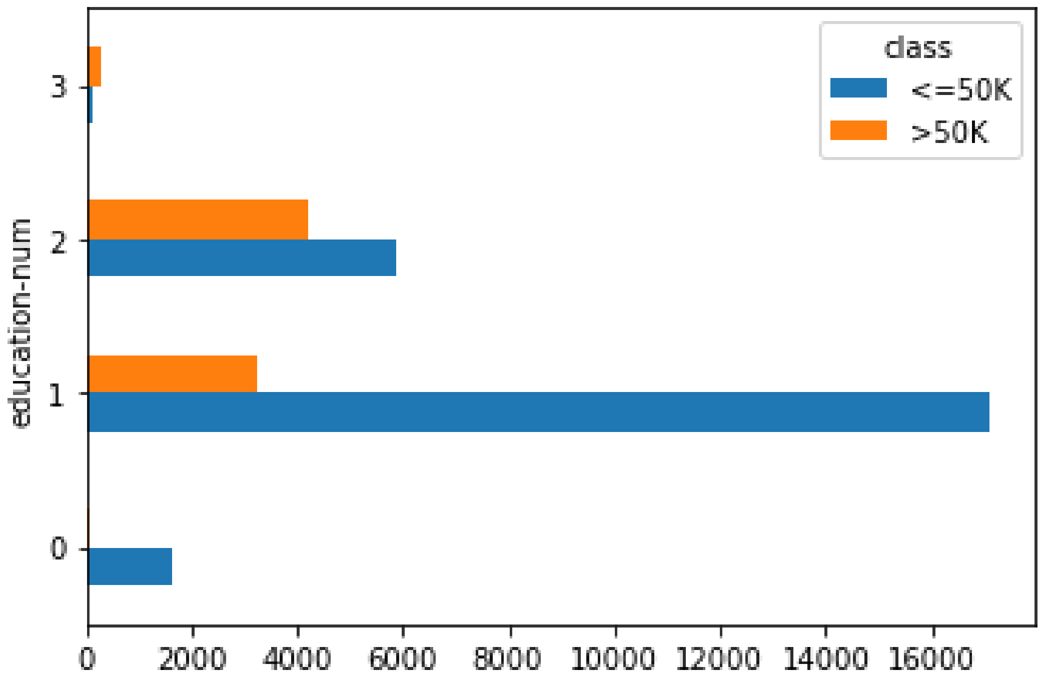
FEATURE ENGINEERING

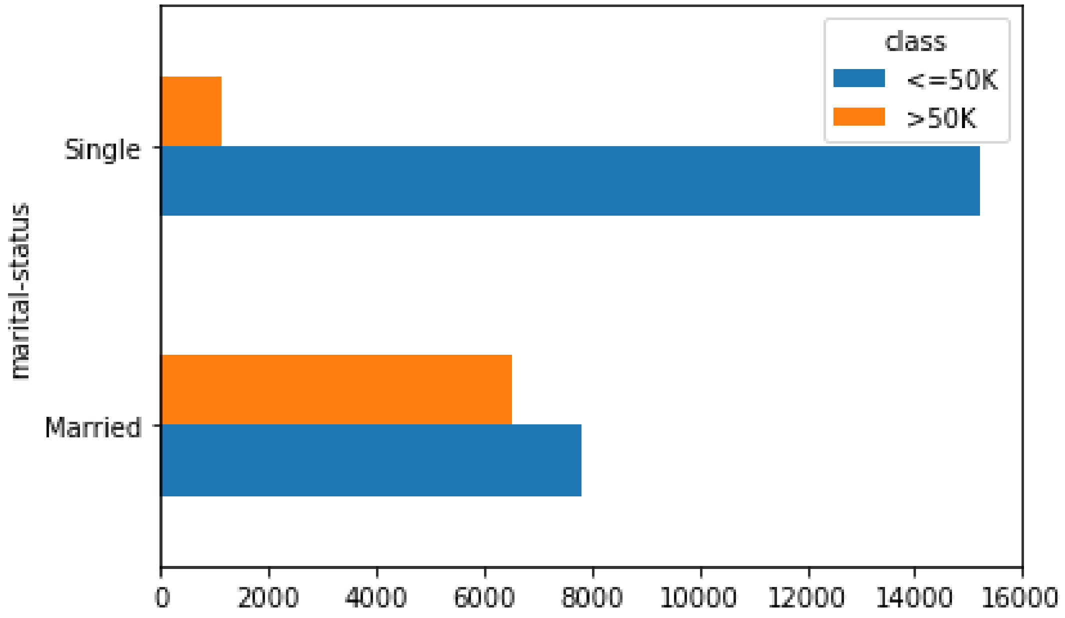
01 - Project Name

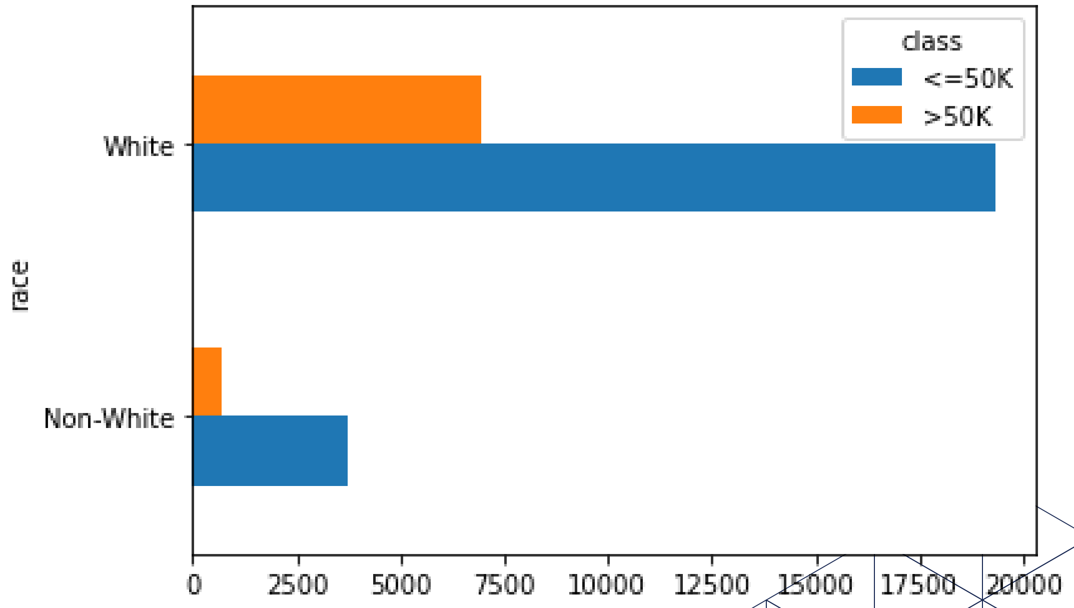






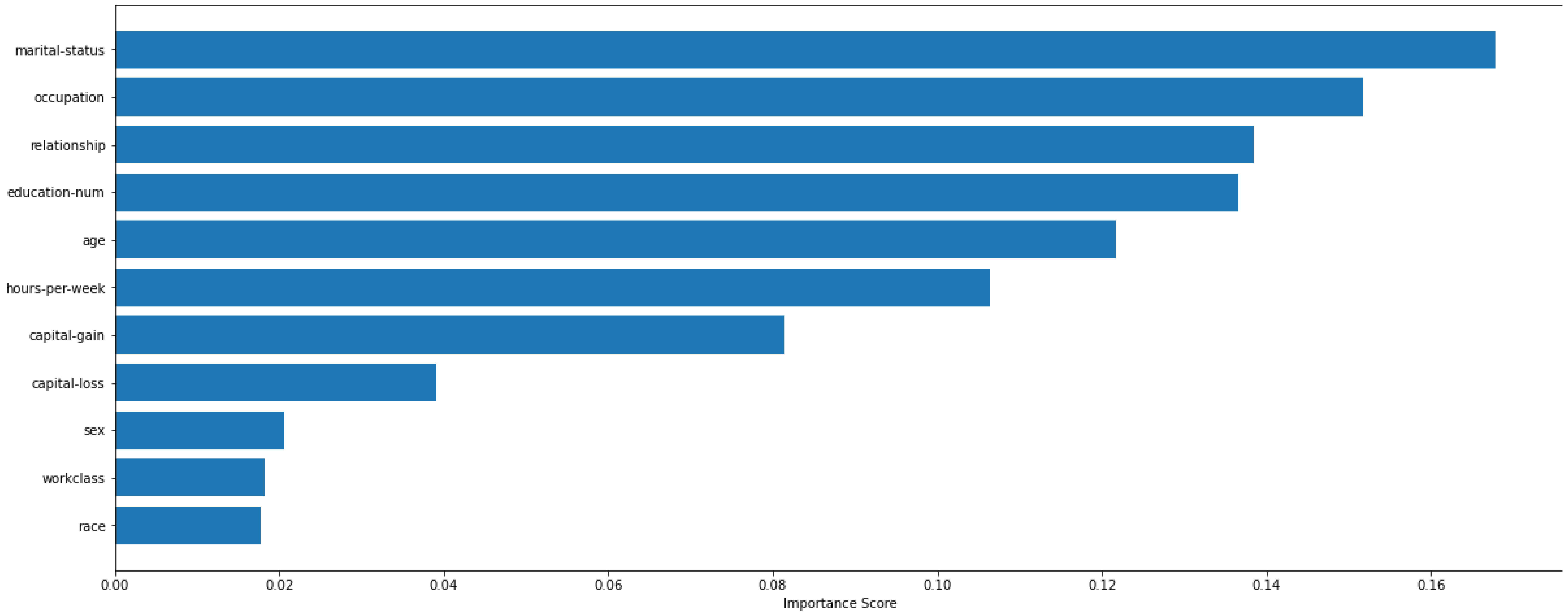






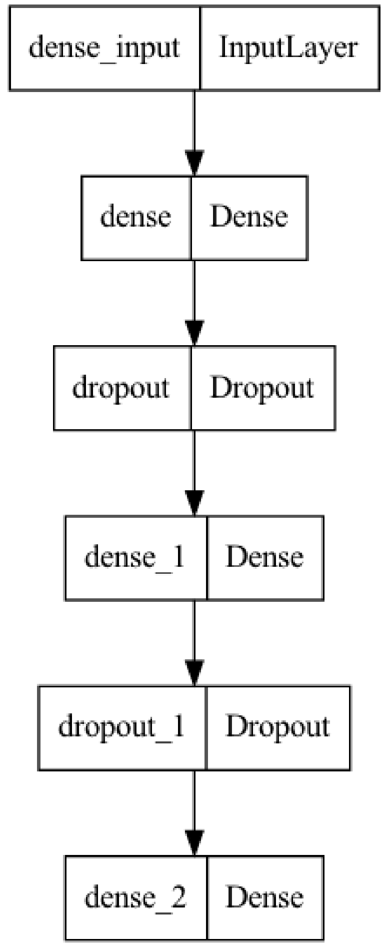
FEATURE SELECTION

Based on the Random feature importance tests, 3 common features with the least importance are sex, race, and workclass.

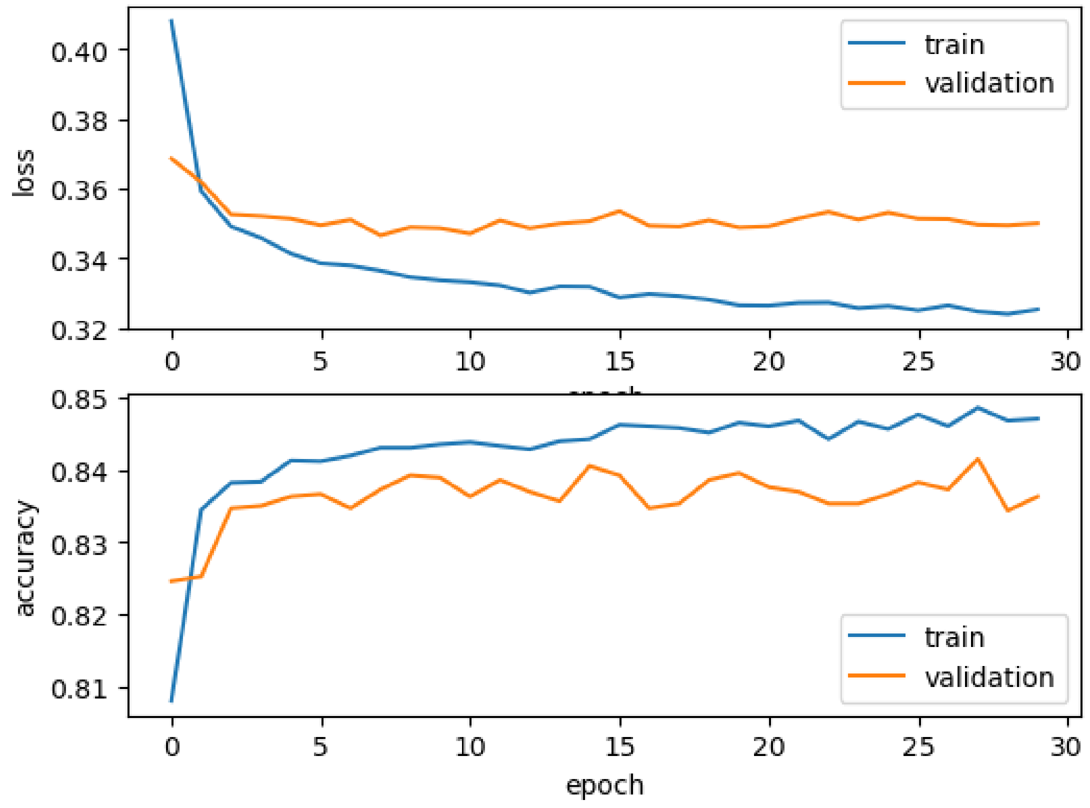


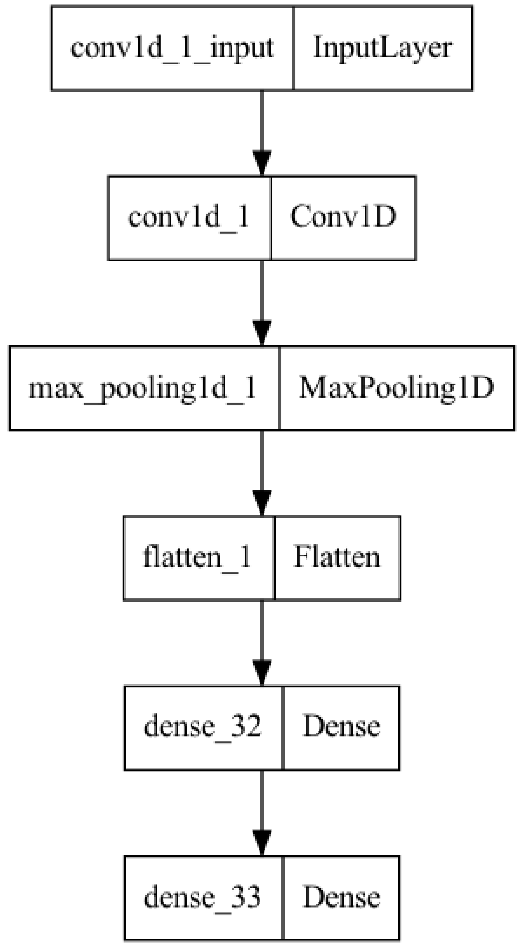
MODELLING

- Various neural network models were explored. DNN and CNN were the most common architectures.
- Model performance was evaluated using accuracy, roc-auc score, precision, recall, and F1 score.
- Models were optimized through hyperparameter tuning and feature selection.
- Models were trained using GPUs on Google Colab and Kaggle to utilize parallelisation.

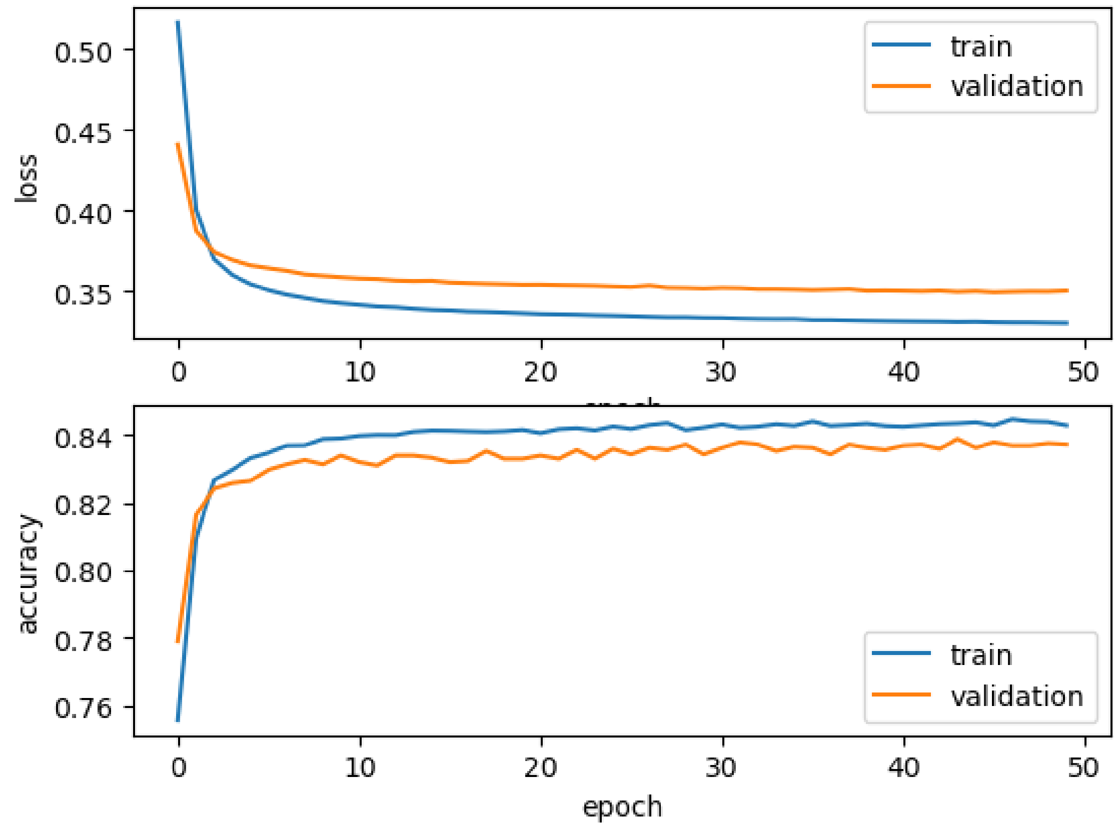


Dense Neural Network Architecture



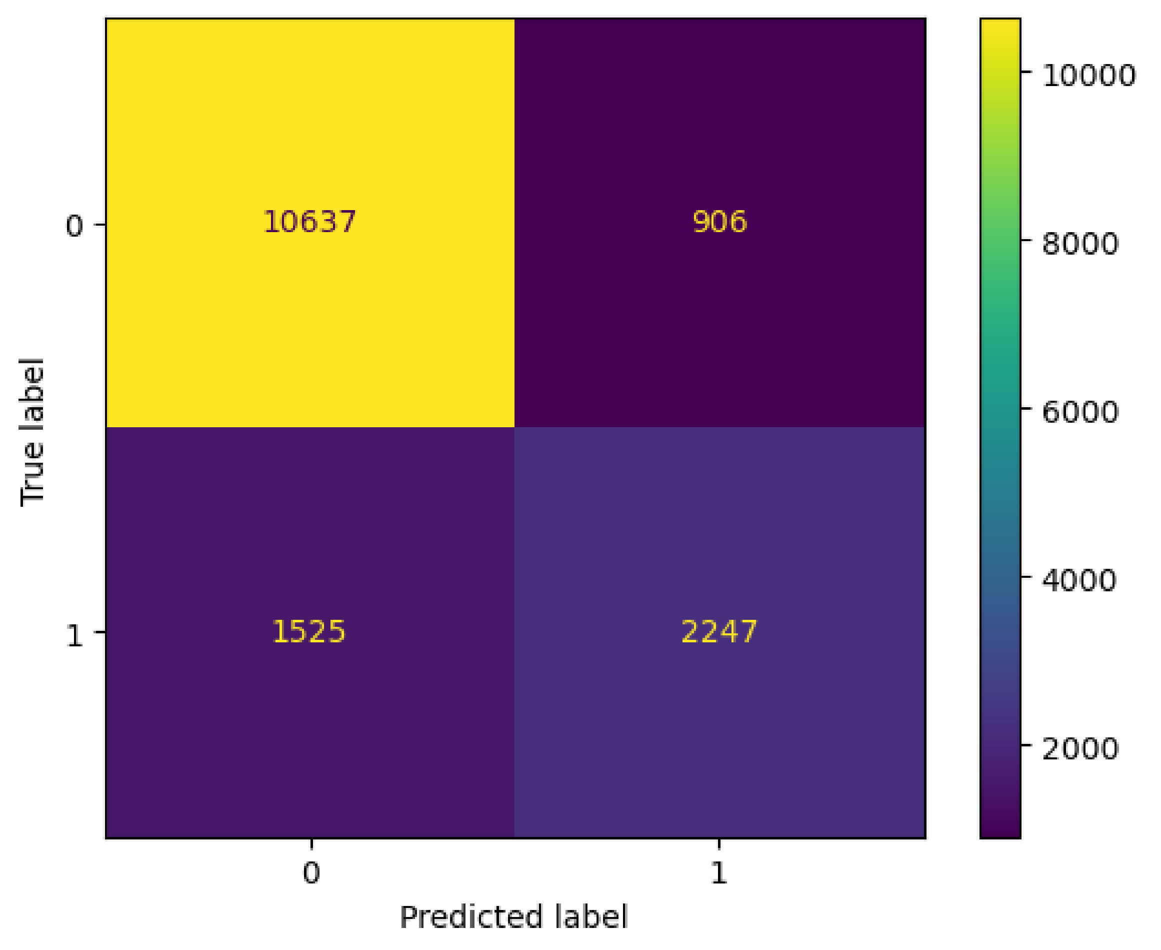


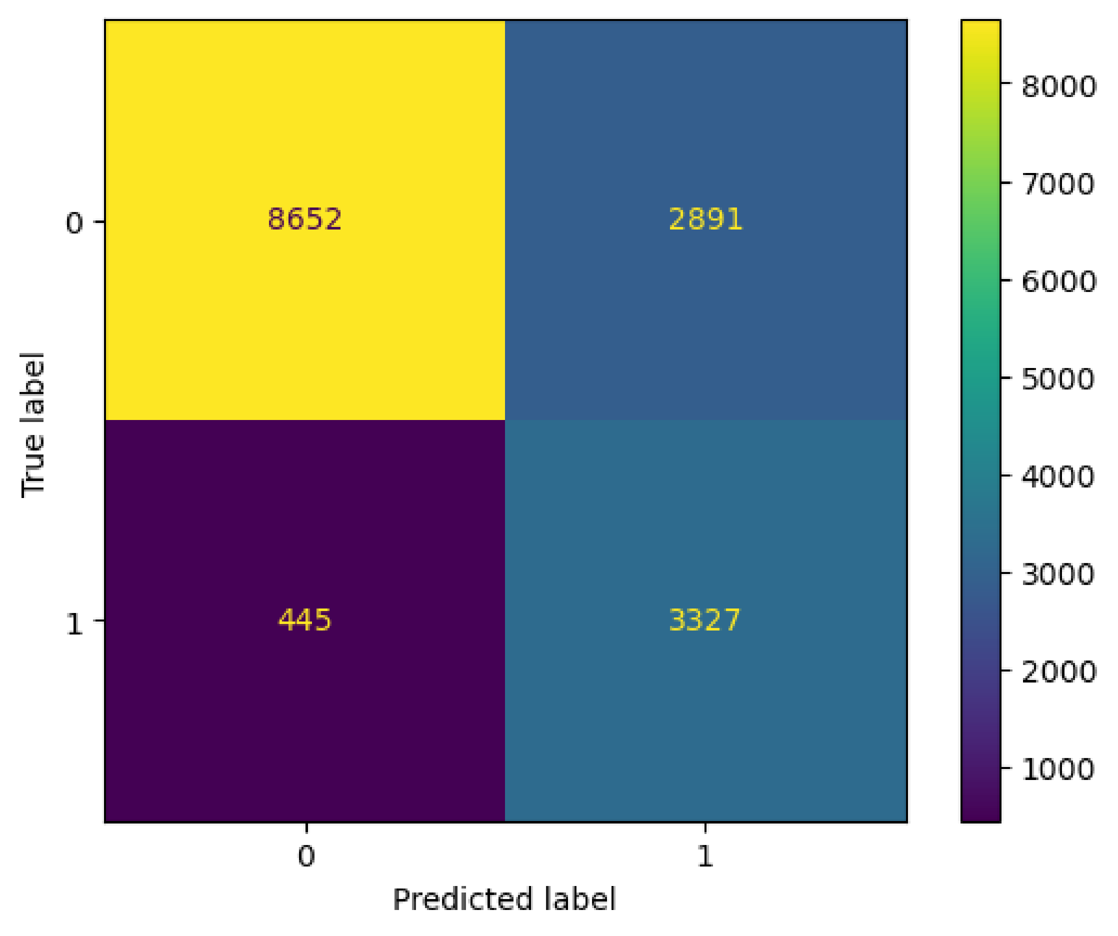
Convolution Neural Network Architecture



RESULTS FOR IMBALANCED TRAINING SET

Default Threshold (0.5)	Best Threshold = 0.212586
Accuracy Score: 0.85 Precision: 0.71 Recall: 0.59 F1: 0.64 AUC: 0.75	Accuracy Score: 0.78 Precision: 0.53 Recall: 0.88 F1: 0.66 AUC: 0.81

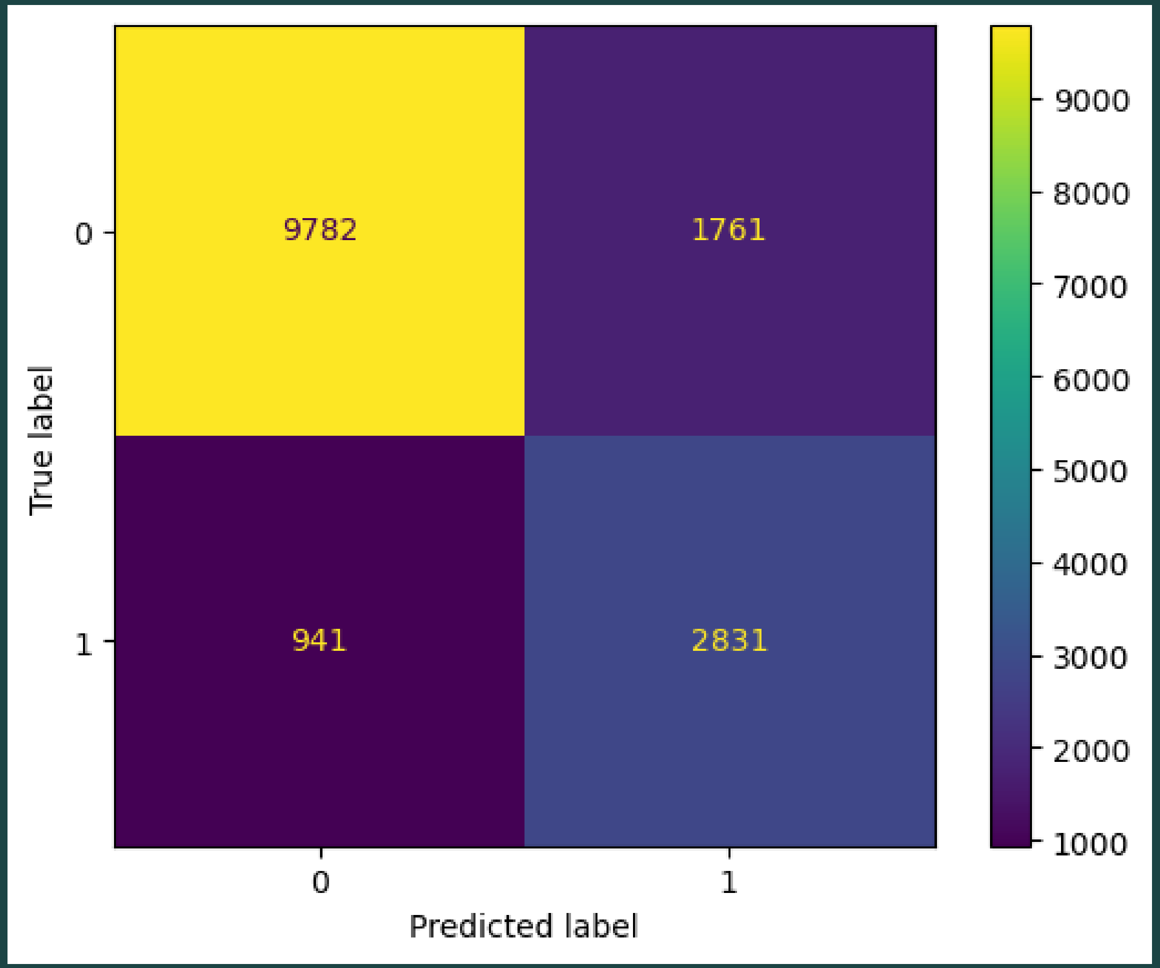




RESULTS FOR OVERSAMPLED TRAINING SET

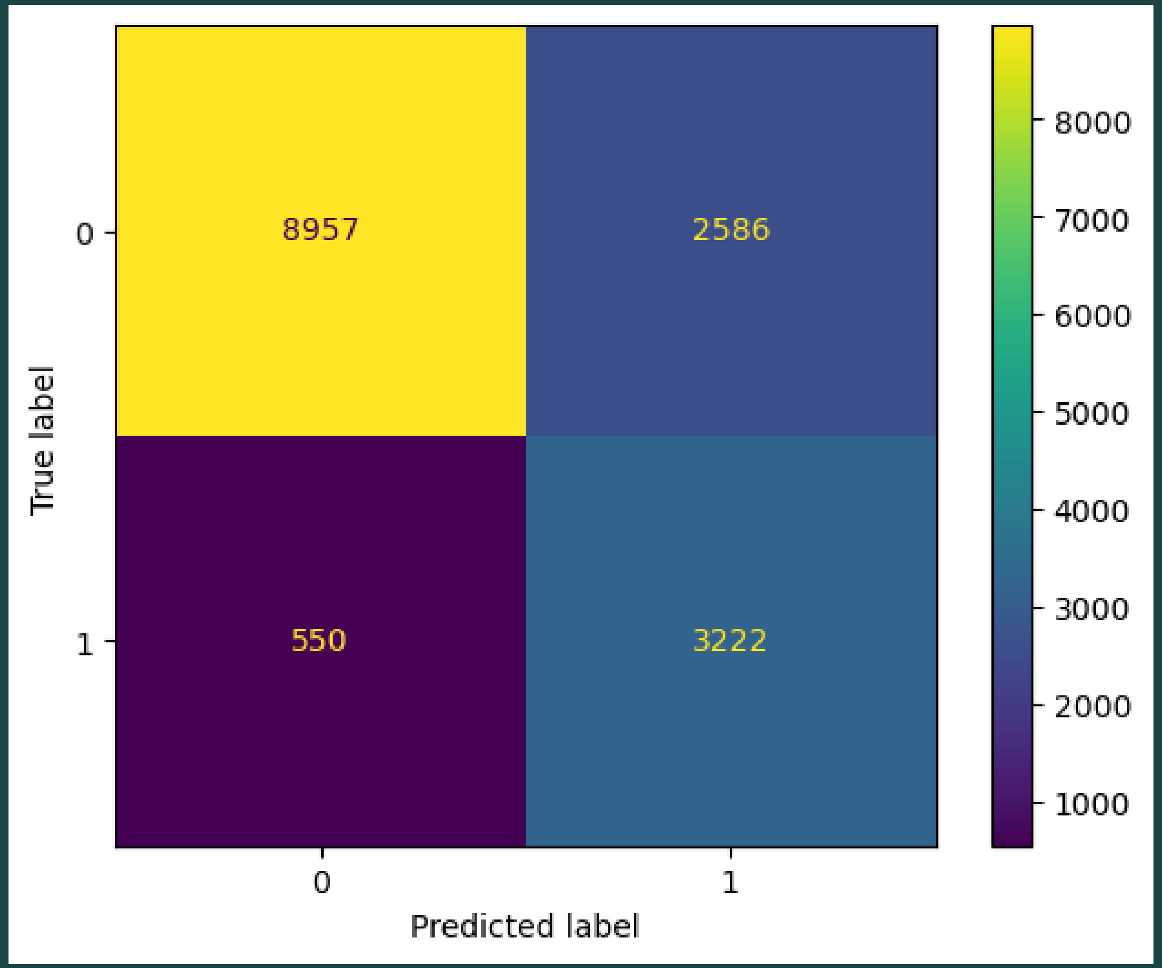
Default Threshold (0.5)

Accuracy Score: 0.82
Precision: 0.61
Recall: 0.75
F1: 0.68
AUC: 0.80



Best Threshold = 0.405082

Accuracy Score: 0.79
Precision: 0.55
Recall: 0.85
F1: 0.67
AUC: 0.82



CONCLUSION

Main Problem	Can we predict an individual's income based on their characteristics?
Challenges	Data is messy, imbalanced and had lots of missing values.
Solution	Using tested machine learning models mainly neural networks to predict income.