Customer Churn Prediction With AI

Using Artificial Neural Networks to Predict At-Risk Customers

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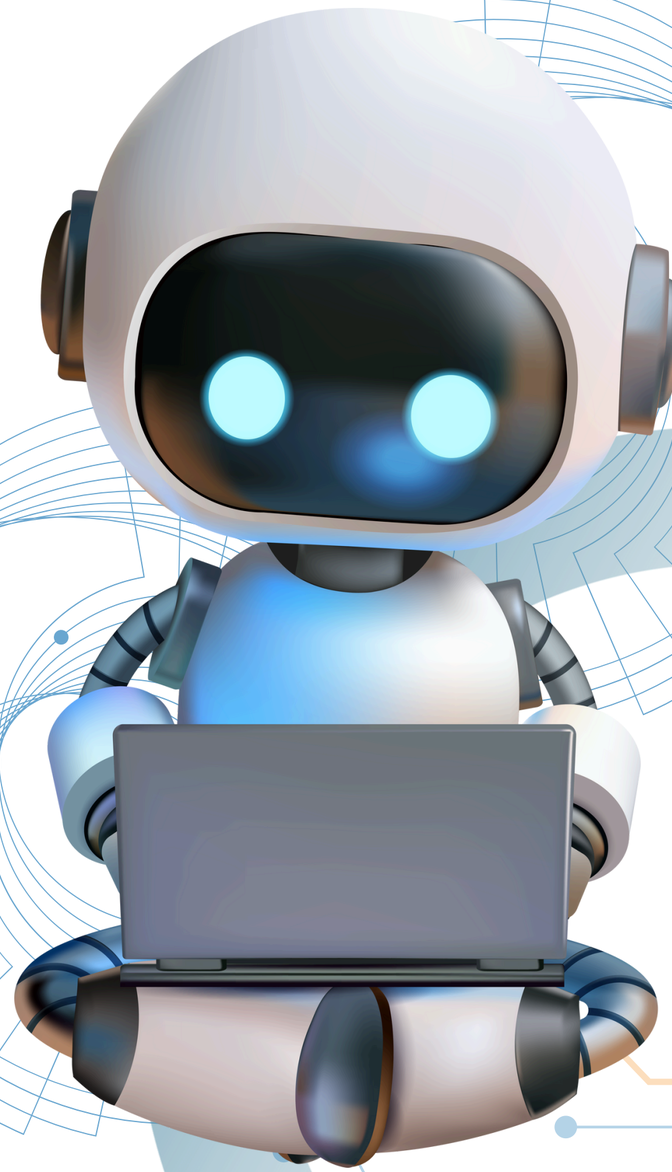
INTRODUCTION

- Customer churn = when customers leave or cancel a service
- Churn causes major revenue loss
- AI can help identify customers at risk
- This project uses Python + an ANN to predict churn

BUSINESS PROBLEM

- Companies struggle to understand why customers leave
- Hard to manually detect patterns in customer behavior
- Goal: Use AI to predict the likelihood of churn
- Helps businesses act early to retain customers



DATASET OVERVIEW

synthetic dataset with 500 customers
Includes:

- Tenure (months with company)
- Monthly Charges
- Total Charges
- Contract Type
- Internet Service
- Support Services
- Payment Method
- Senior Citizen
- Churn (Yes/No)

```
import pandas as pd

df = pd.read_csv("customer_churn.csv")
print("Loaded shape:", df.shape)
df.head()
```

```
Loaded shape: (500, 10)
```

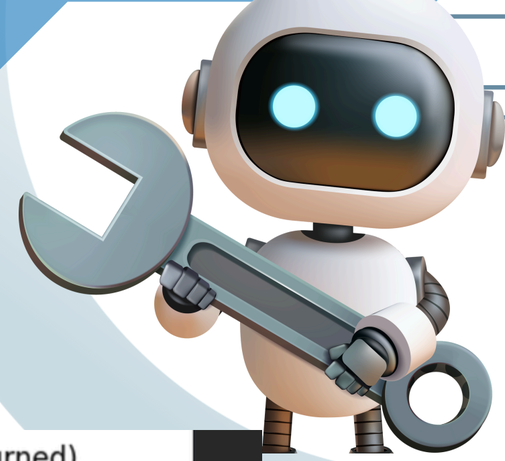
	tenure	MonthlyCharges	TotalCharges	Contract	InternetService	TechSupport	OnlineSecurity	PaymentMethod	SeniorCitizen	Churn
0	52	90.51	4004.76	One year	No	Yes	Yes	Bank transfer	1	Yes
1	15	44.87	4629.03	Two year	Fiber optic	Yes	Yes	Electronic check	1	Yes
2	61	53.03	6721.05	Month-to-month	DSL	Yes	Yes	Electronic check	0	No
3	21	63.45	3294.61	Two year	No	No	Yes	Credit card	0	No
4	24	45.37	6190.20	Month-to-month	DSL	Yes	No	Credit card	0	No

DATA PREPARATION

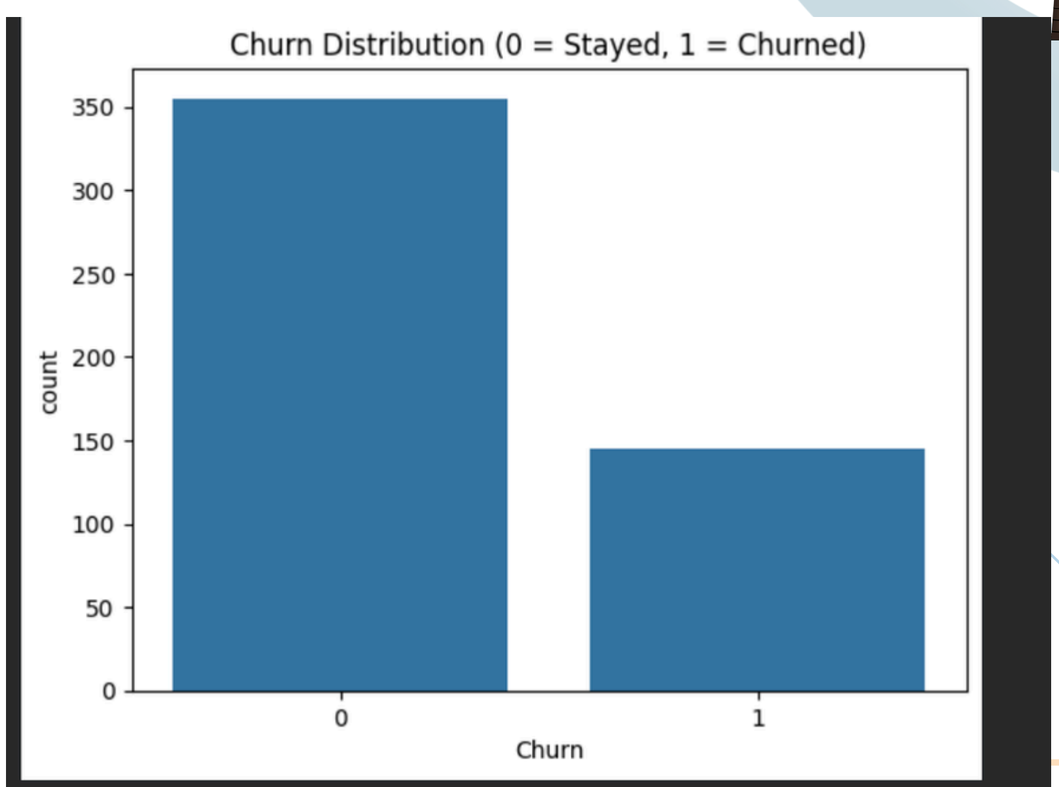
- Removed missing values
- Converted “Yes/No” to 1/0
- One-hot encoded categorical features
- Scaled numeric features using StandardScaler
- Split into Train (80%) and Test (20%)

```
Dataset info:
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 500 entries, 0 to 499
Data columns (total 10 columns):
 #   Column           Non-Null Count  Dtype
---  ------           --------------  -----
 0   tenure           500 non-null    int64
 1   MonthlyCharges   500 non-null    float64
 2   TotalCharges     500 non-null    float64
 3   Contract         500 non-null    object
 4   InternetService  500 non-null    object
 5   TechSupport      500 non-null    object
 6   OnlineSecurity   500 non-null    object
 7   PaymentMethod    500 non-null    object
 8   SeniorCitizen    500 non-null    int64
 9   Churn            500 non-null    int64
dtypes: float64(2), int64(3), object(5)
memory usage: 39.2+ KB
None

Summary statistics (only numeric columns):
            tenure  MonthlyCharges  TotalCharges  SeniorCitizen       Churn
count  500.000000       500.00000    500.000000     500.000000  500.000000
mean    35.680000         70.77286   4053.279340       0.484000    0.290000
std     20.812591         27.72090   2314.366718       0.500244    0.454216
min      1.000000         20.26000    101.880000       0.000000    0.000000
25%     17.000000         47.19750   2035.510000       0.000000    0.000000
50%     35.000000         72.71000   4173.740000       0.000000    0.000000
75%     54.000000         94.23250   5987.535000       1.000000    1.000000
max     71.000000        119.77000   7994.890000       1.000000    1.000000
```

EXPLORATORY DATA ANALYSIS



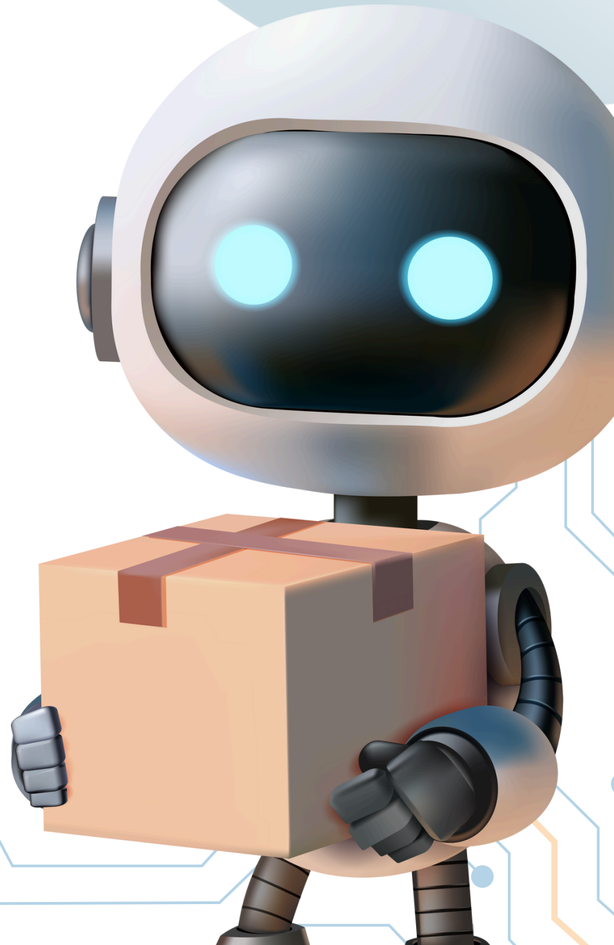
- Checked churn distribution (major imbalance)
- Created correlation matrix
- Identified which features relate most to churn
- Found “Month-to-Month” contract is common among churners




```
Top correlations with Churn:
Churn             1.000000
TotalCharges      0.066244
tenure            0.063257
MonthlyCharges    0.021293
SeniorCitizen    -0.019227
Name: Churn, dtype: float64
```

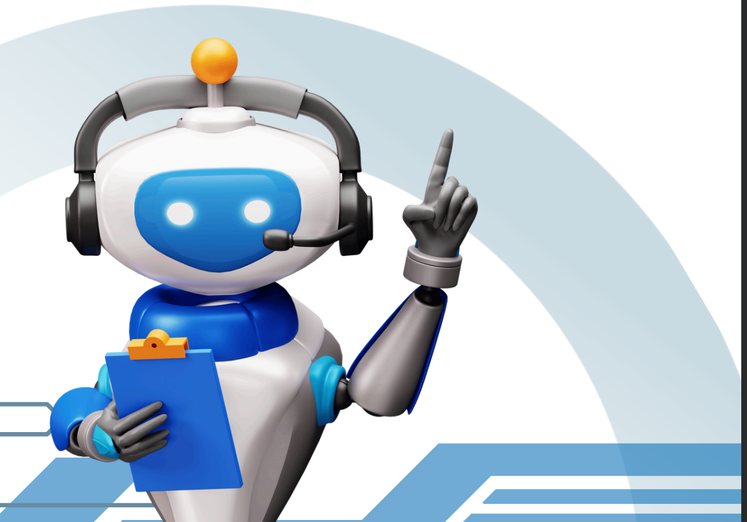
MODEL SELECTION

- Chosen model: Artificial Neural Network (ANN)
- Why ANN?
  - Learns complex patterns
  - Handles mixed features well
  - Good for classification tasks like churn prediction
- Built using TensorFlow/Keras



ANN ARCHTICTURE

- Input layer: All encoded customer features
- Hidden Layer 1: 16 neurons (ReLU)
- Hidden Layer 2: 8 neurons (ReLU)
- Output layer: 1 neuron (Sigmoid)
- Optimizer: Adam
- Loss: Binary Crossentropy



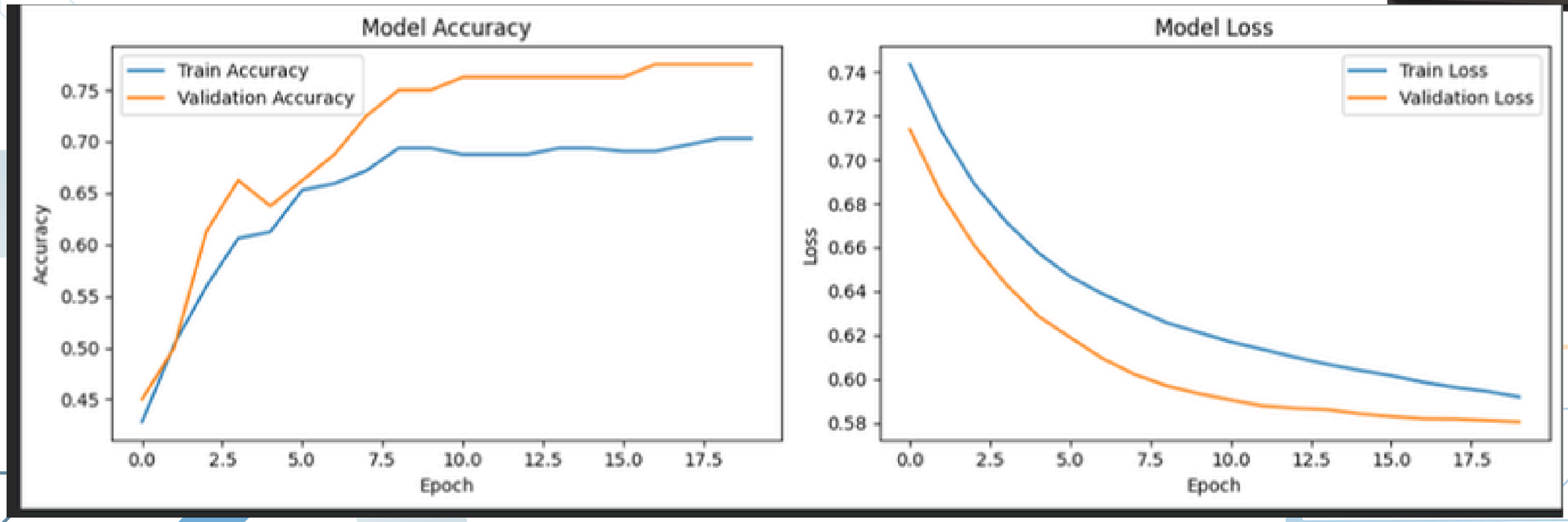
Model: "sequential"

Layer (type)	Output Shape	Param #
dense (Dense)	(None, 16)	208
dense_1 (Dense)	(None, 8)	136
dense_2 (Dense)	(None, 1)	9

Total params: 353 (1.38 KB)
Trainable params: 353 (1.38 KB)
Non-trainable params: 0 (0.00 B)

TRAINING THE MODEL

- Trained for 20 epochs
- Observed:
- Training accuracy ↑
- Loss ↓
- Validation metrics show model learning patterns



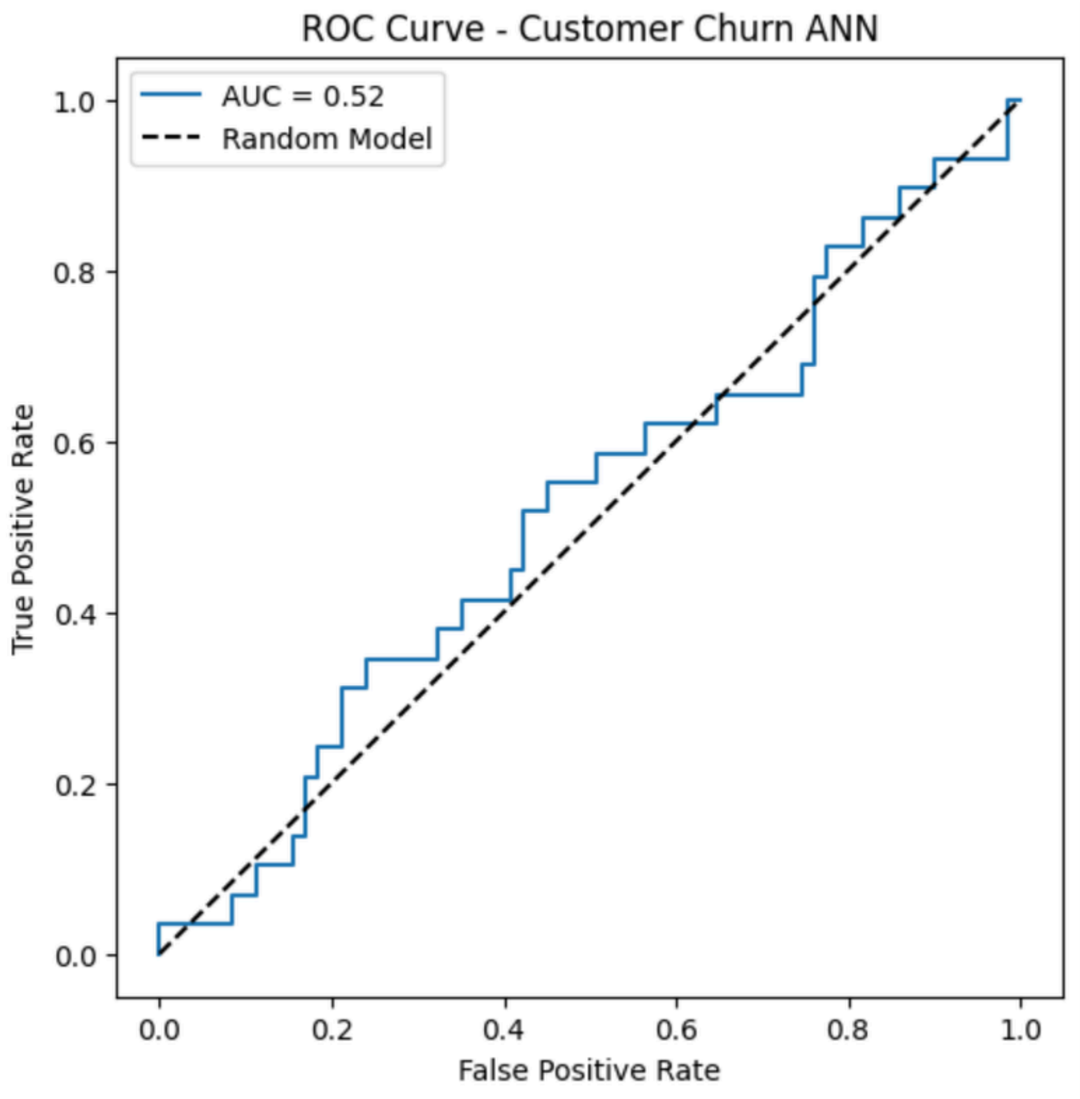
EVALUATION METRICS

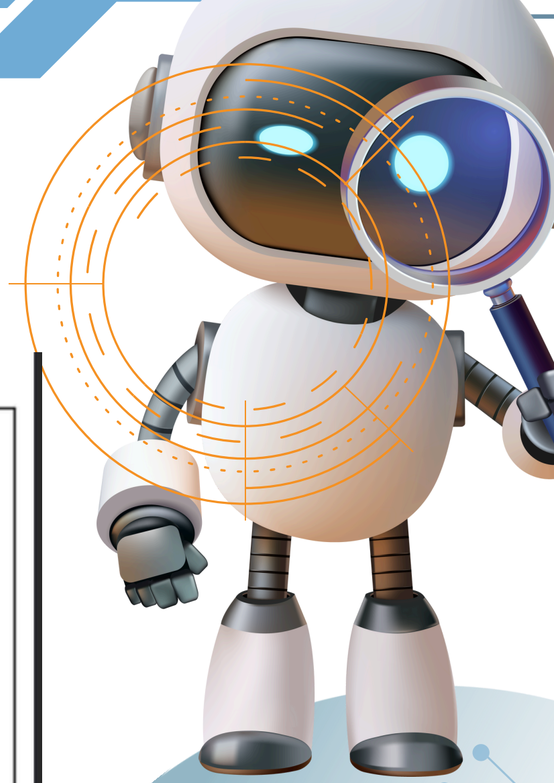
- Accuracy: 72%
- BUT accuracy is misleading for imbalanced data
- Precision (Churn): 1.00
- Recall (Churn): 0.03 (very low)
- F1-score: Very low for churn
- AUC Score: 0.52 (almost random performance)

```
…  4/4 ━━━━━━━━━━━━━━━━━━━━ 0s 29ms/step

Classification Report:
              precision    recall  f1-score   support

           0       0.72      1.00      0.84        71
           1       1.00      0.03      0.07        29

    accuracy                           0.72       100
   macro avg       0.86      0.52      0.45       100
weighted avg       0.80      0.72      0.61       100

Confusion Matrix:
[[71  0]
 [28  1]]
AUC Score:
0.5177270519669742
```

ROC CURVE

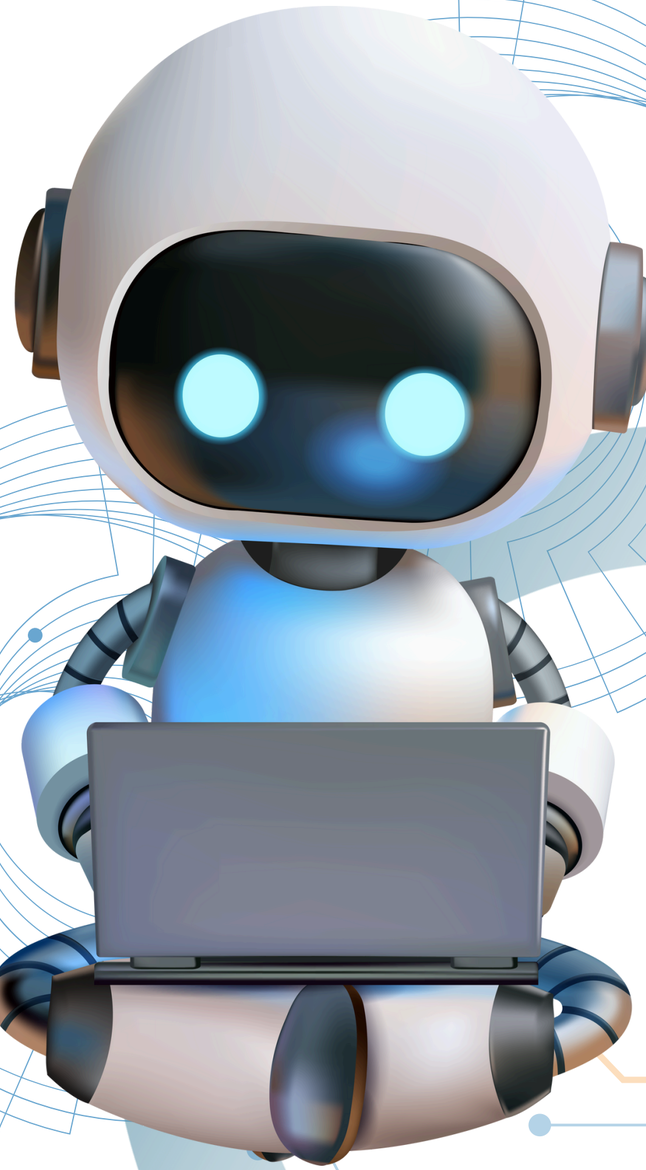
- AUC = 0.52
- ANN struggles to distinguish churners from non-churners
- Reflects strong class imbalance in dataset





KEY FINDINGS

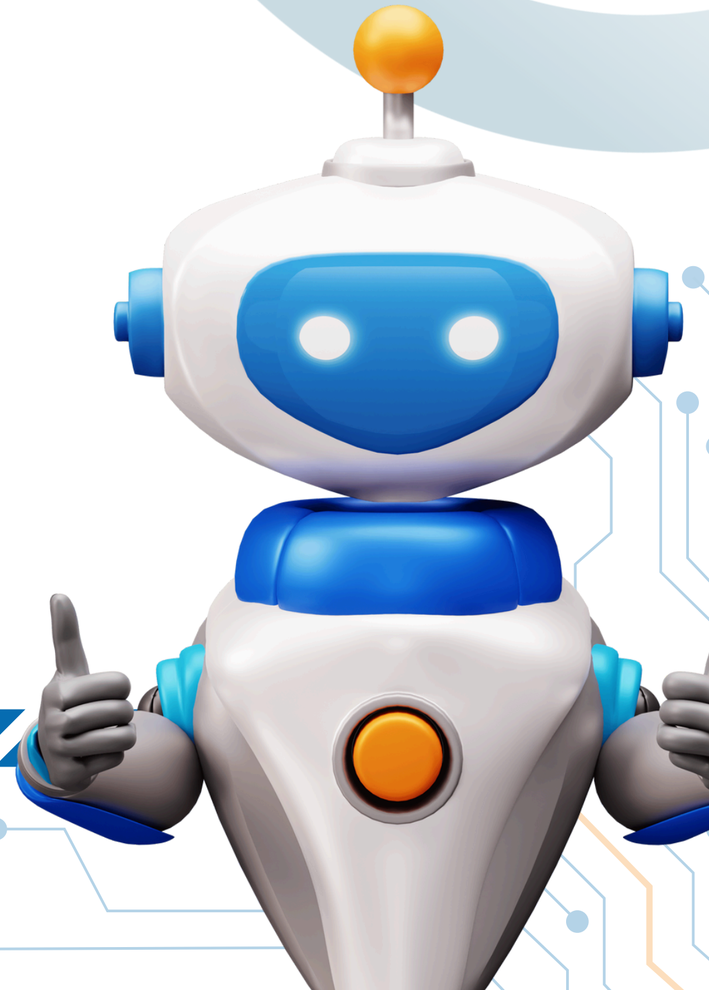
- Model predicts “non-churn” customers accurately
- Fails to detect customers likely to leave
- AI struggles with imbalanced datasets
- Need better features or balancing techniques



BUSINESS IMPACT

- AI can help reduce churn — if trained correctly
- Early detection helps businesses:
- Offer discounts
- Improve customer support
- Prevent loss of loyal customers
- Current model not ready for real-world use
- But project demonstrates important AI foundations

THANK YOU



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