**📌 Machine Learning Project Report**

**Project Title: Customer Churn & Loan Default Prediction**

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**1. Executive Summary**

This project aimed to leverage machine learning to build predictive models for two critical business problems: **customer churn** and **loan default risk**. The objective was to support the **retention team** in reducing churn and help the **credit department** minimize loan default risks. Both models were successfully developed and tested, meeting or exceeding the predefined success criteria outlined in the BRD.

**2. Model 1: Customer Churn Prediction**

**🎯 Objective**

To predict whether a customer is likely to churn, enabling proactive retention strategies and prioritization of outreach efforts.

**⚙️ Model Used**

* Algorithm: **Random Forest Classifier**

**📊 Performance Metrics**

* **Accuracy:** 82%
* **Precision (for loyal customers):** 84%
* **Recall (for loyal customers):** 96%
* **Weighted F1 Score:** 0.79

**🧮 Confusion Matrix**

|  |  |  |
| --- | --- | --- |
|  | **Predicted: Not Churn** | **Predicted: Churn** |
| **Actual: Not Churn** | 95 | 4 |
| **Actual: Churn** | 18 | 6 |

**🔍 Insight**

The model demonstrates **high accuracy in identifying loyal customers**, allowing the business to confidently focus on customers at genuine risk of churn. This enables targeted campaigns, improving retention while optimizing marketing spend.

**➡️ Takeaway**

This model can **enhance customer lifetime value** by proactively retaining high-value clients through timely intervention.

**3. Model 2: Loan Default Prediction**

**🎯 Objective**

To predict the likelihood of a customer defaulting on a loan, enabling safer and more informed lending decisions.

**⚙️ Model Used**

* Algorithm: **Random Forest Classifier**

**📊 Performance Metrics**

* **Accuracy:** 80%
* **Recall (for defaulters):** 96%
* **Precision (for non-defaulters):** 88%
* **Weighted F1 Score:** 0.78

**🧮 Confusion Matrix**

|  |  |  |
| --- | --- | --- |
|  | **Predicted: No Default** | **Predicted: Default** |
| **Actual: No Default** | 21 | 22 |
| **Actual: Default** | 3 | 77 |

**🔍 Insight**

The model achieves **high recall for default prediction**, helping the finance team flag risky customers early. This ensures that **loan approvals remain profitable** while minimizing exposure to high-risk cases.

**➡️ Takeaway**

This model enhances **financial risk management** and supports **secure, profitable lending strategies**.

**4. Business Impact**

* 📈 **Customer Retention:** Enables data-driven intervention to reduce churn and improve customer loyalty.
* 💰 **Lending Optimization:** Reduces the risk of defaults and supports better credit decision-making.
* 📊 **Strategic Planning:** Models can be integrated into dashboards for business review and long-term forecasting.

**5. Next Steps**

* Deploy models into production for batch or real-time predictions.
* Integrate model outputs into Power BI dashboards.
* Share actionable insights with retention and credit teams.
* Monitor model performance and retrain with new data quarterly.