Assignment 12 – AI in Data Science

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Course: Applied Data Science with AI

Week #: 12

Project Title: Customer Churn Prediction

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1. Reading Summary

Reading Material:

- AI in Healthcare – WHO
- AI in Finance – MIT

Key Learnings:

- AI applications in **healthcare** are transforming diagnosis, treatment planning, and patient care through machine learning models that analyze medical images, predict disease progression, and personalize treatment recommendations.
- **Financial institutions leverage AI** for fraud detection, algorithmic trading, credit scoring, risk assessment, and customer service automation, demonstrating how predictive models drive business decisions.
- Both sectors emphasize the importance of ethical AI deployment, data privacy, model interpretability, and regulatory compliance when implementing AI systems that affect human lives and financial outcomes.

Reflection:

- The WHO and MIT readings provided valuable context for understanding how AI techniques similar to those used in my

customer churn prediction project are deployed across critical industries. The healthcare applications demonstrated how predictive models can save lives through early disease detection, while the finance applications showed how temporal models optimize business outcomes.

Classroom Task Documentation

Task Performed:

- Participated in case study discussions analyzing AI implementations in healthcare and finance sectors
- Examined parallels between medical patient outcome prediction and customer churn prediction methodologies

Weekly Assignment Submission

Assignment Title: Industry Application of Customer Churn Prediction

1. Executive Summary

Customer churn prediction has emerged as a critical application of artificial intelligence across multiple industries, with telecommunications, banking, insurance, and subscription-based services leading adoption. The LSTM-based churn prediction model developed in this project demonstrates how advanced deep learning architectures can capture temporal patterns in customer behavior, achieving **81-84% accuracy** with significantly improved **recall (76-82%)** compared to traditional methods. This report explores real-world industry applications, implementation strategies, and the tangible business value delivered by AI-powered churn prediction systems.

2. Industry Applications Across Sectors

2.1 Telecommunications

Telecom companies face annual churn rates of **15–25%**, making AI-driven retention essential. Organizations like Verizon and T-Mobile use models similar to our **LSTM architecture** to analyze call records, network usage, billing trends, and service complaints. When early churn indicators appear

(reduced usage, poor service experience, payment delays), automated retention strategies—discounts, upgrades, or priority support—are triggered.
LSTMs are ideal here because customer dissatisfaction typically builds gradually over multiple months.

2.2 Banking and Financial Services

Banks apply churn prediction across credit cards, savings accounts, and investment products. **RNN-based systems** evaluate transaction history, balance trends, and service engagement. Early signs—declining activity or lower balances—enable banks to prevent attrition through offers like fee waivers, personalized advice, or loyalty rewards. Since acquiring new customers **costs 5–7×** more than retaining them, accurate prediction directly increases profitability.

2.3 Subscription-Based Services

Netflix, Spotify, Adobe, and fitness apps rely heavily on churn modeling to maintain subscriber retention. They analyze viewing patterns, feature engagement, and payment consistency. Temporal models help detect upcoming cancellations (e.g. drop in watch time). The masking and variable-length handling in our LSTM architecture aligns perfectly with real subscription behavior.

3. Implementation Strategy & Business Integration

3.1 Data Infrastructure

Effective deployment requires integrated data pipelines combining **CRM** logs, billing, interactions, and product usage metrics. The sequential features engineered in our project (monthly charges, service evolution, payment patterns) can be automated using ETL pipelines on cloud platforms like **AWS, GCP, or Azure.**

3.2 Deployment & Real-Time Scoring

Companies deploy **LSTM** models using Docker/Kubernetes and implement:

- Batch scoring (monthly churn prediction)
- Real-time scoring (during renewals or complaint calls)

Model outputs feed into marketing automation systems. High-risk customers receive immediate retention interventions, whereas moderate-risk customers enter automated outreach workflows.

3.3 Business Impact

Reducing churn by **even 5%** can increase profits by **25–95%.**
With **76–82% recall**, our model detects the majority of potential churners, enabling financially beneficial retention campaigns. Even with some false positives **(72–78% precision),** the return on investment remains strong due to high customer lifetime value.

4. Advanced Considerations & Future Directions

4.1 Ethics & Explainability

Regulations such as **GDPR and CCPA** require transparent automated decisions. Tools like **SHAP or LIME** help explain which sequential behaviors influenced churn scores, ensuring fairness and compliance.

4.2 Continuous Learning

Customer behavior changes over time, so companies use MLOps pipelines for periodic model retraining and A/B testing. Future approaches may use transformer-based architectures with attention mechanisms for even stronger long-term memory and accuracy.

5. Conclusion

This project demonstrates how **LSTM-based** churn prediction models bring significant business value by capturing temporal customer behavior. The improved accuracy and recall translate into stronger retention, reduced revenue loss, and more informed decision-making. As AI advances, organizations will incorporate multimodal data and real-time analytics to build even more effective churn prediction systems, solidifying their role in customer relationship management.

GitHub Link:

https://github.com/Rabia-Abdul-Sattar/Customer-Churn-Prediction