Financial Operations Analytics

Revenue Forecasting, Churn & Profitability Analysis

A Comprehensive End to End Financial Analytics Project

Duration: 2-3 Hours | Recorded Lectures Available

@ashoks773

@ashoks773

@sharma-ak

Instructor: Dr. Ashok Kumar Sharma
Bioinformatics Scientist (Senior Data Analyst)
Cedars Sinai Medical Center, Los Angeles, CA

Personal webpage:
https://ashoks773.github.io

Tools: Python | Pandas | Scikit-learn | Prophet | Statsmodels

Follow: @datawithashok

YouTube

Project Overview

1. **Revenue Forecasting**
   - Predict monthly/quarterly revenue
   - Identify seasonal patterns and trends
   - Support strategic financial planning
2. **Customer Churn Analysis**
   - Identify at-risk customers before they churn
   - Calculate customer lifetime value (CLV)
   - Reduce churn through targeted interventions
3. **Profitability Analysis**
   - Segment customers by profitability
   - Optimize pricing and resource allocation
   - Maximize ROI across customer cohorts

Financial customers

customer_id	signup_date	segment	industry	country	plan	mrr	contract_len	number_of_u	support_tick	usage_score	nps_score	churn_date	i
CUST_00000	1/31/23	Startup	Healthcare	Other	Basic	49	24	3	2	53	7		
CUST_00000	12/30/23	Startup	Retail	USA	Basic	49	12	4	1	55	60		
CUST_00000	5/10/22	Small Busine	Retail	Other	Professional	149	12	8	1	52	7	3/22/24	
CUST_00000	7/18/23	Startup	Retail	USA	Business	399	1	1	3	54	17		
CUST_00000	2/4/23	Startup	Technology	USA	Business	399	12	2	0	55	100		
CUST_00000	12/31/22	Small Busine	Retail	UK	Basic	49	12	6	1	45	-11		
CUST_00000	9/20/24	Small Busine	Other	Canada	Professional	149	1	5	2	50	9		
CUST_00000	11/10/22	Startup	Finance	USA	Business	399	24	4	3	68	3		
CUST_00000	6/26/24	Enterprise	Manufacturir	USA	Professional	149	1	407	2	44	94		
CUST_00001	5/1/20	Startup	Retail	Australia	Basic	49	12	1	3	71	-22		
CUST_00001	4/11/21	Mid-Market	Real Estate	Other	Business	399	12	34	3	33	64		
CUST_00001	5/23/23	Small Busine	Real Estate	USA	Basic	49	36	5	0	71	-34		

Financial transactions

transaction_	customer_id	transaction_	amount	transaction_	status	payment_me	year_month	cohort_mont	transaction_
CUST_00000	CUST_00000	1/31/23	52.78	New	Completed	Credit Card	2023-01	2023-01	2023-01
CUST_00000	CUST_00000	2/28/23	52.87	Subscription	Completed	Credit Card	2023-02	2023-01	2023-02
CUST_00000	CUST_00000	3/28/23	52.84	Subscription	Completed	Credit Card	2023-03	2023-01	2023-03
CUST_00000	CUST_00000	4/28/23	53.22	Subscription	Completed	Credit Card	2023-04	2023-01	2023-04
CUST_00000	CUST_00000	5/28/23	51.86	Subscription	Completed	Wire Transfe	2023-05	2023-01	2023-05
CUST_00000	CUST_00000	6/28/23	47.05	Subscription	Completed	PayPal	2023-06	2023-01	2023-06
CUST_00000	CUST_00000	7/28/23	49.53	Subscription	Completed	Wire Transfe	2023-07	2023-01	2023-07
CUST_00000	CUST_00000	8/28/23	47.83	Subscription	Completed	Credit Card	2023-08	2023-01	2023-08
CUST_00000	CUST_00000	9/28/23	48.12	Subscription	Completed	Credit Card	2023-09	2023-01	2023-09
CUST_00000	CUST_00000	10/28/23	69.56	Subscription	Completed	Credit Card	2023-10	2023-01	2023-10
CUST_00000	CUST_00000	11/28/23	45.58	Subscription	Completed	ACH	2023-11	2023-01	2023-11
CUST_00000	CUST_00000	12/28/23	51.68	Subscription	Completed	ACH	2023-12	2023-01	2023-12

Monthly revenue

year_month	total_revenu	num_transac	avg_transact	unique_custo	revenue_grov	month	quarter	is_q4
1/1/20	21878.65	97	225.553093	97		1	1	0
2/1/20	42934	173	248.17341	173	96.2369707	2	1	0
3/1/20	55509	239	232.25523	239	29.2891415	3	1	0
4/1/20	75856.8	314	241.582166	314	36.6567584	4	2	0
5/1/20	104698.22	409	255.985868	409	38.0208762	5	2	0
6/1/20	118719.53	479	247.848706	479	13.3921188	6	2	0
7/1/20	136785.25	560	244.259375	560	15.2171425	7	3	0
8/1/20	152817.37	639	239.150814	639	11.7206497	8	3	0
9/1/20	173125.54	714	242.472745	714	13.2891765	9	3	0
10/1/20	192940.47	784	246.097538	784	11.4454112	10	4	1
11/1/20	204928.68	845	242.519148	845	6.21342428	11	4	1
12/1/20	233216.37	928	251.310744	928	13.8036755	12	4	1

🎯 PROJECT

Example 1

1. Revenue Forecasting "Predicting the company's income"

Look at last month's sales?

That's correct: Revenue forecasting means **predicting future earnings** using past data.
It helps businesses plan budgets, set goals, and make smarter investments.

Example:

- If Netflix sees that subscriptions usually increase by 10% during holidays, it can **forecast** higher revenue in December.
- If a SaaS company earns $100,000 this month and has been growing 5% each month, it can **predict $105,000** next month.

Common tools & methods:
ARIMA or Prophet models : help predict future trends from past data.
Exponential smoothing : gives more weight to recent data.
Seasonality checks : catch repeating patterns (like holiday spikes).

Example 2

2. Churn Analysis — “Why customers leave you”

That’s Chrun: **Customer churn** means customers who **stop buying or unsubscribe**.
Churn analysis helps find out:

- Who is likely to leave?
- Why they might leave?
- What can we do to keep them?

Example:

•A telecom company notices customers with frequent network issues are leaving.
•A bank sees users with low account activity eventually close their accounts.

Common tools & methods:

•**Logistic Regression:** Predicts yes/no: will this customer churn?
•**Random Forest & Gradient Boosting:** Advanced models that find hidden churn signals.
•**RFM & Cohort Analysis:** Groups customers by behavior and tracks retention.

Example 3

3. Profitability Analysis — "Where are we really making (or losing) money?"

Exactly — revenue ≠ profit.

it measures which customers, products, or regions **actually bring profit**,
and which are **costing money**.

- A company finds small customers generate lots of support tickets → low profit.
- Premium clients bring fewer issues but higher revenue → high profit.
  So they decide to **focus on high-value clients**.

Tools & techniques:

•**Regression models** : Understand what drives profit.

•**Feature importance** : Identify which factors (cost, discount, marketing spend) impact profit.

•**Monte Carlo Simulation** : Test "what if" profit scenarios (e.g., if prices change).

Real-world mini-examples for class discussion

Scenario	Technique	Questions?
Netflix wants to predict next month's subscribers	Revenue Forecasting	What data would you use?
A bank is losing customers after fee increase	Churn Analysis	How can they detect this early?
An e-commerce store sells hundreds of items but low margin	Profitability Analysis	How can they find what's really profitable?

Analytics Techniques Covered

Time Series Analysis

- ARIMA/SARIMA Models
- Facebook Prophet
- Exponential Smoothing
- Seasonality

Cohort & Retention Analysis

- Cohort-based Revenue Tracking
- Retention Rate Calculations
- Customer Lifetime Value (CLV)
- RFM Segmentation

Decomposition Regression Analysis

- Linear Regression (Revenue Drivers)
- Logistic Regression (Churn Prediction)
- Random Forest & Gradient Boosting
- Feature Importance Analysis

Advanced Techniques

- Customer Segmentation (K-Means)
- Survival Analysis
- Monte Carlo Simulation

Project Workflow

Phase 1: Data Acquisition & Understanding

- Load financial transaction data
- Data quality assessment
- Exploratory data analysis
- Define business questions

Phase 2: Data Preprocessing

- Handle missing values & outliers
- Feature engineering
- Time series preparation
- Create cohort structures

Phase 3: Revenue Forecasting

- Time series decomposition
- ARIMA/Prophet modeling
- Model validation & selection
- Generate forecasts with confidence intervals

Phase 4: Churn Analysis

- Define churn metrics
- Build predictive models
- Calculate CLV
- Risk stratification

Phase 5: Profitability & Cohort Analysis

- Customer segmentation
- Cohort retention analysis
- RFM analysis
- Profitability optimization

Phase 6: Reporting & Documentation

- Executive dashboard
- Business recommendations
- GitHub documentation

📋 END-TO-END

Deliverables

Technical Deliverables

- Clean, documented Python code
- Professional visualizations
- 3 trained ML models (ARIMA, Prophet, Random Forest)
- Interactive dashboards
- Comprehensive Jupyter notebooks

Business Deliverables

- Revenue forecast: Next 12 months
- Churn prediction model: >75%+ accuracy
- Customer segments: 5-7 actionable groups
- Profitability analysis by cohort
- Executive summary report

Documentation

- GitHub repository with README
- Technical methodology document
- Business insights presentation
- Data dictionary
- Model performance reports

Expected Outcomes & Skills

Technical Skills

- Time series forecasting (ARIMA, Prophet, SARIMA)
- Advanced regression techniques
- Customer analytics (CLV, RFM, cohorts)
- Data visualization mastery
- Model evaluation & selection

Business Skills

- Financial metrics interpretation
- Strategic recommendations
- Stakeholder communication
- ROI quantification
- Data-driven decision making

Career Impact

- Portfolio-ready project for interviews
- Real-world business problem solving
- End-to-end analytics experience
- GitHub presence for recruiters
- Presentation-ready materials

GitHub

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## 📊 Project Overview

A comprehensive end-to-end financial analytics project covering revenue forecasting,

### 🎯 Business Objectives

1. **Revenue Forecasting** - Predict future revenue with 90%+ accuracy using time se
2. **Churn Prediction** - Identify at-risk customers before they leave
3. **Profitability Analysis** - Segment customers and optimize resource allocation
4. **Cohort Analysis** - Track customer behavior and retention over time

### 💡 Key Results

- 📈 **Revenue Forecast**: ${forecast.sum():,.0f} predicted for next 12 months
- 🎯 **Churn Model Accuracy**: {churn_results[best_churn_model_name]['roc_auc']:.1%}
- 💰 **Identified Value**: ${at_risk_mrr * 12:,.0f} annual revenue at risk
- 👥 **Customer Segments**: {optimal_k} distinct groups with targeted strategies

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## 📁 Project Structure
```

```
financial-operations-analytics/
│
├── financial_customers.csv           # Customer master data
├── financial_transactions.csv        # Transaction history
├── monthly_revenue.csv               # Aggregated monthly metrics
│
├── financial_analytics.py            # Complete analysis script
├── EXECUTIVE_SUMMARY_FINANCIAL.txt   # Executive report
├── kpi_summary.txt                   # Key metrics summary
│
├── at_risk_customers.csv             # High churn risk list
├── rfm_segmentation.csv              # RFM customer segments
│
├── financial_viz/                    # All visualizations (16 files)
│   ├── 01_initial_exploration.png
│   ├── 02_ts_decomposition.png
│   ├── 03_acf_pacf_analysis.png
│   ├── 04_arima_forecast.png
│   ├── 05_prophet_forecast.png
│   ├── 06_prophet_components.png
│   ├── 07_churn_analysis.png
│   ├── 08_churn_model_evaluation.png
│   ├── 09_churn_feature_importance.png
│   ├── 10_risk_stratification.png
│   ├── 11_cohort_retention.png
│   ├── 12_revenue_cohorts.png
│   ├── 13_rfm_analysis.png
│   ├── 14_clv_analysis.png
│   ├── 15_profitability_dashboard.png
│   └── 16_FINAL_EXECUTIVE_DASHBOARD.png
│
├── README.md                         # This file
└── requirements.txt                  # Python dependencies
```