Introduction to ERS

Credit Card Delinquency Watch

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PROJECT: HDFC CAPSTONE PROJECT

A Lightweight, Data-Driven Framework for Early Delinquency Detection

Tool: Built using Python + Streamlit

- Credit card delinquency is a major financial risk for banks.
- Most banks detect risk after payments are missed.
- This project builds an early warning system to flag customers before they become delinquent.
- A working prototype web app was built using Python, Pandas, and Streamlit.
- ERS generates risk tiers (Low/Medium/High) + outreach recommendations.

Problem Statement

- Banks observe early clues in customer behaviour (spend drop, high utilisation, low payments).
- These early signals are not used effectively for proactive intervention.
- Existing systems rely on lag indicators like:
- Missed payments
- Over-limit accounts
- High DPD (Days Past Due)
- By the time a customer becomes delinquent, roll-rate progression is already high.

GOAL : **We need a lightweight system to identify early risk patterns and reduce roll-rates.**

ANALYZING:

- Credit cards contribute to bank revenue through:
  - NII (Net Interest Income)
  - NFI (Fees & charges)
- Defaults reduce profitability and increase collection costs.
- Customer behaviour changes before a missed payment.
- Early outreach improves:
  - Recovery
  - Customer satisfaction
  - Financial discipline

Project Objective+Innovative

- Build a lightweight, rule-based Early Risk Signal (ERS) model.
- Detect customers likely to enter delinquency before it happens.
- Provide risk flags + risk score + risk tier.
- Generate simple outreach actions for bank staff.
- Present results via a user-friendly web application.
- Keep solution scalable & easy to automate.

Dataset & Features

keycolumns:

- Utilisation %
- Avg Payment Ratio
- Min Due Payment Frequency
- Merchant Mix Index
- Cash Withdrawal %
- Recent Spend Change %
- DPD Bucket Next Month

These behavioural metrics help identify stress in spending, repayment and credit usage.

ERS Scoring Model

- ERS is rule-based, not ML (easy to explain & deploy).
- Each behavioural pattern contributes points.
- Total score determines the risk tier.

Pattern	Condition	Points
P1: Utilisation	Util ≥ 90%	+3
P2: Low Commitment	Payment Ratio ≤ 40%	+2
P3: Min Payment Trap	Min Due Frequency ≥ 75%	+2
P4: Liquidity Stress	Cash Withdrawal ≥ 15%	+1
P5: Sudden Spend Drop	Spend Change ≤ -20%	+2
P6: Concentrated Spending	Merchant Mix ≤ 0.30	+1
P7: Prior DPD	Past DPD > 0	+2
P8: Over-limit	Utilisation > limit	+2

System Architecture (Logical Design)

User Uploads CSV →
Data Cleaning →
Feature Engineering→
ERS Scoring →
Risk Tiering →
Dashboard →
Outreach Log

Technology Stack

- Python → Core processing
- Pandas → Data cleaning & scoring
- Numpy → Calculations
- Streamlit → Web UI
- Plotly → Charts
- AgGrid → Table display
- session_state → State management
- CSV → Input & Output

Resources needed:

- Laptop
- Python 3.11
- Streamlit installed
- VS Code / Terminal

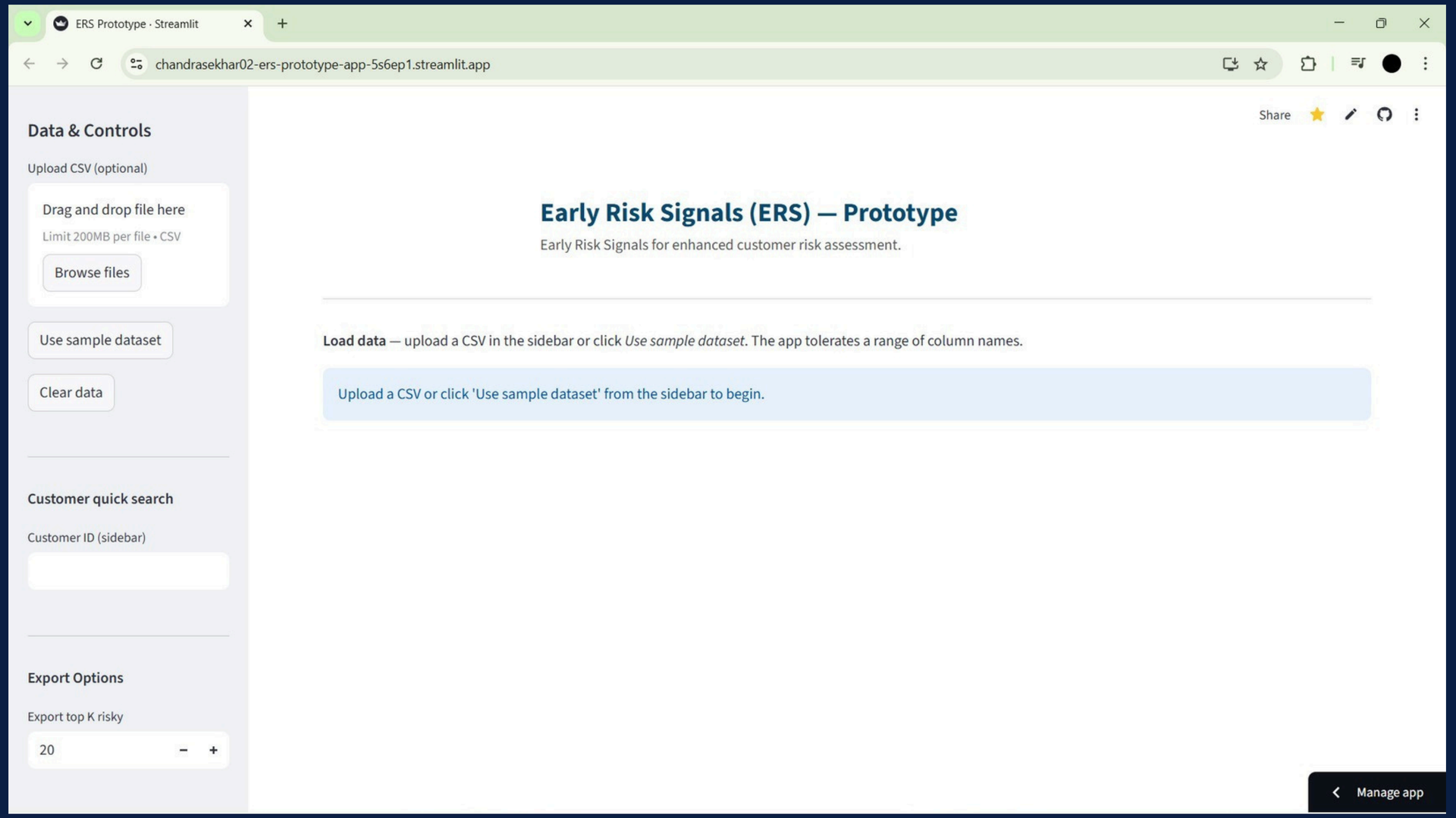
Features of ERS Web Application

- Upload customer dataset
- Clean & standardise column names
- Calculate ERS score & risk tier
- Visual dashboards:
- Risk distribution pie chart
- ERS vs Utilisation scatter plot
- Customer lookup panel
- Recommended actions
- Outreach logging (CSV export)
- Top-K risky customer export

App Screenshots

- Home page
- Overview tab
- Customer tab
- Risk tier color badges
- Logs tab

>>>


ERS Prototype · Streamlit
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Data & Controls
Upload CSV (optional)
Drag and drop file here
Limit 200MB per file • CSV
Browse files
Use sample dataset
Clear data
Customer quick search
Customer ID (sidebar)
Export Options
Export top K risky
20
Share
Early Risk Signals (ERS) — Prototype
Early Risk Signals for enhanced customer risk assessment.
Load data — upload a CSV in the sidebar or click Use sample dataset. The app tolerates a range of column names.
Upload a CSV or click 'Use sample dataset' from the sidebar to begin.
Manage app

ERS Prototype · Streamlit

chandrasekhar02-ers-prototype-app-5s6ep1.streamlit.app

Share

Data & Controls

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Drag and drop file here

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Export top K risky

20

Overview Customer Logs

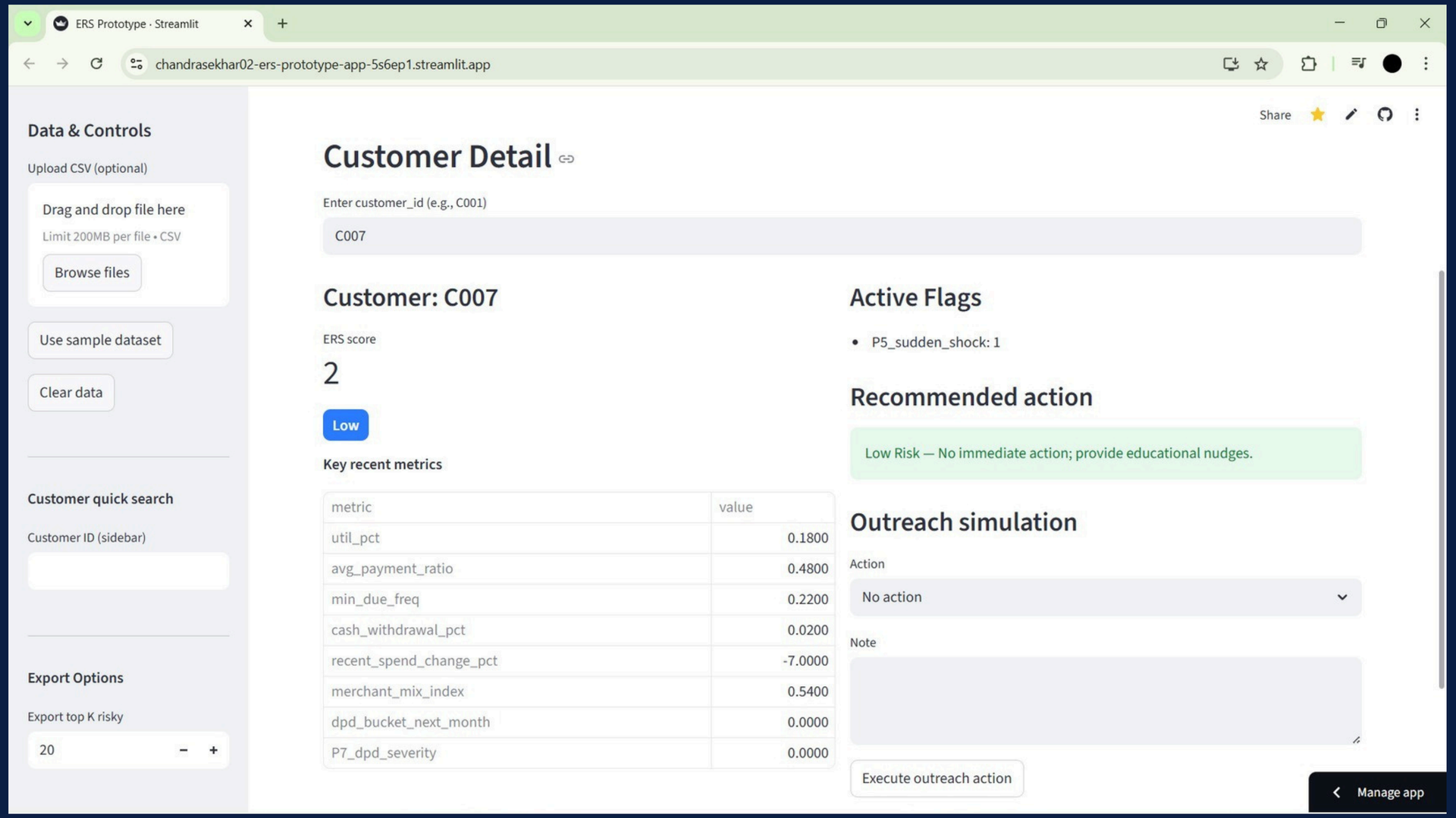
Overview

Total customers	High risk	Medium risk	Low risk
100	17	25	58

Risk tier distribution

Risk Tier Distribution

Manage app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20
Customer Detail
Enter customer_id (e.g., C001)
C007
Customer: C007
ERS score
2
Low
Key recent metrics
metric value
util_pct 0.1800
avg_payment_ratio 0.4800
min_due_freq 0.2200
cash_withdrawal_pct 0.0200
recent_spend_change_pct -7.0000
merchant_mix_index 0.5400
dpd_bucket_next_month 0.0000
P7_dpd_severity 0.0000
Active Flags
P5_sudden_shock: 1
Recommended action
Low Risk — No immediate action; provide educational nudges.
Outreach simulation
Action
No action
Note
Execute outreach action
Manage app

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Risk Tier Distribution

Upload CSV (optional)

Drag and drop file here

Limit 200MB per file • CSV

Browse files

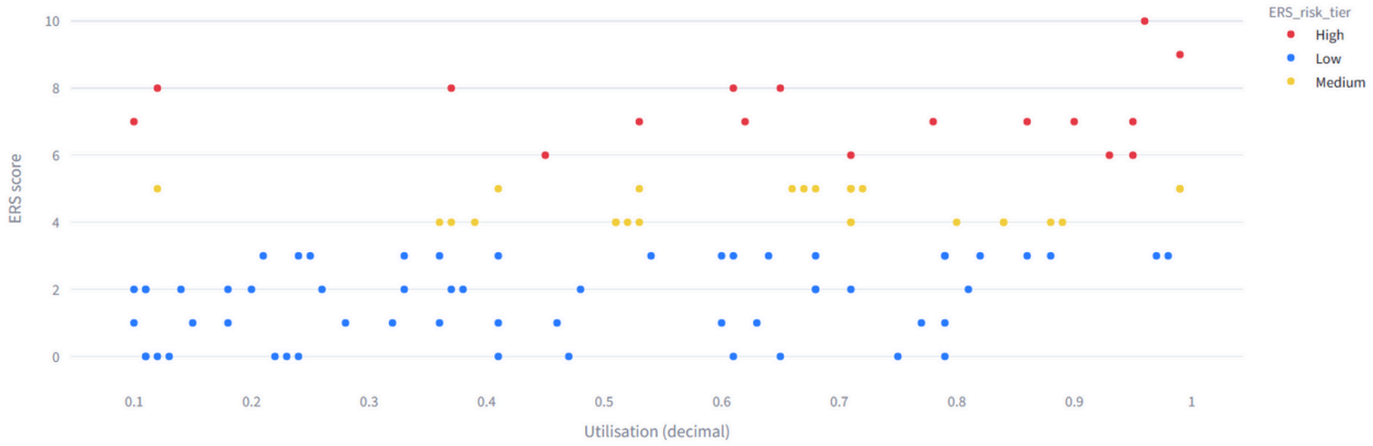
Use sample dataset

Clear data

Customer quick search

Customer ID (sidebar)

ERS Score vs Utilisation



Top risky customers (by ERS score)

Upload CSV (optional)

Drag and drop file here

Limit 200MB per file • CSV

Browse files

Use sample dataset

Clear data

Customer quick search

Customer ID (sidebar)

Early Risk Signals (ERS) — Prototype

Early Risk Signals for enhanced customer risk assessment.

Load data — upload a CSV in the sidebar or click *Use sample dataset*. The app tolerates a range of column names.

Overview Customer Logs

Outreach Logs

Recent outreach actions (latest 10)

	timestamp	customer_id	ERS_score	ERS_tier	action	note
1	2025-12-03T19:52:25.541205	C020	1	Low	Send SMS (log)	
0	2025-12-01 16:59:46.808134	C001	3	Low	Call & log note	

Browse files

Use sample dataset

Clear data

Customer quick search

Customer ID (sidebar)

Export Options

Export top K risky

20 − +

Portfolio table

	customer_id	credit_limit	util_pct	avg_payment_ratio	dpd_bucket_next_month	P7_dpd_severity	ERS_score	ERS_risk_tier
0	C001	165000	0.12	0.32	3	4	8	High
1	C002	95000	0.1	0.49	0	0	1	Low
2	C003	60000	0.14	0.88	0	0	2	Low
3	C004	125000	0.99	0.65	0	0	5	Medium
4	C005	115000	0.23	0.48	0	0	0	Low
5	C006	135000	0.36	0.96	0	0	4	Medium
6	C007	75000	0.18	0.48	0	0	2	Low
7	C008	75000	0.88	0.49	0	0	3	Low
8	C009	140000	0.24	1	0	0	0	Low
9	C010	200000	0.99	0.81	1	2	9	High

Validation & Testing:

- Verifiedscoring logicwithsample dataset.
- Cross-checked high-risk customers with high utilisation + spend drop + DPD.
- Tested multiple CSV formats (column name variations).
- User tests for customer lookup & outreach logging.

Stress-tested corner cases:

- Missing values
- Empty rows
- Non-numeric inputs

Innovation & Business Impact

- Converts raw credit card data into actionable early signals.
- Helps reduce delinquency roll-rates.
- Improves customer communication & financial discipline.
- Lightweight prototype that can scale to production.
- Gives banks a proactive, not reactive, risk view.

Future Enhancements

- Integrate bank authentication (login).
- Connect database instead of CSV.
- Automate daily scoring via scheduler.
- Send real SMS / in-app notifications.
- Add machine learning risk prediction model.
- Deploy on cloud (AWS / GCP).

Conclusion

- Built a fully functioning Early Risk Signal System.
- Accurate, interpretable, and easy to use.
- Provides meaningful insights for early intervention.
- Demonstrates strong technical + analytical + UI design skills.

Thank You!