# Project Overview

## Problem Statement

Managing recurring bills and subscriptions is a major financial challenge for many Americans. The average American spends about $90 per month (~$1,080/yr) on subscriptions, with roughly 14–20% of that total wasted on ghost subscriptions (Goldsmith). In fact, a 2025 survey found that 85.7% of respondents had at least one unused subscription at any given time (Self Financial).

The issue extends beyond subscriptions to recurring bills. According to the Federal Reserve, 17% of Americans did not pay all of their bills in full in the prior month, with this reaching 36% in lower-income groups versus 6% in higher-income households (Board of Governors of the Federal Reserve System).

To address these challenges, I introduce to you, Derin. Derin is a CLI-based AI financial companion that leverages pattern recognition and statistical anomaly detection to help users track and analyze recurring bills, identify unusual charges, and gain clearer insight into their finances.

## Core Features

- Bill Detection: Automatically identifies recurring bills from transaction data
- Smart Alerts: Detects unusual price increases using robust statistical analysis
- Subscription Analysis: Identifies and categorizes subscription services
- Due Date Tracking: Monitors upcoming bill payments

## Tech Stack

- Language: Python 3
- Libraries: sentence-transformers, click & python-dateutil
- Data Storage: Stored Locally in JSON files (~/.derin_bills.json)

## Key Algorithms

- Bill Detection: Pattern matching on transaction names and date intervals (25-35 days)
- Anomaly Detection: Robust z-score using Median Absolute Deviation (MAD)
- Bill Classification: Rule-based categorization using merchant name keywords

## AI Implementation

- Merchant Normalization with NLP Embeddings (HuggingFace/pyTorch)
- Pattern Recognition AI - Recurring Bill Detection using time patterns and a variance threshold for price changes
- Rule Based AI - Bill trends and bill type classification
- Statistical AI - z-scores with MAD to flag outliers

## Future Implementations

- Fine tuning Merchant Normalization
- AI-Powered Insights: OpenAI integration for personalized financial advice
  - AI to scan transactions and provide insights for spending habits
- Bank Integration: Plaid API for real transaction data
- Mobile App: Cross-platform mobile application
- Advanced Analytics: Machine learning for spending pattern prediction

# Works Cited

Goldsmith, Marlisa. "Unused Subscriptions Costing Americans Hundreds Annually, Survey Says." *FOX 35 Orlando*, 3 July 2025, [fox35orlando.com/news/unused-subscriptions-costing-americans-hundreds-annually-survey-says](fox35orlando.com/news/unused-subscriptions-costing-americans-hundreds-annually-survey-says).

Board of Governors of the Federal Reserve System. *Report on the Economic Well-Being of U.S. Households in 2023 – May 2024*. Federal Reserve, May 2024, [federalreserve.gov/publications/2024-economic-well-being-of-us-households-in-2023-expenses.htm](federalreserve.gov/publications/2024-economic-well-being-of-us-households-in-2023-expenses.htm).

Self Financial. "The Cost of Unused Paid Subscriptions." *Self Financial*, 2025, www.self.inc/info/cost-of-unused-paid-subscriptions/.