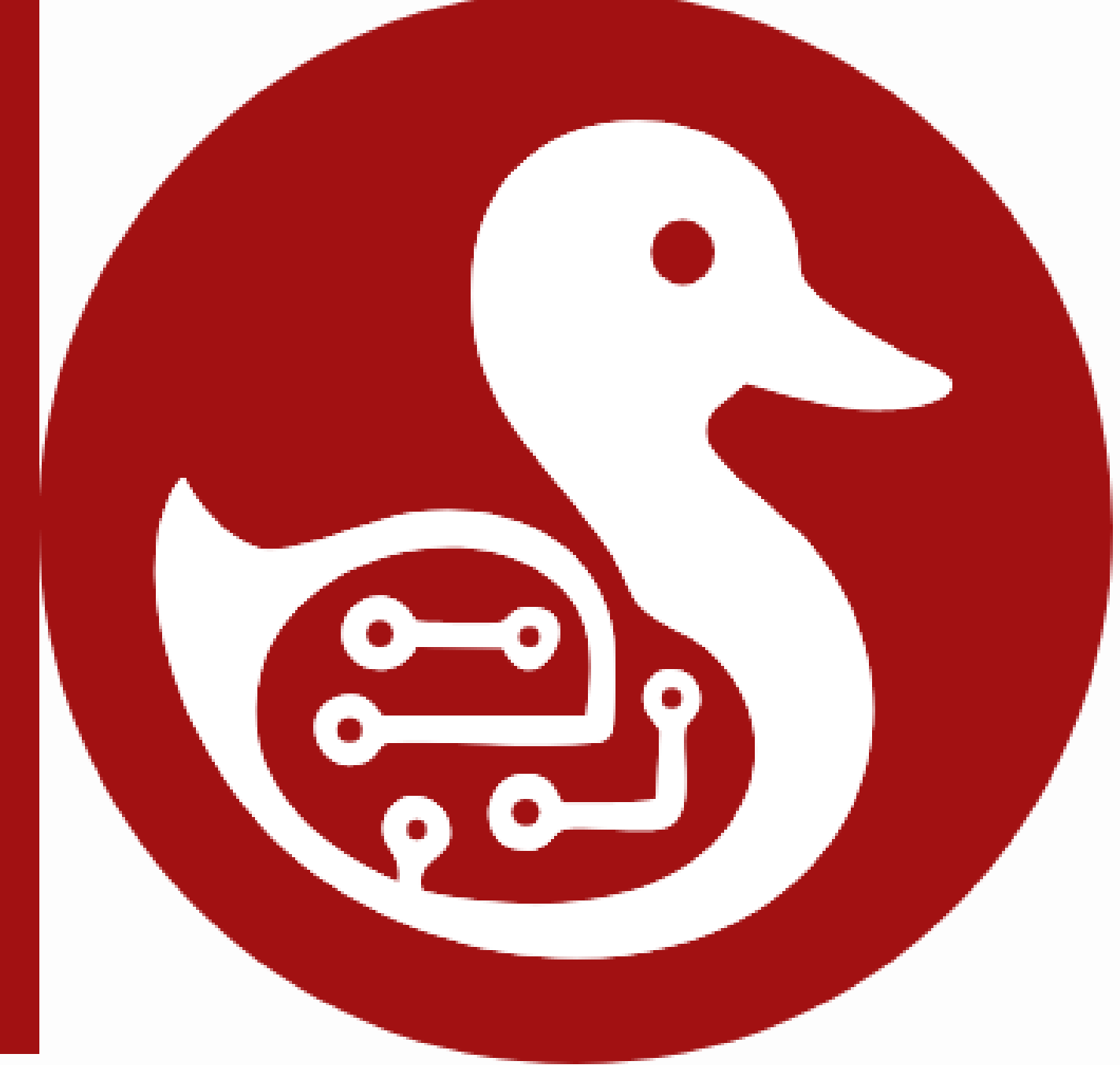# PREDICTING EMPLOYEE ATTRITION USING REINFORCEMENT LEARNING | DEMI

EE 595-B GROUP 10 : CODE BROS | EDEN CHARLES, DRISHTI PAREKH, MEETKUMAR GAJERA

An AI-powered system that predicts employee attrition and recommends the most cost-effective intervention to maximize retention.

PROBLEM STATEMENT :

Employee attrition is costly, unpredictable, and influenced by multiple HR factors.

This system uses supervised learning & reinforcement learning to:
- Predict attrition risk
- Simulate future employee outcomes
- Recommend cost-effective retention strategies

IMPORTANCE :

Employee attrition imposes substantial financial and operational costs. Traditional HR methods lack the ability to anticipate risk and select effective interventions. A predictive, data-driven system is essential to improve retention, reduce turnover costs, and support informed organizational decision-making.

GOAL

To build a unified ML+RL system that:

Predicts employee attrition risk, simulates the impact of potential HR actions,
Recommends the optimal intervention based on long-term business value.

RL ENVIRONMENT SIMULATION

Simulates how each HR intervention influences attrition probability for an employee.
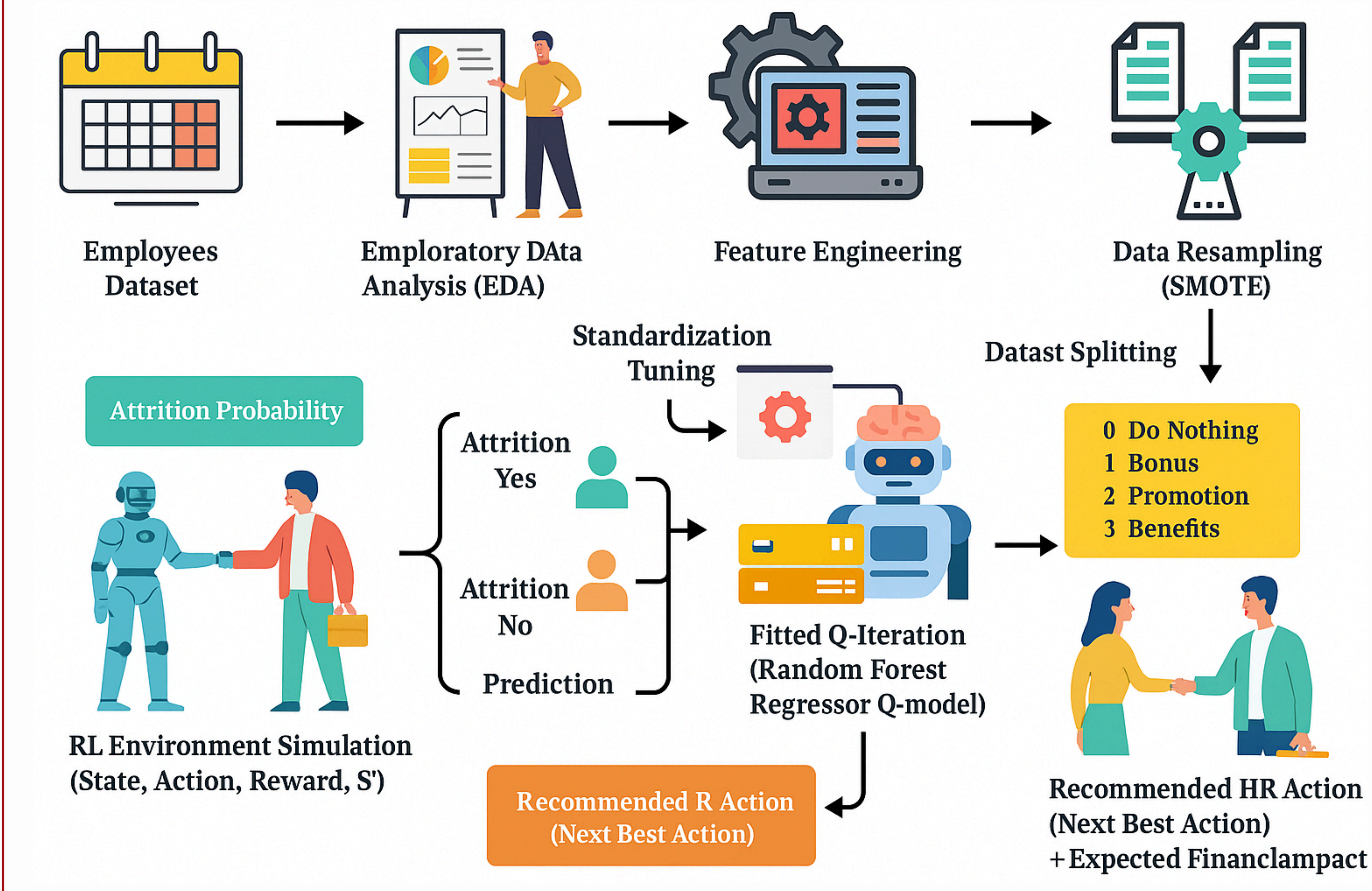- **Actions Modeled:**
0 - DO NOTHING | 1 - SMALL BONUS | 2 - PROMOTION | 3 - BENEFITS PACKAGE
- **Reward Function:**
Reward = (Retention Probability x Employee Value) - Action Cost.
* This creates a structured set of transitions: (state, action, reward, next state, done) to train the RL agent

SYSTEM ARCHITECTURE

Employees Dataset → Emploratory DAta Analysis (EDA) → Feature Engineering → Data Resampling (SMOTE)

Attrition Probability

Standardization Tuning

Datast Splitting

Attrition Yes / Attrition No → Prediction

Fitted Q-Iteration (Random Forest Regressor Q-model)

0 Do Nothing
1 Bonus
2 Promotion
3 Benefits

RL Environment Simulation (State, Action, Reward, S')

Recommended R Action (Next Best Action)

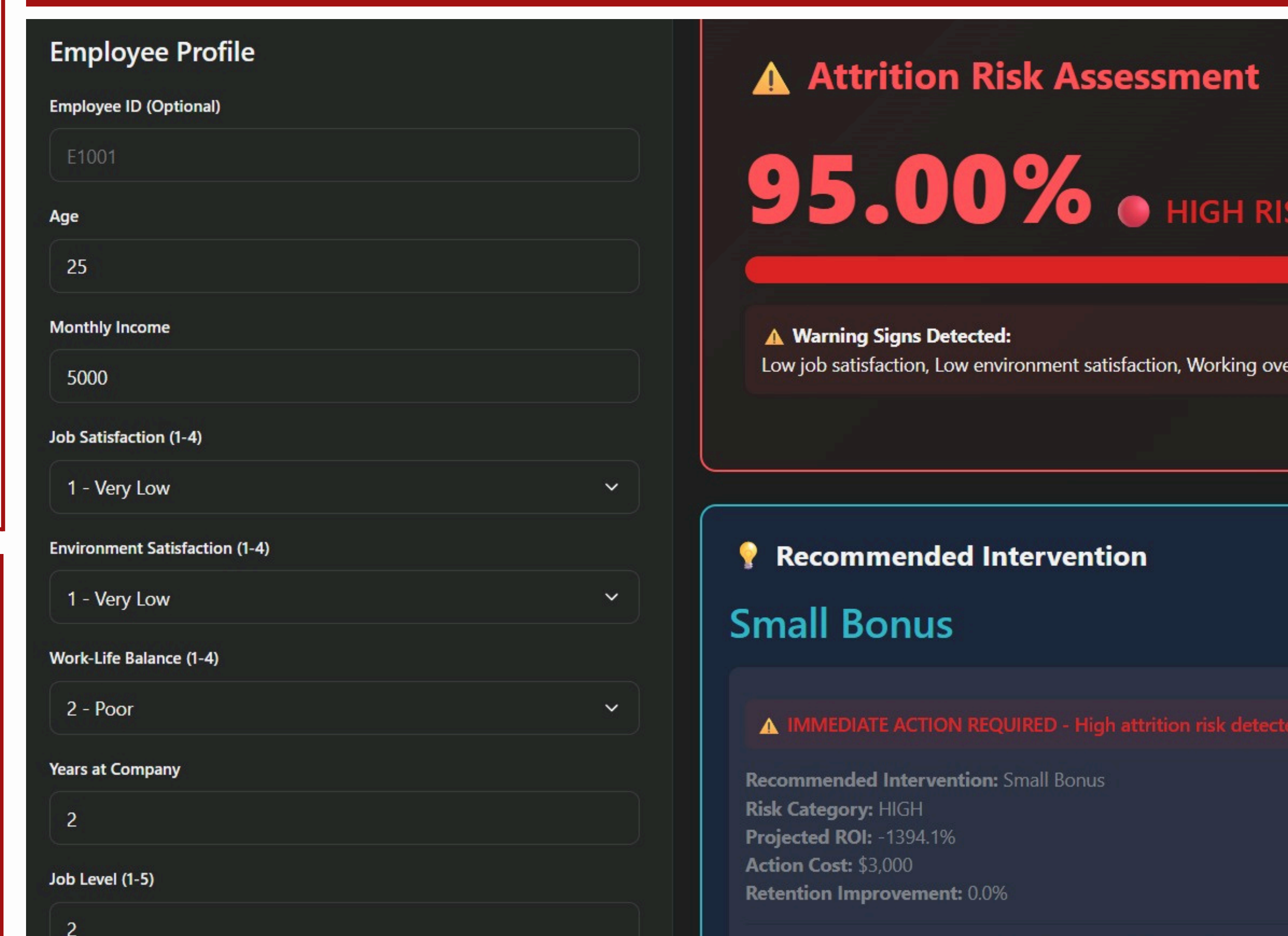Recommended HR Action (Next Best Action) + Expected Financlampact

DATASET

IBM HR Analytics Employee Attrition Dataset
1,470 Employees & 35+ features that describes
- Demographics, Job Attributes, Experience, Compensation, HR Metrics, Attrition (Yes/No)

FITTED Q - ITERATION (FQI)

A batch reinforcement learning method used to learn the *long-term value* of each HR action.
Model:
The Q-function was approximated using a *Random Forest Regressor*.
Iterative Update Rule:
$$Q(s,a) = R + \gamma \max_{a'} Q(s',a')$$
Outcome:
The model determines the *optimal next-best HR intervention* for each employee state, maximizing long-term retention value while minimizing cost.

DASHBOARD OUTPUT

Employee Profile

Employee ID (Optional)
E1001

Age
25

Monthly Income
5000

Job Satisfaction (1-4)
1 - Very Low

Environment Satisfaction (1-4)
1 - Very Low

Work-Life Balance (1-4)
2 - Poor

Years at Company
2

Job Level (1-5)
2

⚠️ **Attrition Risk Assessment**

95.00% ● HIGH RISK

⚠️ **Warning Signs Detected:**
Low job satisfaction, Low environment satisfaction, Working overti

💡 **Recommended Intervention**

Small Bonus

⚠️ IMMEDIATE ACTION REQUIRED - High attrition risk detected
Recommended Intervention: Small Bonus
Risk Category: HIGH
Projected ROI: -1394.1%
Action Cost: $3,000
Retention Improvement: 0.0%

OUTPUT

Recommended Action + Expected Financial Impact + Attrition Probability Change"
Delivered through a **Flask dashboard** that enables HR users to:
- Upload employee data
- View attrition risk
- Receive the next best action recommendation

CONCLUSION

Conclusion
This integrated ML+RL system provides a proactive, data-driven method to reduce employee attrition and optimize HR decision-making. It transforms predictive analytics into actionable strategy recommendations, improving retention and organizational stability.

Our contribution: A unified ML + RL model for predicting attrition and recommending optimal HR interventions.