AI-Driven Non-Financial Risk Prediction and Control Effectiveness System for Banking

Capstone Project – Post Graduate Diploma in Artificial Intelligence & Machine Learning

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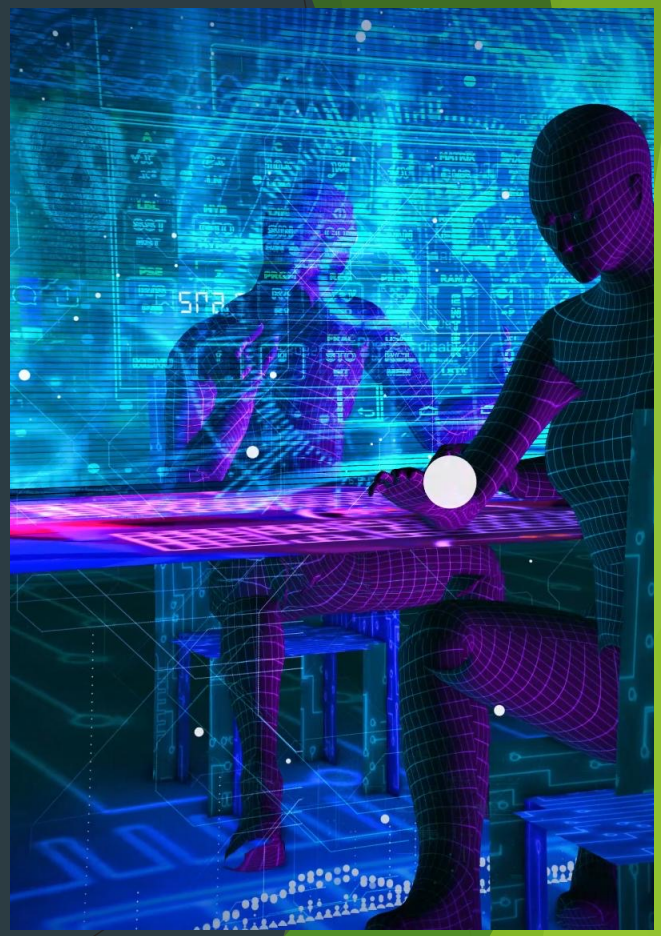
How AI / ML is Reshaping Risk Management

- Machine Learning in Risk Detection and Prediction
  - Machine learning algorithms analyze vast data to predict events and identify complex risk patterns automatically and efficiently.
- Recommender Systems
  - Recommend which business units, processes, or products should be reviewed first based on similarity to high-risk profiles.
- Natural Language Processing
  - Interpret unstructured text data, uncovering hidden threats or messages missed by traditional methods such as incident narratives, regulatory messages, audit findings.



Our Challenge in Banking

The Problem

Banks face thousands of non-financial risk events yearly: system outages, fraud, compliance breaches, vendor failure.

This could lead to financial losses, customer impact, regulatory sanctions, reputational damage.

Traditional tools are backward-looking and reactive.

There is a need for proactive and predictive risk management to prevent losses and to have more effective resource allocation.

AI-Driven Solution

Predict whether NFR event will occur in the next 30 days.

Estimate the potential severity loss of these events.

Prioritize mitigation and effective control design and implementation

Explainable. Ethical. Responsible. Auditable.

Data and Approach

- Synthetic dataset simulating real banking risk data (10,000 records, 120 business units, 2 years).
- Data included operational, control, HR, IT, and external risk indicators.
- Focused on predicting risk event occurrence and potential financial loss.

How We Apply AI / ML

Data Collection, Preparation, EDA

- Consistency checks
- Distribution and outliers
- Correlation and relationships

Feature Engineering

- Improve predictive performance
- NFR expertise and banking context
- Handle data limitations

Model Selection, Training and Evaluation

- Supervised learning
- Classification – prediction of event occurrence
- Regression - potential loss amount

Model Validation and Tuning

- Explainability
- Address limitations - Imbalance, Leakage, Overfitting
- Optimize

Model Deployment and Monitoring

- Deploy as decision support
- Continuously monitor

**EDA - Exploratory Data Analysis*

Addressing Model Limitations

Class Imbalance

- NFR events are rare (~4%), which can cause under detection.
- Addressed through stratified sampling, class weighting, and probability threshold tuning.
- Ensure material risk events are prioritized within limited review capacity.

Target Leakage

- Preserve predictive integrity.
- Addressed through variables that would only be known after an event were excluded from event prediction, and event indicators were excluded from severity amount modeling.
- Ensure all predictions are forward-looking and decision-relevant.

Overfitting

- Prevent the models from learning noise or historical artefacts.
- Addressed through independent train–test evaluation, model regularization, and the use of ensemble tree-based methods. Conservative learning behavior was applied.
- Ensure stable performance on unseen data.

Responsible & Ethical AI

- **Current Scope:** Synthetic data contains no direct sensitive attributes, so demographic bias testing is not applicable.
- **Potential Bias Risks:** Business units, HR indicators, historical patterns, and incident narratives may act as indirect proxies in real-world data.
- **Fairness Governance:** Monitor prediction parity, error rates, and threshold impacts across identified proxy groups.
- **Mitigation Controls:** Apply debiasing techniques, fairness-aware validation, careful feature design, and ongoing monitoring.
- **Risk Committee Assurance:** The model framework is designed to support fair, explainable, and regulator-ready deployment.

Business Impact and Results

Priority Business Units

- UNIT_116
- UNIT_112
- UNIT_045
- UNIT_098
- UNIT_070
- UNIT_051
- UNIT_090
- UNIT_017
- UNIT_032
- UNIT_103

- The AI-Driven NFR Prediction Model forecasted that NFR events will occur in the next 30 days.
- These are the top 10 business units that should be prioritized because of highest predicted probability.
- Focus on proactive measures, mitigation strategies, and effective control design and implementation.

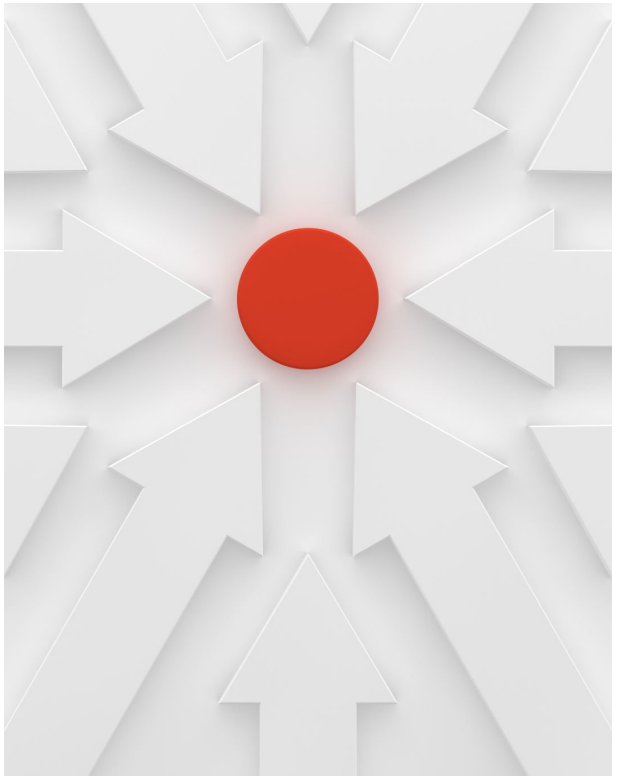
Potential Loss Avoided

$7.6 M

This figure represents the projected financial loss should risk events materialize within the top 10 prioritized business units.

Future Directions

- Develop dynamic, adaptive risk thresholds.
- Continue monitoring and refining features and evaluation metrics for greater business value.
- Integrate more unstructured data (incident narratives, audit findings, regulatory messages) to check for hidden patterns



Conclusion

1. AI can transform Non-Financial Risk management in banking.
2. Proactive, explainable models help predict events and avoid / minimize losses.
3. Ongoing improvement and ethical oversight are essential for success.

Thank You / Q&A