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Intro AI	Assignment 15 Loan Default
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GitHub: <https://github.com/jkiawu7/colab-git-V2-Jkiawu7>

Task 5: Ethical Considerations in Loan Default Prediction

Introduction

The development of a loan default prediction model carries significant ethical responsibilities, as these systems influence real financial decisions and may affect customers' access to credit. Ethical considerations must focus on fairness, transparency, accountability, and the protection of sensitive information. This section assesses how these issues were addressed in the modeling process and identifies areas for improvement.

Fairness and Bias

Machine learning models trained on historical financial data may unintentionally replicate or amplify existing inequalities. Fairness was evaluated by comparing model performance across subgroups using home ownership as a proxy for socioeconomic stability, due to the absence of sensitive demographic features such as gender or race. The model showed varying accuracy levels:

- OWN: 0.809
- MORTGAGE: 0.746
- RENT: 0.719

While differences are not extremely large, the disparity indicates that renters—who often represent lower-income or more financially vulnerable populations—experience reduced predictive performance. This could lead to inconsistent decision-making if the model were deployed in a real-world lending institution. These results highlight the need for fairness evaluations across protected characteristics (e.g., age, race, gender) when such data is available and ethically permissible.

Transparency and Explainability

Transparency is crucial for establishing trust in automated financial systems. SHAP explainability was used to understand how individual features influenced predictions. The analysis showed that `dti_income_ratio`, `income_to_loan`, `annual_income`, and credit utilization were the most influential factors. These results align with established credit-risk theories, supporting the validity of the model's decision process.

Providing interpretable explanations is essential, particularly in regulated industries like finance where applicants may request justification for adverse decisions. Explainable AI techniques help ensure accountability and minimize the risk of black-box models making inconsistent or discriminatory decisions.

Privacy and Data Protection

All data used in the model was non-identifiable and free from sensitive personal attributes such as race, gender, or health information. However, in real-world contexts, strict adherence to privacy legislation (e.g., GDPR, PIPEDA, Fair Credit Reporting Act) is necessary. Data should be collected and processed only for legitimate purposes, and adequate security measures must be in place to protect against unauthorized access. The dataset must also undergo regular audits to verify the continued relevance and legality of its use.

Recommendations for Ethical Improvement

Several steps can be taken to strengthen ethical compliance:

- Fairness Audits: Evaluate performance across legally protected demographic groups to detect and correct bias.
- Bias Mitigation Techniques: Consider re-sampling, reweighting, or fairness-optimized algorithms if unequal performance persists.
- Explainability in Deployment: Provide applicants with clear explanations of adverse decisions based on SHAP insights.
- Regular Monitoring: Implement continuous monitoring to detect model drift or emerging bias after deployment.
- Human Oversight: Ensure that the model assists decision-making rather than replacing human judgment entirely.

Conclusion

The loan default prediction model demonstrates strong predictive ability, but ethical considerations remain central to responsible deployment. Through fairness testing, explainability, and respect for privacy, the project takes meaningful steps toward responsible AI use. Ongoing evaluation and transparent governance are essential to ensuring that the system remains fair, accountable, and aligned with ethical lending practices.