

Machine Learning in the Mortgage Industry: A Comprehensive Review

Sajede Farahani

PhD. Candidate

Industrial & Manufacturing Engineering
University of Wisconsin-Milwaukee (UWM)
Milwaukee, WI, USA
sajede@uwm.edu

Wilkistar Otieno

Associate Professor and Past Chair
Industrial & Manufacturing Engineering
University of Wisconsin-Milwaukee (UWM)
Milwaukee, WI, USA
otieno@uwm.edu

Abstract

Credit risk refers to the potential financial loss incurred when a borrower fails to meet their contractual repayment obligations. Effectively managing credit risk is a fundamental component of risk management for financial institutions. In recent decades, credit risk assessment, particularly in consumer lending, has become increasingly data- and model-driven. Financial institutions now rely heavily on credit scoring models to predict the likelihood of delinquency or default across a range of consumer credit products, including mortgages, auto loans, credit cards, and personal loans. In this study, we present a comprehensive literature review of existing research methods and machine learning (ML) techniques applied specifically to mortgage credit scoring models, with a focus on how Explainable Artificial Intelligence (XAI) can enhance the robustness and transparency of predictive modeling. We find that only a limited number of studies have incorporated XAI methods into mortgage credit scoring, highlighting a significant gap in the current literature. Moreover, although many individual studies include macroeconomic indicators, such as interest rates, unemployment rates, and inflation, as well as climate-related variables, there is a notable absence of a comprehensive framework that organizes and classifies these variables. To address this shortcoming, we propose a structured categorization intended to serve as a practical reference for researchers and practitioners seeking to incorporate these factors more systematically into future credit risk models.

Keywords

Mortgage, risk, machine learning, explainable AI

Biographies

Dr. Wilkistar Otieno is an Associate Professor in the Department of Industrial and Manufacturing Engineering at the University of Wisconsin–Milwaukee. Her industry-driven research involves sustainable manufacturing, and machine learning aided predictive analytics. She has a passion for teaching statistical-related courses and inspires student involvement.

Ms. Sajede Farahani received bachelors and master's in industrial engineering from Amirkabir University of Technology. She is a PhD. Candidate in Industrial and Manufacturing Engineering at the University of Wisconsin-Milwaukee, where she serves also as a teaching and research assistant. She has had several industrial internships and co-ops, notably, at S&P Global Market Intelligence as a Credit Risk Analyst, at the Society for Hispanic Engineers (SHPE) as a data scientist and at Northwestern Mutual as a risk associate intern.