

# A Comprehensive Deep Learning Network for Predicting Bank Loan Defaults

**B. Srikar, S. Hemanth, Shaik Yunus , Nageswarrao Dontamsetti**

Department of Computer Science and Engineering

CMR Technical Campus, Kandlakoya , Medchal -Malkajgiri, India

**Abstract:** *The rapid growth of digital banking has significantly increased the volume of loan applications, making automated credit risk assessment essential. Traditional credit risk models relying on structured data often overlook the rich textual information embedded in banking records. This paper proposes a deep learning framework for predicting bank loan defaults by transforming text-based features into numerical vectors using two approaches: a custom scratch-based vectorization technique and pre-trained BERT embeddings. Both representations are used to train Multi-Layer Perceptron (MLP) and Long Short-Term Memory (LSTM) models. Experimental results demonstrate that scratch-based vectorization outperforms BERT embeddings across all evaluation metrics, achieving superior accuracy, precision, recall, and F1-score. SHAP (SHapley Additive exPlanations) interpretability tools are integrated to provide transparent feature importance analysis. A GUI-based application offers an end-to-end pipeline for dataset processing, model training, evaluation, and visualization.*

**Keywords:** Bank Loan Default, Deep Learning, MLP, LSTM, BERT, Scratch Vectorization, SHAP, Credit Risk, NLP, Financial Prediction

