Financial Inclusion in Sub-Saharan Emerging Markets: The Application of Deep Learning to Improve Determinants

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Abstract. Financial inclusion promises to improve worldwide economies by eradicating poverty. In this study, we use high-dimensional household-level survey data from Eswatini, Namibia, Rwanda, and Madagascar to ascertain the main factors that prevent individuals from accessing financial services. This study uses deep learning techniques to perform dimensionality reduction for feature extraction to overcome the common challenge of obscured interpretation in high-dimensional data analysis. To test the effectiveness of reduced features in measuring financial inclusion within and across countries, different algorithms were evaluated on seven performance metrics. From the results, we observed that for Eswatini, Rwanda, and Madagascar, the catboost algorithm was the best predictor of financial inclusion. In each of these three countries, the top three predictors were quality of financial services, spending and income, and remittances; money management and remittances; financial capacity and e-payments and mobile money; and banking and other non-microfinance institutions, remittances, house information, and well-being through farming. For Namibia, the top three features were bank penetration, general and money management, risk, and mitigation with the random forest as the algorithm for financial inclusion prediction. Lastly, it was established that the general cross-region features were banks and non-banks, income/expenditure and money management, and demographics, with the Gaussian Naïve Bayes as the best algorithm for a generalised prediction of financial inclusion.

Keywords: Financial Inclusion · Deep learning · Feature interpretability · Dimension reduction