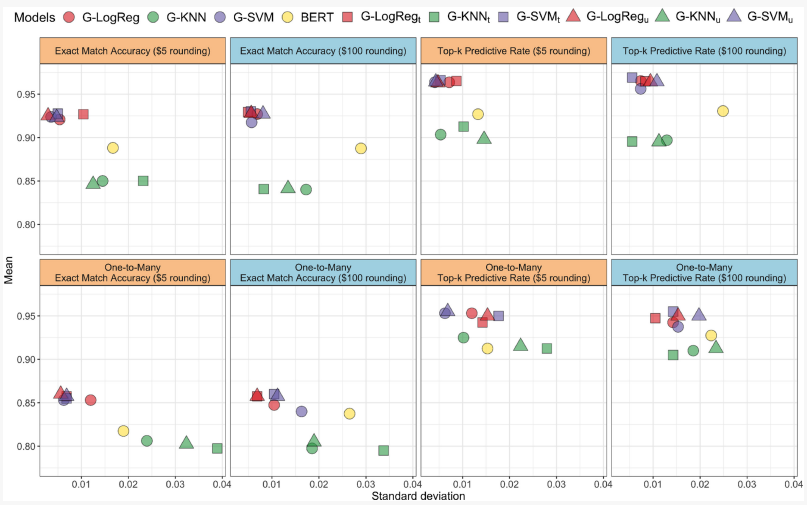
Enhancing Bookkeeper Decision Support Through Graph Representation Learning for Bank Reconciliation

GA, UNITED STATES, November 20, 2025 /EINPresswire.com/ -- Researchers have developed a graph-based expert system that improves the accuracy and prediction stability of automated bank reconciliation. By modelling historical transactional data as a network graph, the system can learn complex one-to-many matching scenarios that existing tools often fail to predict correctly. The findings point to more reliable automation for high-risk domains such as finance and accounting.



Most graph-based models and variants (red, purple) outperform BERT (yellow) with higher mean model performance (y-axis) and lower standard deviation of model performance (x-axis) across repeated training runs.

Bank reconciliation is an essential part of maintaining the financial health of a business, requiring bookkeepers to match incoming bank statement lines to invoices. For large businesses that process thousands of records, it is both time-consuming and tedious, which is why many rely on automated tools that suggest likely matches for bookkeepers to confirm. While these tools work reasonably well for simple one-to-one matches, they often perform poorly when a single payment needs to be reconciled against multiple invoices (one-to-many matches).

In a new study published in The Journal of Finance and Data Science, a team of Australian researchers explored whether graph representation learning could improve the accuracy of match suggestions in these scenarios.

"Instead of modelling each transaction in isolation, a system could leverage a network mapping out the entire general ledger, where each historical record and its reconciliation are represented as a node and edge in a graph." shares Justin Munoz, lead author of the study. "New records can then be added to this graph, transformed into numerical representations or embeddings, and fed into a downstream machine learning model that scores the match likelihood for any pair of

records."

Trained and evaluated on three years of real-world bookkeeping data, the graph-based method was shown to significantly improve match accuracy, outperforming an industry standard, with the largest gains on one-to-many matches. The researchers attributed these gains to higher-quality embeddings that capture both the structural properties of the ledger graph and the contextual information contained in transactions.

Further, the team found that graph-based models exhibited much lower prediction instability than other non-graph embedding methods such as Google's BERT, a popular language model. In this context, prediction instability refers to variation in model performance when a model is retrained multiple times. As shown in Figure 1, the best models cluster in the top-left region of high accuracy and low prediction instability.

"For high-risk domains such as finance and accounting, stability matters just as much as accuracy." adds Munoz. "Our findings highlight a promising direction for accounting technology that bookkeepers can rely on in day-to-day work, improving both trust and reliability."

References
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