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Towards Scalable, Efficient and Privacy Preserving Machine Learning
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Context and Motivation

\( C_1 \): Company i
\( B_1 \): Local bank transactions of \( C_1 \)
\( C_B \): Fraudulent company
\( A \): Central Supervision Authority
\( N \): Data Mining for fraud detection

The network consists of 4 entities: Central Authority, Company, Bank, and Fraudulent Company, with transactions and data mining for fraud detection.

Objectives

- Minimize the computational costs incurred by privacy preservation.
- Provide an end-to-end privacy preserving outsourced data classification service.
- Enable a set of mutually untrusted data owners to have a global vision on the union of their data without breaching the privacy of each one of them.
- Enable dynamic data model updates when new training data samples are available.

Related work

Different ML algorithms

- Clustering (1)
- Classification (2)
- Association Rule Mining (3)

Different Privacy-preservation objectives

- ML output protection
- Data privacy

Privacy Preservation techniques

- Cryptographic techniques (SMC/HE, GC, OT)

Design principles

- Cryptographic based protection (data model, training data, classification queries and responses)
- Partial homomorphic encryption (PHE) based building blocks
- Combine PHE with cryptographic blinding (DTPKC cryptosystem [6])
- We implemented the VFDT incremental decision tree learning algorithm [7]
- Decent privacy and utility levels
- Efficient runtime
- Entirely outsourced ML computations over encrypted data

Preliminary results

- We have used a synthetic dataset for fraud detection in a B2B network.
  - This dataset contains 1000 bank transactions with 9 attributes each.
  - We compare our work to the Ciphermed framework [8].

Preliminary results figure shows the performance comparison of different methods.

References