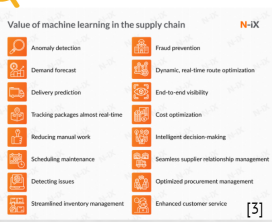
Machine Learning, Privacy & Supply Chains

Research Question:

How can privacy be preserved for machine learning based applications in supply chains?

01: Introduction

- Supply chains are vital in the modern age
- Machine Learning applications exist in several aspects of supply chains
- Vulnerabilities exist, and privacy concerns arise, especially related to sensitive data



[3]

02: Objective

The case for privacy-preservation for ML applications in supply chains:

- Adoption of ML solutions in supply chains is increasing [6]
- ML solutions offer increased efficiency for supply chain management [8]
- Organizations are reluctant to implement ML solutions due to privacy concerns

Advantageous Machine Learning Applications:

- Demand Forecasting and Forecasting Accuracy
  - Significant advantages in accuracy over traditional methods
  - Models may be susceptible to attacks
- Customer/Supplier Relations Using Chat-bots
  - Improved performance of chat-bots, large reductions in expenses [1]
  - Several privacy issues concerning training data exist

03: Method

Literature reviews of existing sources will be conducted, with the use of Google Scholars, WorldCat, IEEExplore, and other similar tools from the TULib resources.

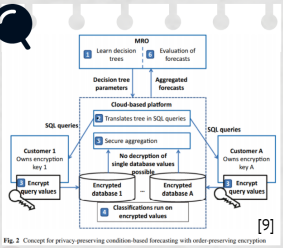
Research Method Steps:

1. Identify privacy concerns in Supply Chains
2. Identify threats to privacy in Machine Learning applications
3. Discover privacy-preserving techniques for machine learning applications
4. Determine connections between uses of machine learning and supply chains
5. Determine privacy-preserving techniques to address issues

04: Results - Threats

Related mostly to sensitive data. Following attacks pose risks [2]:

- Model Inversion Attacks
- Reconstruction Attacks
- Membership Inference Attacks
- Re-Identification



[9]

Fig. 2 Concept for privacy-preserving condition-based forecasting with order-preserving encryption

05: Results - Potential Solutions

Cryptographic Approaches

- Cryptographic Protocols
  - Good for custom solutions
  - Can be slow and remain susceptible to some attacks [9]
- Homomorphic Encryption
  - High level of privacy preservation and safeguards against various attacks
  - Can be costly or lack functionality depending on situation [2]
- Garbled Circuits
  - Significantly fast operations compared to other approaches [7]
  - More than two parties cannot collaborate

Differential Privacy With Perturbation Approaches

- Input and Output Perturbation
- Algorithmic Perturbation
  - Useful for safeguarding against re-identification, reconstruction, and inference attacks [5]
  - Lossy encryption reduces accuracy

06: Conclusion

- Significant benefits are possible by using machine learning in supply chains
- Organizations are reluctant to implement efficient solutions due to privacy concerns
- Some existing implementations of ML do not take special care for privacy
- Cryptographic approaches and differential privacy can be used for different applications, especially in demand forecasting and chat-bot development and training.

Potential Area for Future Work

- Demand forecasting in Fast Fashion industry's supply chains

07: References

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