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Applying Machine Learning to Encrypted Network Traffic for Malware Detection

Derek Manning
Elizabethtown College, manningd1@etown.edu

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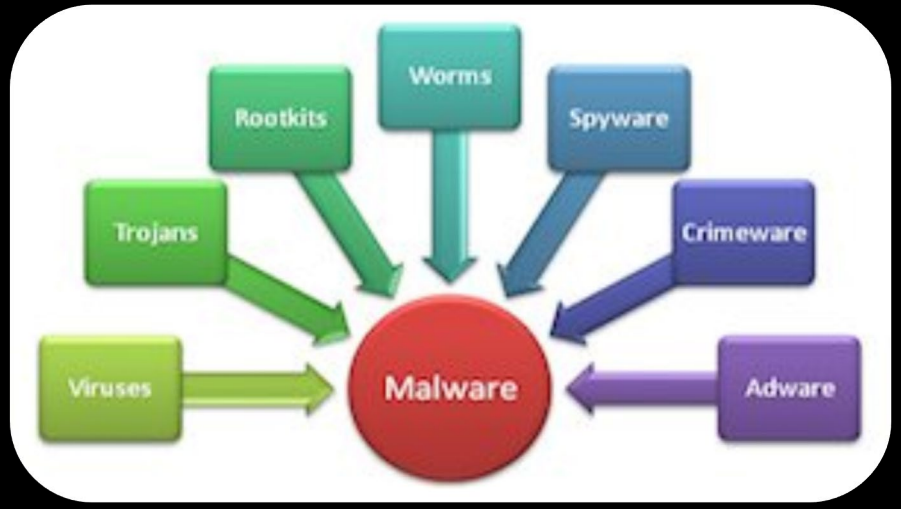
Mentor: Dr. Peilong Li

Background

- Malware: malicious software with intent to cause damage
- Large expense for businesses
- $55 Billion in damages every year
- 130 large-scale, targeted breaches in the U.S. annually
  - Growing 27 percent per year

Intro to Malware Analysis

- Take advantage of vulnerabilities in a system
- Offline analysis and inference
- Rule based security
- Deep packet inspection



Motivation

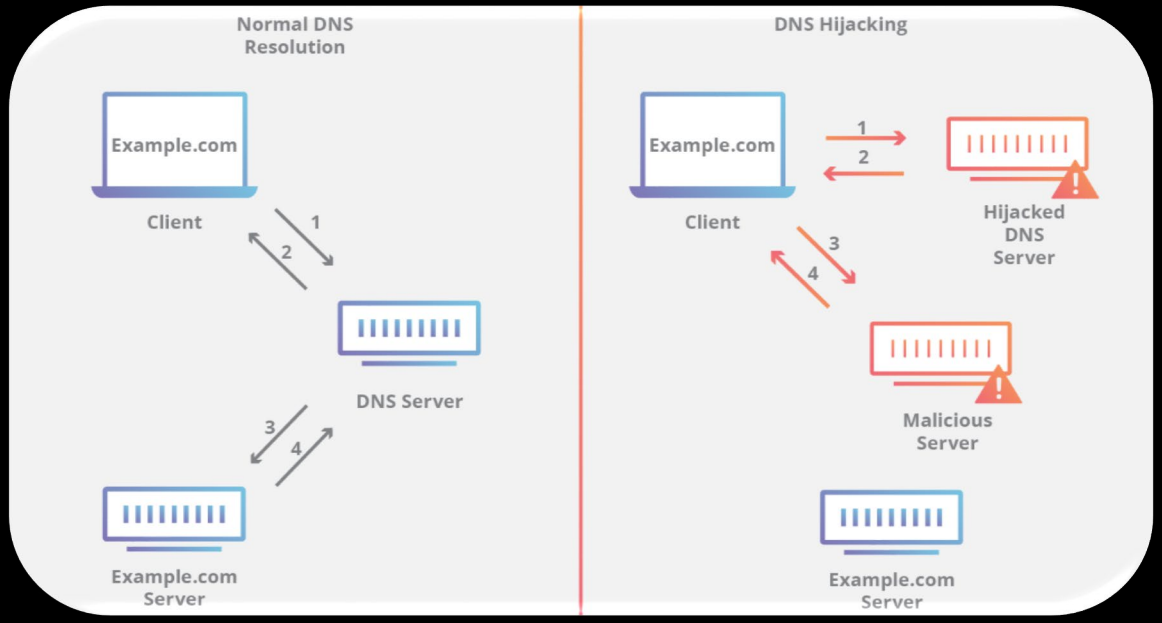
- Real-time inference with high accuracy
- Optimize for Intel hardware
- On encrypted traffic

Tools for Analysis

- Packet capture tool
- Cisco Joy (packet cleaning)
- Python
- Intel Data Analytics Acceleration Library (DAAL)

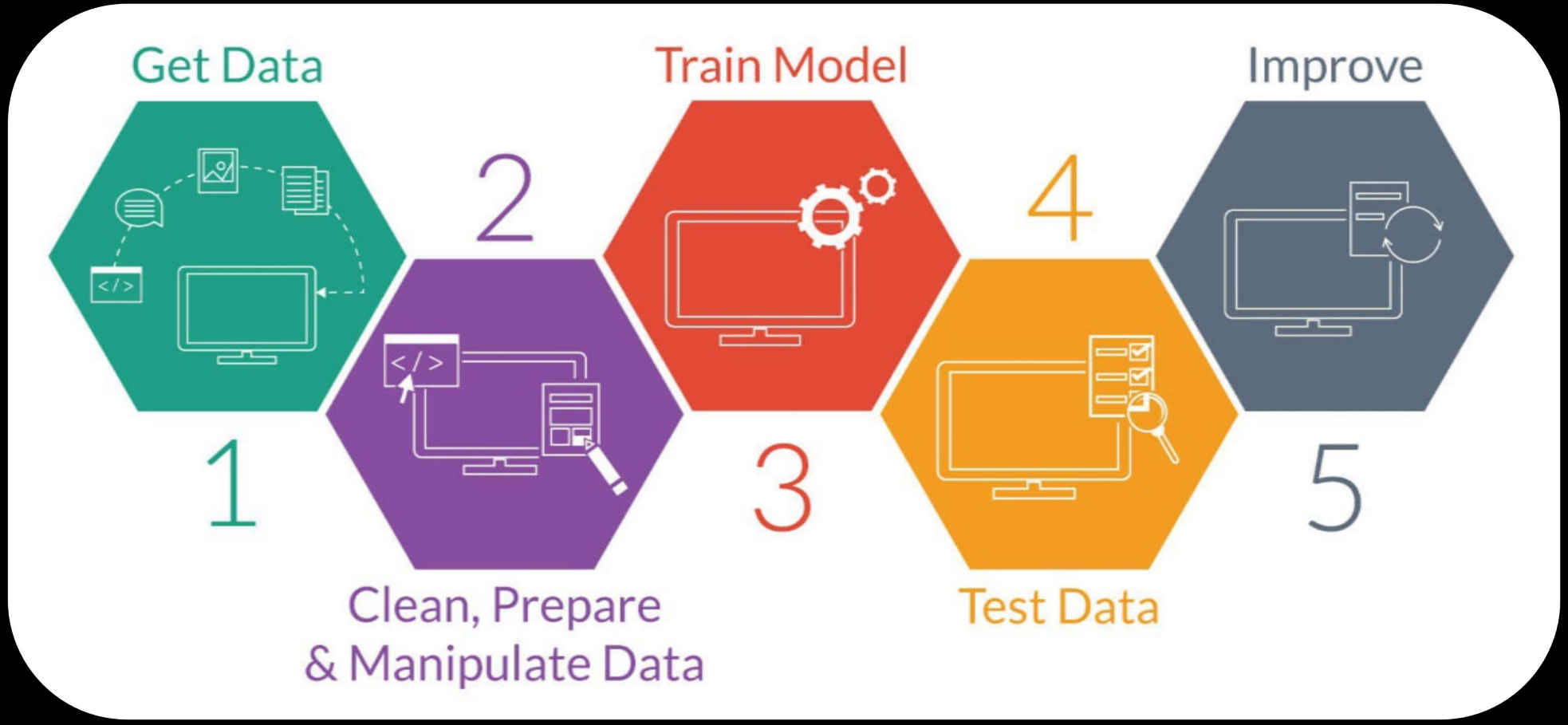
Network Traffic Structure

- HTTP (Hypertext Transfer Protocol)
- TLS (Transport Layer Security)
- DNS (Domain Name System)
- Encrypted data

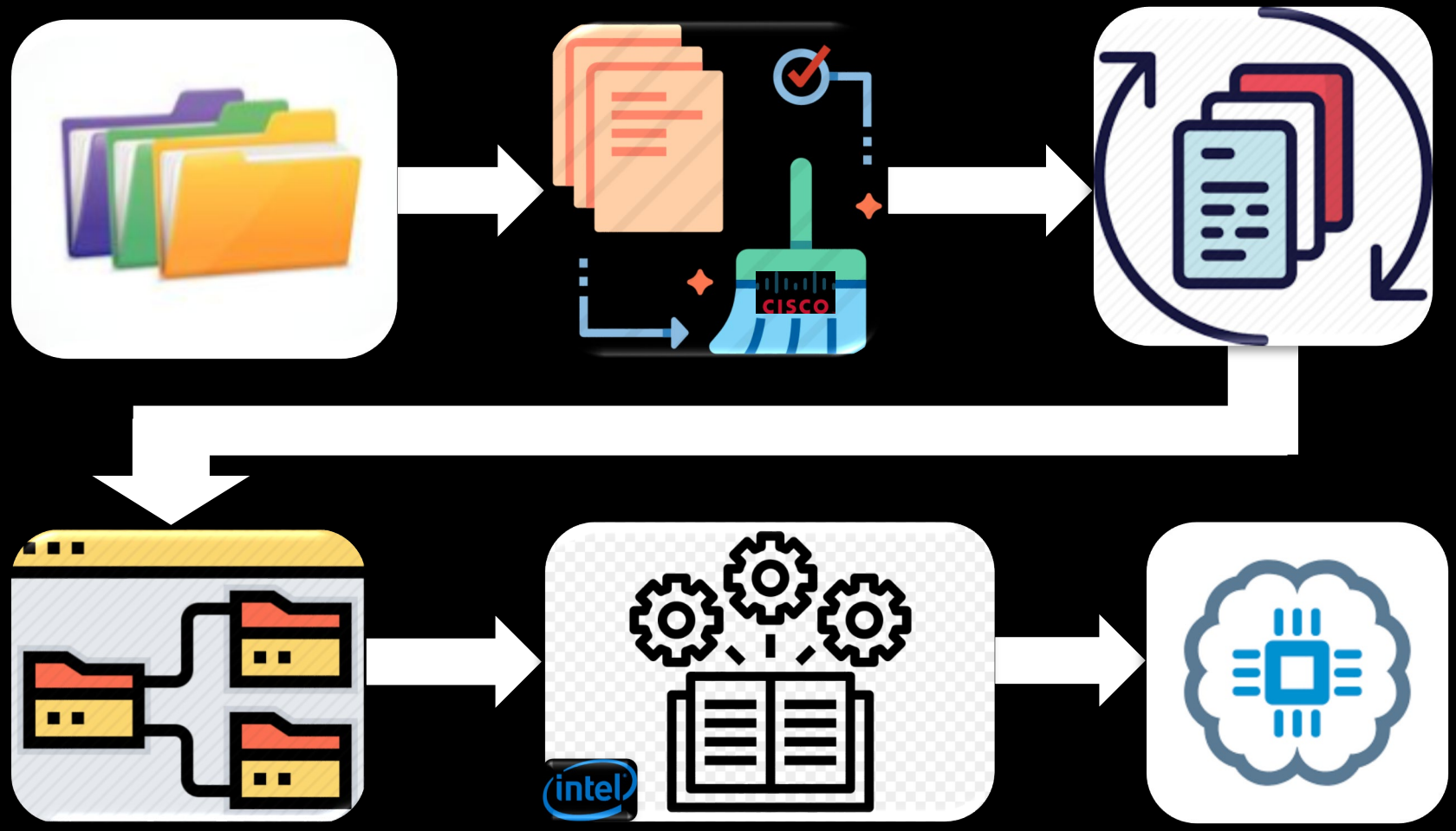


Machine Learning for Inference

- Method of data analysis that automates analytical model building

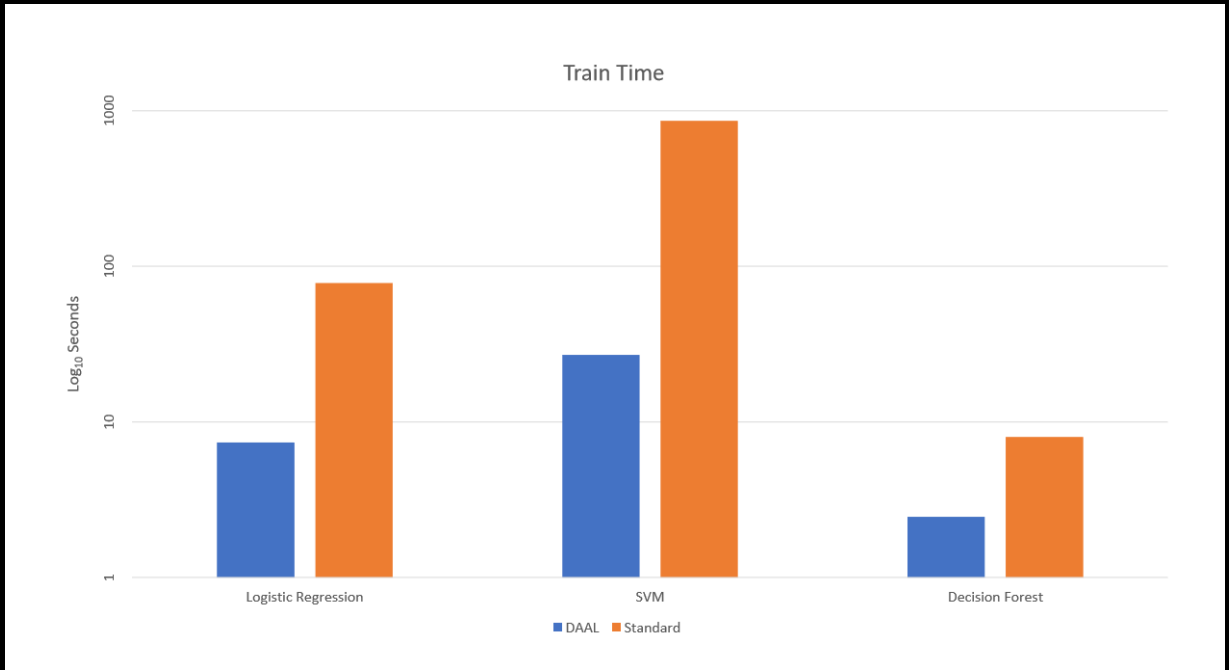


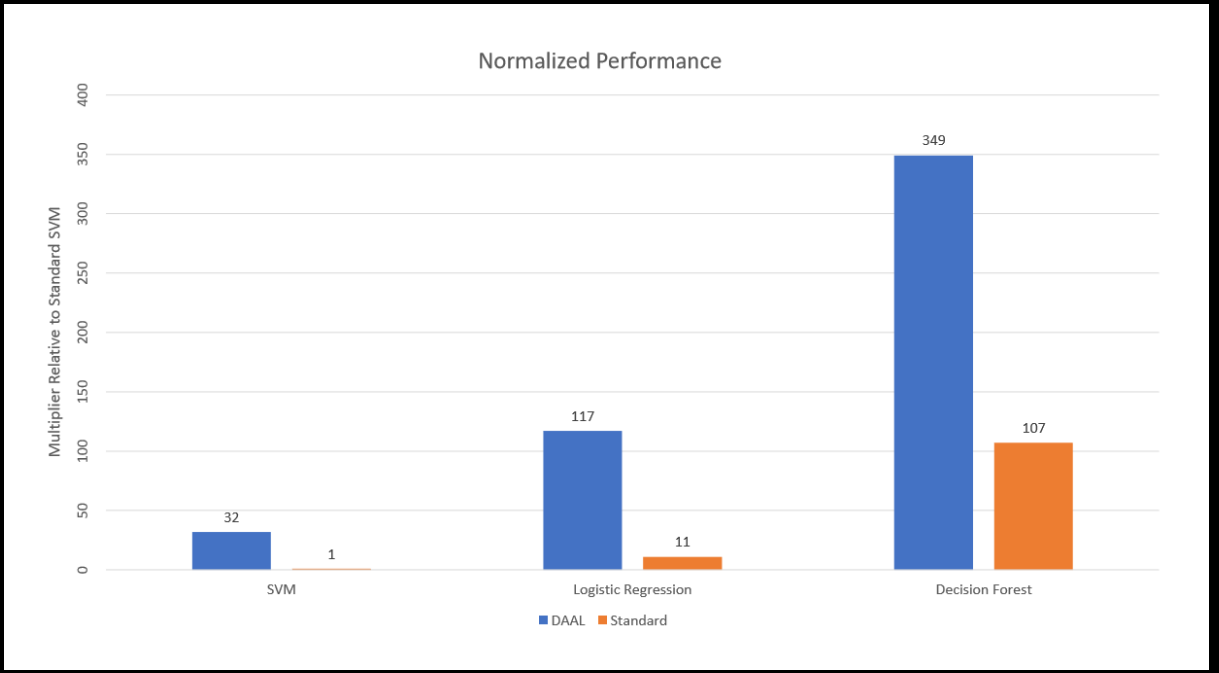
Overall Design



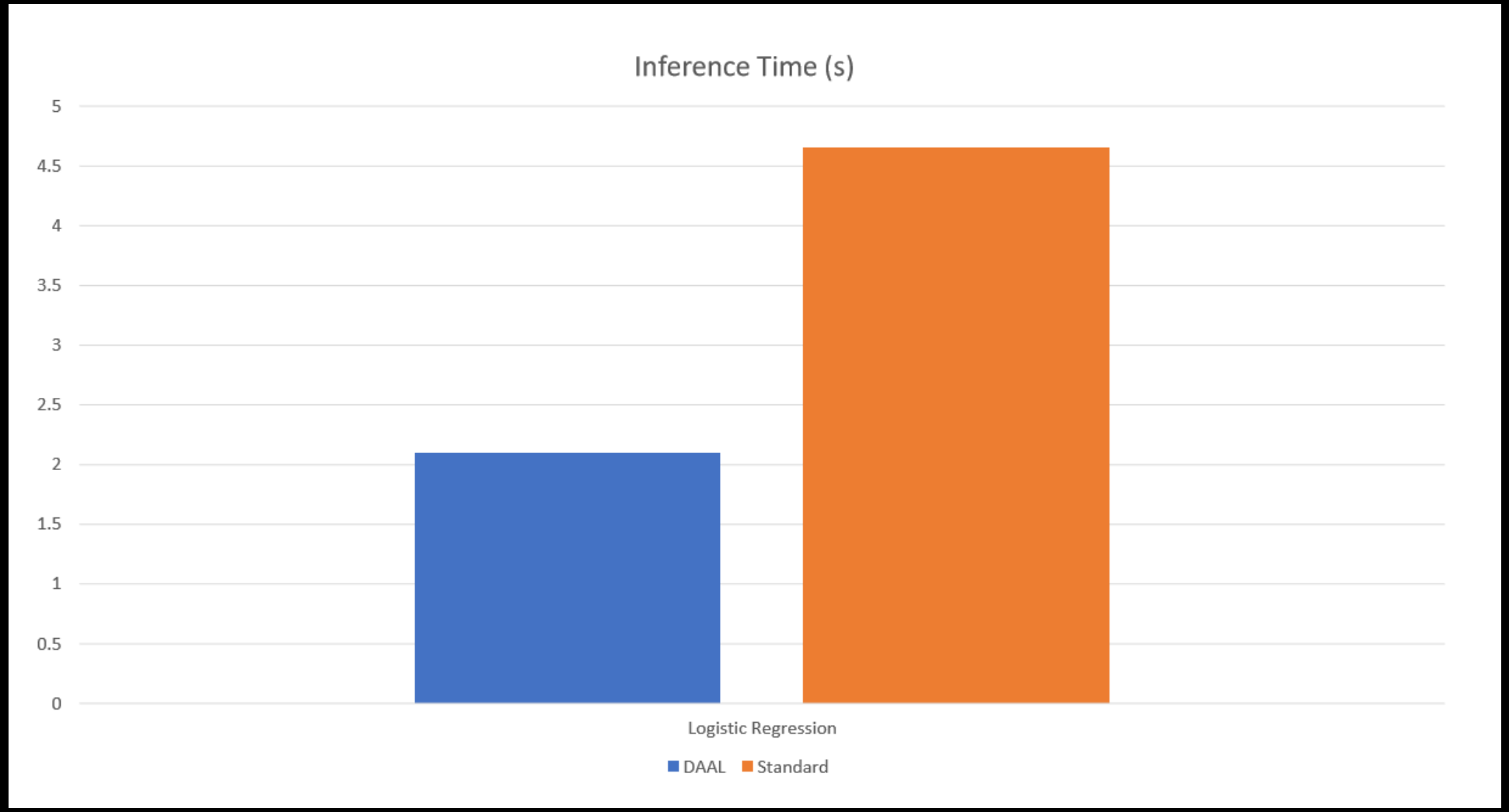
Intel DAAL Background and Results

- Optimizes code for underlying hardware
- Key Takeaway: DAAL 10X faster on average





Inference


Inference Time (s)
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
Logistic Regression
DAAL
Standard

Summary

- Prevalence of malware
- Packet metadata as features, not actual data
- Form a dataset, train model
- Optimize models using Intel DAAL
- Apply model to new data

Q & A

References

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Additional Data