

SECURITY ASSURANCE ACROSS SYSTEM LAYERS

From Credentials to Learning Systems to Executables



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RESEARCH VISION

To design security mechanisms that detect compromise, leakage, and tampering across three critical layers of modern computing systems.

MODERN SYSTEMS

TRUST IN AUTHENTICATION

Detecting Credential Compromise
(*Honeywords, Deception*)

TRUST IN LEARNED MODELS

Privacy & Integrity of ML Systems
(*Inference, Inversion*)

TRUST IN EXECUTABLES

Post-Compilation Binary Tampering
(*Memory-Safety Validation*)

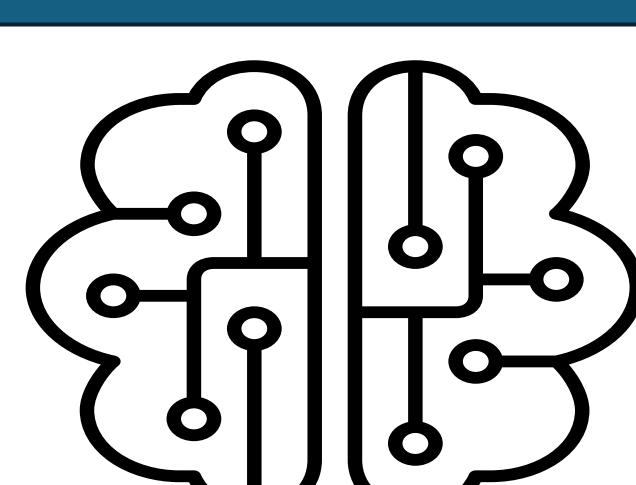


CREDENTIAL LAYER

**** Problem
Credential database breaches remain undetected for months or even years.

Approach
Leverage honeywords credentials to detect misuse of leaked credential databases during authentication.

Key Insight
Credential theft becomes detectable at the moment of exploitation.

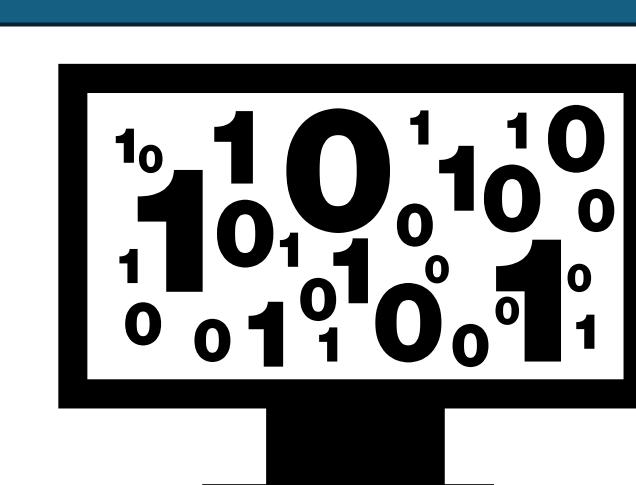


ML SYSTEMS

Problem
ML models can leak sensitive information or misbehave in response to crafted inputs.

Approach
Estimate the feasibility of security & privacy ML attacks under practical black-box threat models.

Key Insight
Many state-of-the-art attacks fail in real-world settings — but some leaks persist.



EXECUTION LAYER

Problem
Memory-safe binaries can lose safety guarantees after compilation due to tampering.

Approach
Pre-execution validation of compiled binaries to ensure safety checks remain intact.

Key Insight
Memory safety must be verified at load-time, not assumed.

Representative Work

- Dionysiou et al., HoneyGen (AsiaCCS 2021)
- Dionysiou et al., Lethe (EuroS&P 2022)

- Dionysiou et al., SoK on MIAs (PETS 2023)
- Dionysiou et al., Deep-BMI (PETS 2023)
- Dionysiou et al., EvilText (AISEC 2021)

- Louka et al., Memory safety in Rust (EuroSec 2024)
- Moreno et al., System call interposition (Middleware 2025)
- VALIDATE (MSCA-PF, ongoing)

TAKE-HOME MESSAGE

Protecting modern systems requires a multilayered approach — from detecting credential database breaches, to securing ML models, to validating executables.

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