

AI Powered Software Engineering

Unlocking Innovation

#AI4SWE



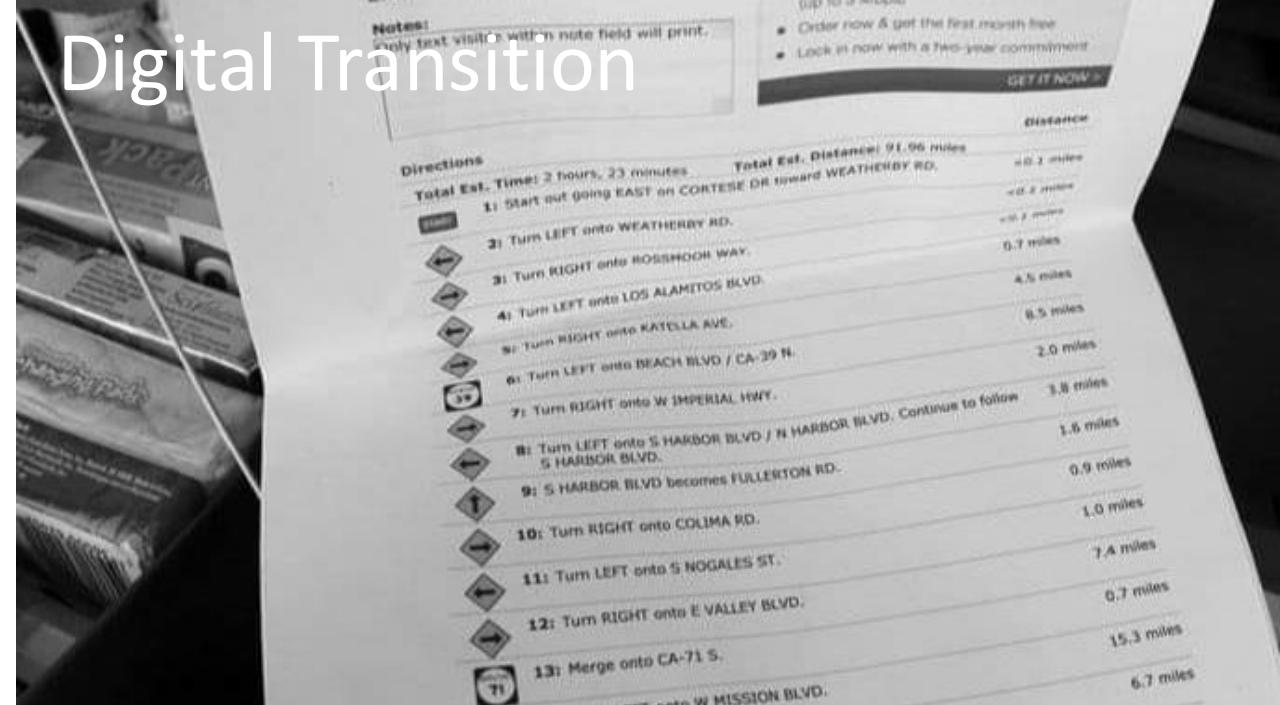
MITRE | SOLVING PROBLEMS
FOR A SAFER WORLD®

Trac Bannon

The Early Days



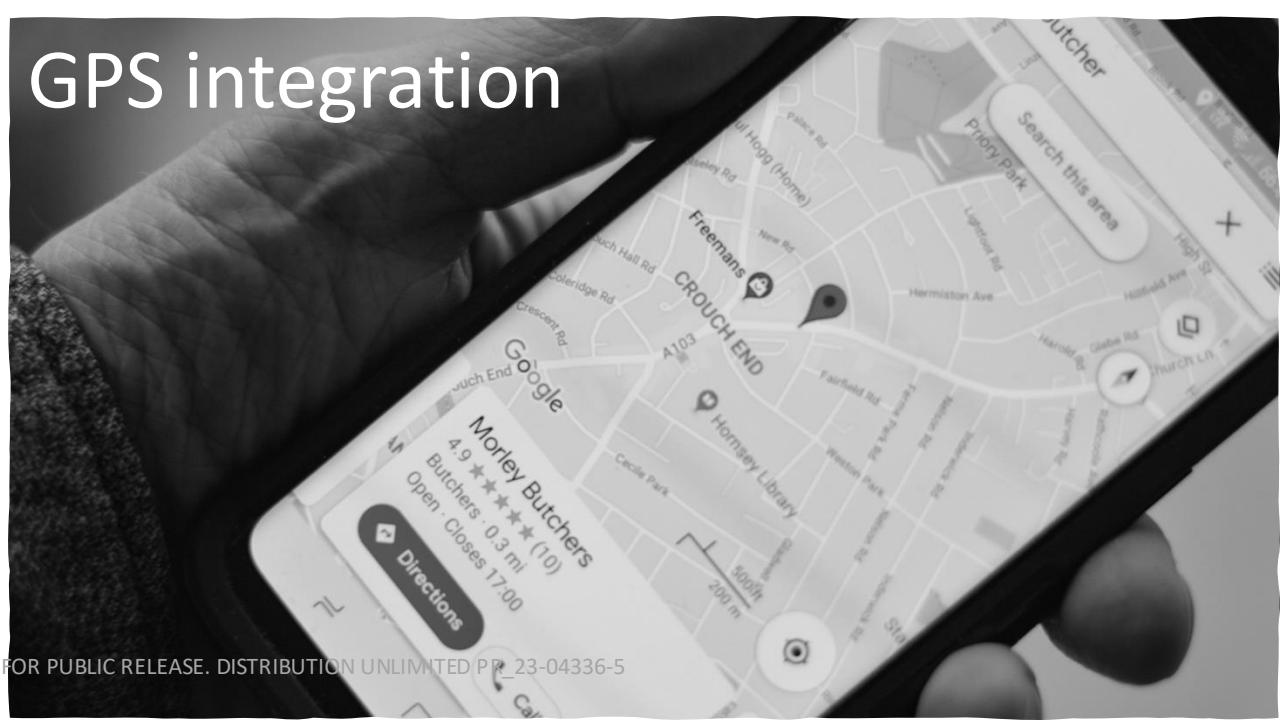
Digital Transition



Special GPS Units



GPS integration



Proliferation



Notes:
Only text visible within note field will print.

- Order now & get the first month free
- Lock in rates with a two-year commitment

GET IT NOW!

AI & Software Engineering

Digital Transition: This is where we are today.

Who Am I? Tracy “Trac” Bannon

/trās/

Metrics
Value Stream Design
#OpenSource
#DevOps
Continuous Testing
#StraightTalkforGovt
Agility
#CALMS
#CloudNative
Continuous Improvement
Automation
#TDM
Continuous Delivery
CI/CD
Building Digital Workforce
Modernization
#RealTechnologists
Digital Transformation
Low Code/No Code
CyberSecurity
Minimum CD
Evolutionary Architecture
AI-Assisted
SDLC
Value Stream Mapping



MITRE



Software architect | researcher | engineer

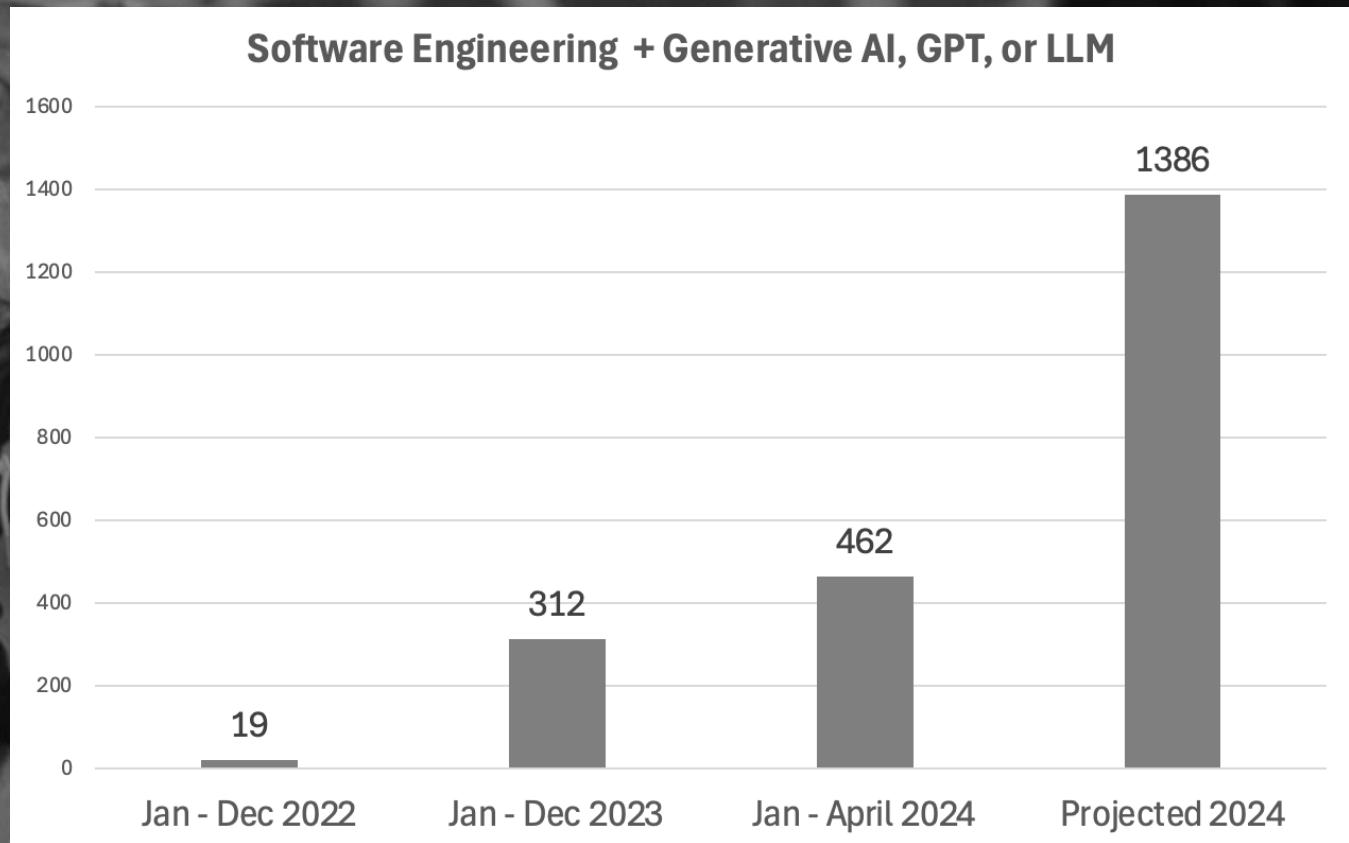
ArchAIecture Research Collaborative

- Focusing on human/machine teaming and trust
- Diverse thought leaders
- Merging scholars and industry
- Data at scale
- Not-for-profit



Quick Retrospective

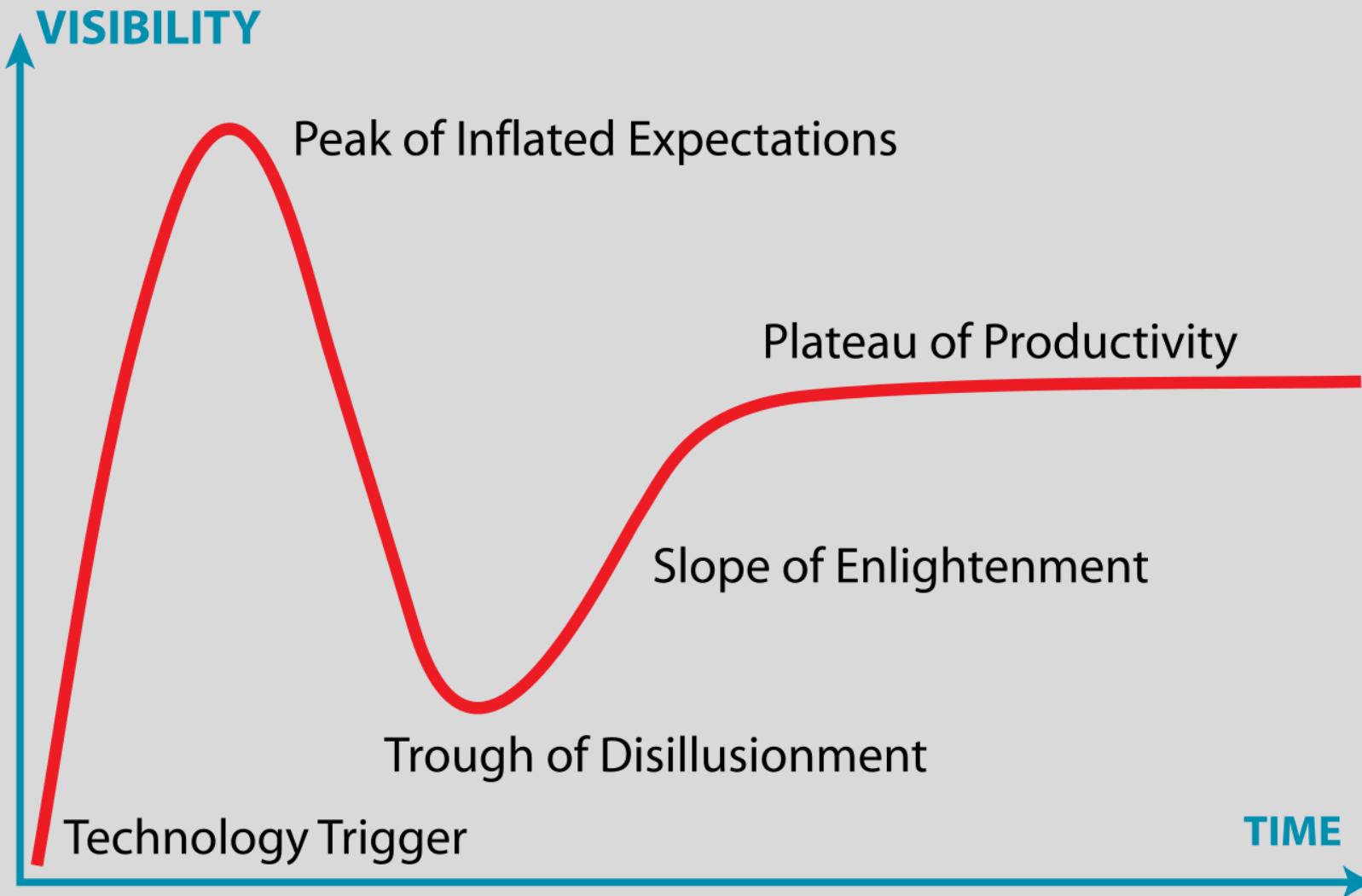
- January 2023 - ChatGPT users hits 100M
- Chronic FOMO
- 2024 - Publishing surges
- Peer-reviewed research lags



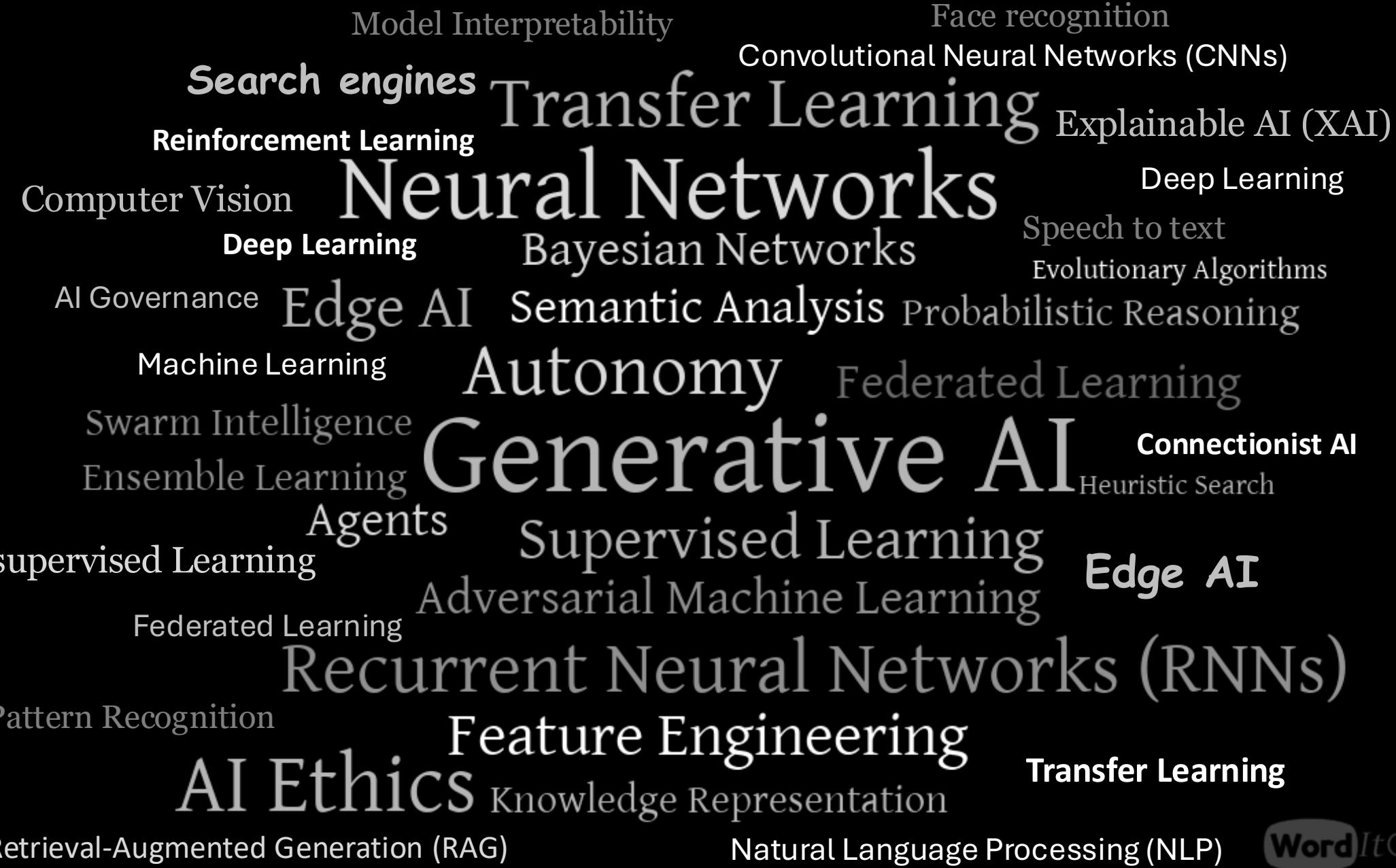
Don't get
swept away
by the hype



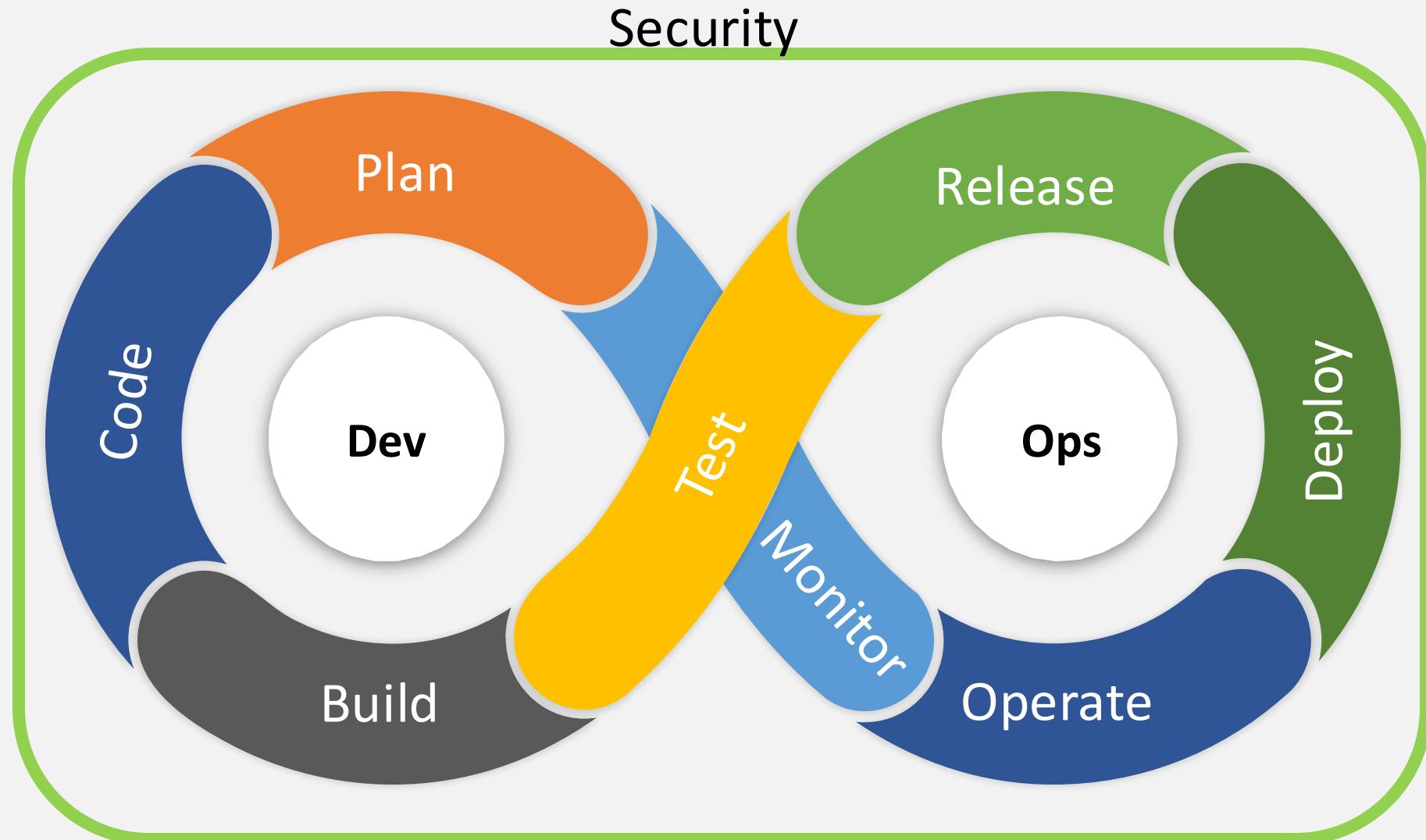
AI in SwEngineering... where are we now?







Where can AI be used with DevSecOps?



Infusing AI across the DevSecOps Continuum

Code

- Architectural Design
- GAI based pair programming
- Code & Unit Testing Generation
- In IDE Secure Code Vulnerability Solution
- ML assisted code review selection
- AI Assisted Code Review
- AI Enabled collaboration
- Suggestive Refactoring

Security
Is infused into all actions and activities

Build

- Aggregated Merge Request Impact Analysis
- GAI-based identification of security vulnerabilities
- ML algorithm optimized build times
- AI-Assisted Security Vulnerability Detection
- Software Composition Analysis

Plan

- Natural Language Requirements Gathering
- NLP Requirements Analysis for inconsistency and ambiguity
- GAI Epic and User Story Generation
- Effort Estimation using Neural Networks
- GAI-assisted Threat Model Policy Identification

Code

Dev

Build

Test

- Natural Language Test Case Generation
- Test Data Generation
- AI Enabled test effectiveness predictions
- E2E Functional Test Execution
- Intelligent Failure/Self Healing Testing
- NLP based API based contract definition
- Intelligent Test Execution

Release

- Compliance Validation
- Reinforced Learning-based models generate deployment scripts
- AI Enabled Failure Analysis
- Release Risk/Success Prediction
- AI Driven CI/CD workflow automation

Release

Ops

Operate

Monitor

- Event Correlation
- False Alarm Filtering
- Self-Healing Techniques
- Root Cause Analysis
- Observe system performance
- Usability Patterns
- Monitoring

Deploy

- Dynamic Environment Provisioning and Deployment Optimization
- Realtime Rollback
- AI-assisted Log Aggregation
- ML Anomaly Detection
- GAI Deployment Scenario Simulations

AIOps engines provide correlation and predictive monitoring

Operate

- Deterministic AI based ticketing and support allocation
- AI Based Self Healing Decision
- LLM Integration for Virtual Assistance
- GAI/GPT powered Knowledge Bases

GAI Usage Patterns

Content Generation

Complex auto-complete as well as new content creation is typically leveraged for generating test cases, code, documentation, and deployment scripts.

Automated Reasoning

Analyzing patterns, suggesting alternatives about code quality, identifying security vulnerabilities, optimizing deployment strategies, and ensuring compliance with standards.

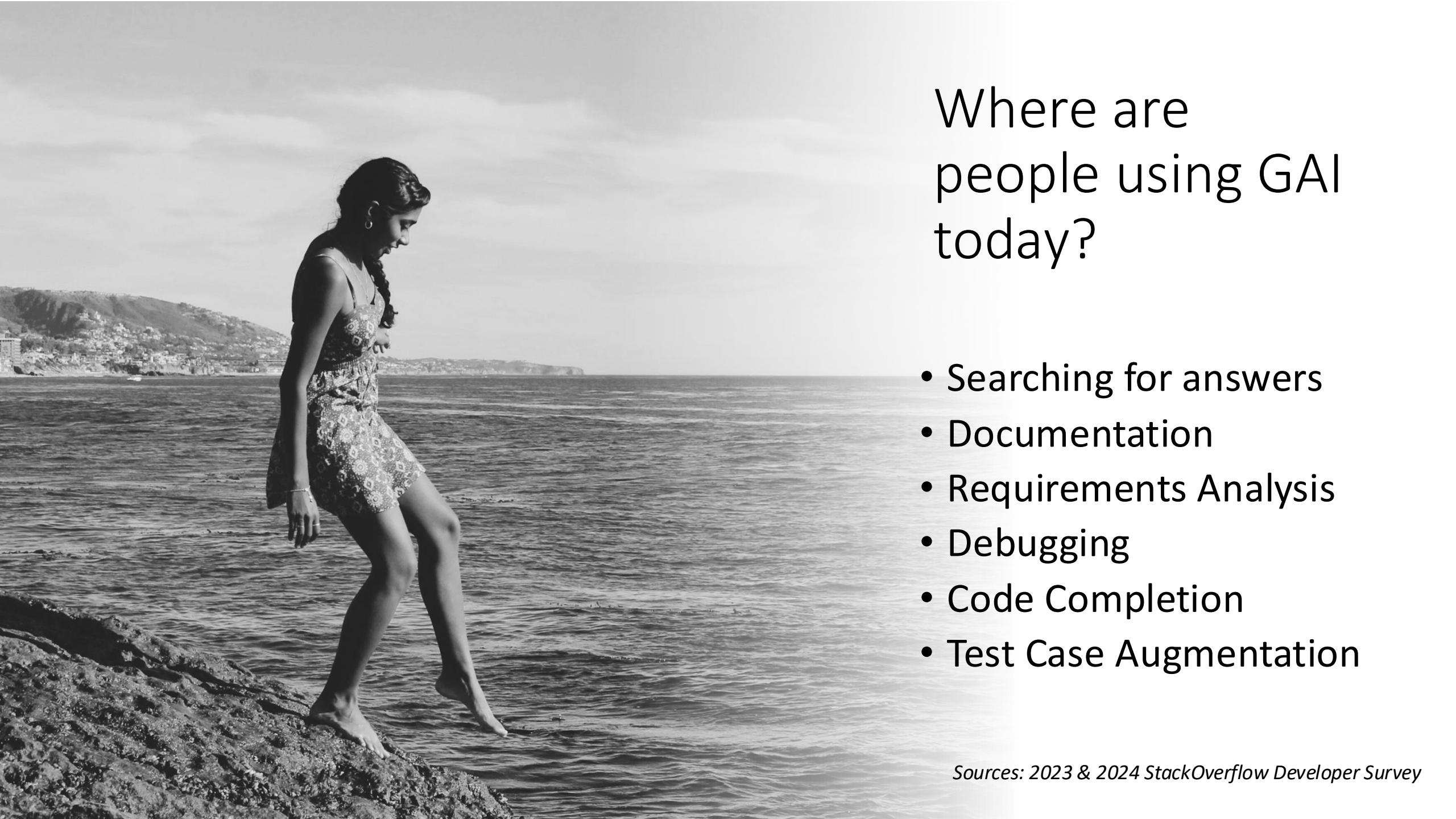


Treat GAI like a
young
apprentice...

Always pay
close
attention!!

Does
Generative AI
contradict
DevSecOps
principles?



A black and white photograph of a woman walking barefoot along a rocky shoreline. She is wearing a patterned, sleeveless dress and is looking down at the water. In the background, there's a coastal town built on a hillside overlooking the sea under a cloudy sky.

Where are people using GAI today?

- Searching for answers
- Documentation
- Requirements Analysis
- Debugging
- Code Completion
- Test Case Augmentation

Sources: 2023 & 2024 StackOverflow Developer Survey

Unveiling the Human Side of GAI in Software Engineering

Practice-wide survey to get to ground truth

**Human-Machine
Collaboration**

Trust Optimization

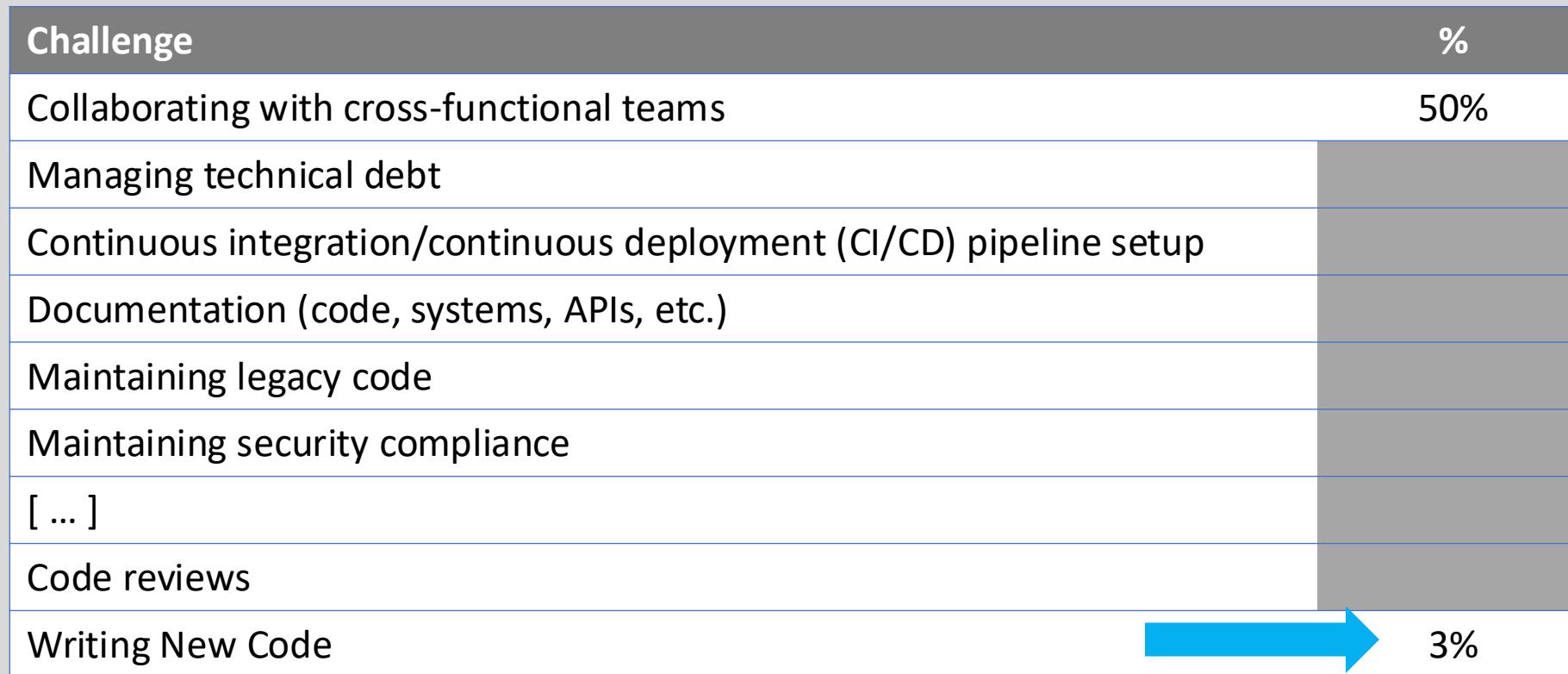
**Skill Evolution &
Team
Communication**

**Personal Impact &
Future Outlook**

Take the Survey



Most challenging, time consuming, or painful tasks^

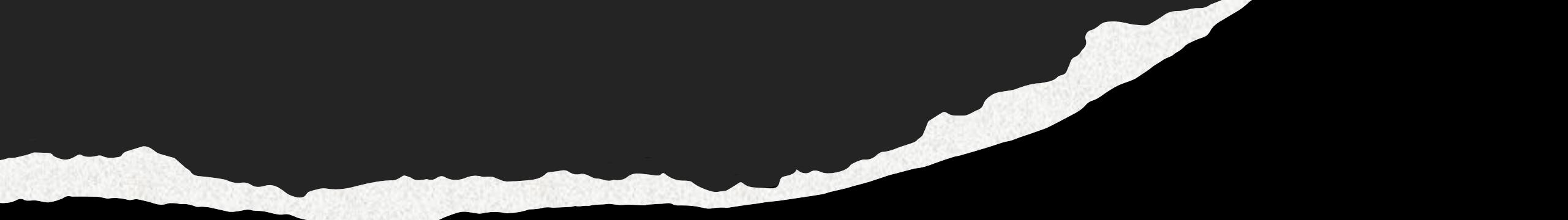


Take the Survey



40+ different challenges have been identified so far!

^{^This data will be more insightful when correlated with role and experience}



Are we addressing the pain points?

AI-Augmented

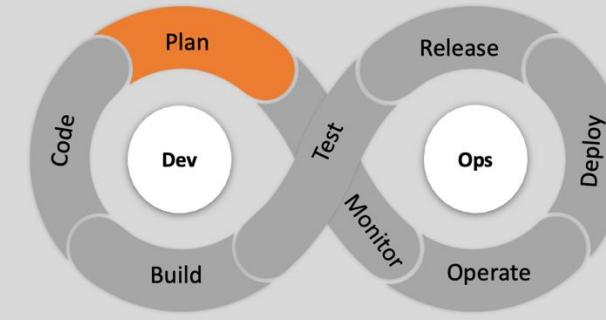
Requirements Analysis

Use Case:

- Requirements generation via text analysis
- Analyze user transcripts
- Include crowdsourced survey

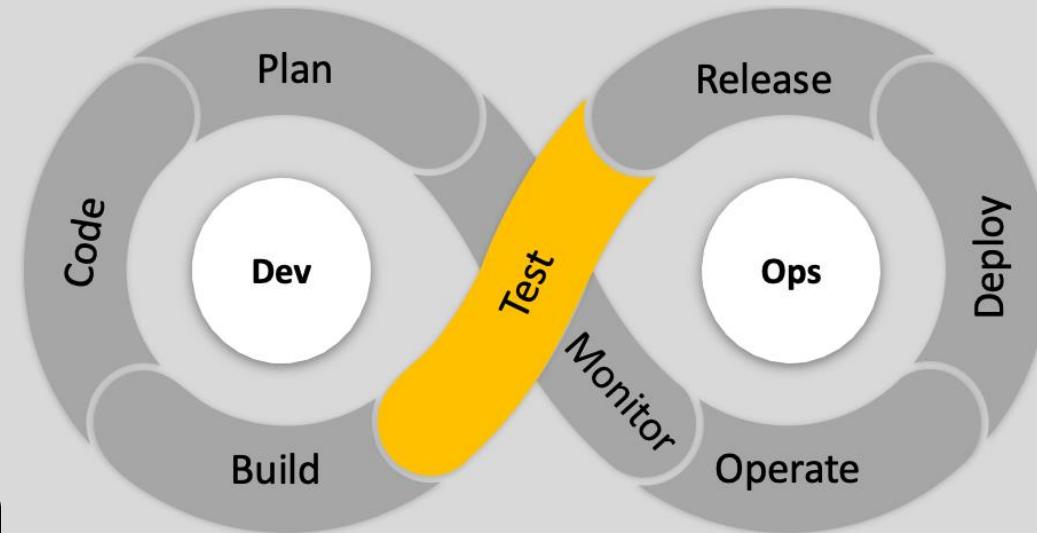
Considerations:

- Version control GPT prompts ++
- Diverse Datasets
- QA = rigorous testing + humans in the loop



AI-Augmented Testing Use Cases

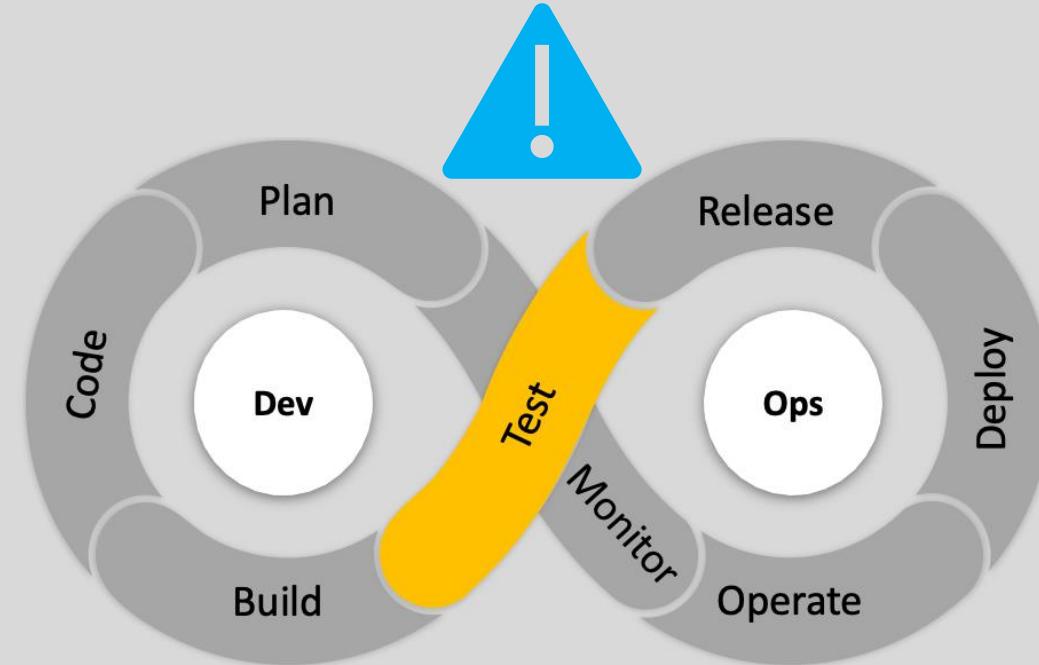
- Increase test coverage
- Brainstorming
- Synthetic Test Data Augmentation



AI-Augmented

^ Testing Considerations

- Data Privacy & Integrity
- Beware of Irrelevant Tests
- Transparency and Explainability

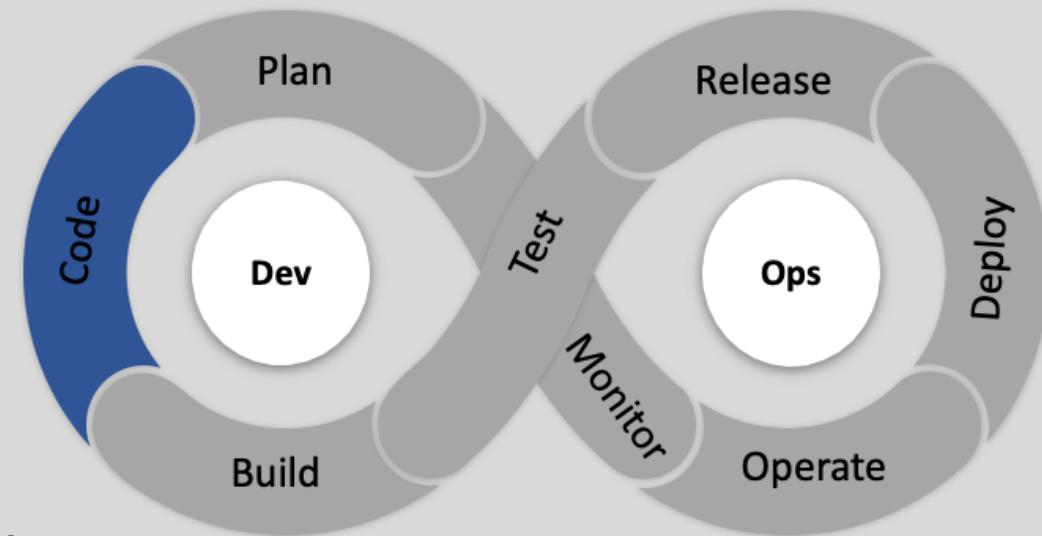


The elephant in the
corner....

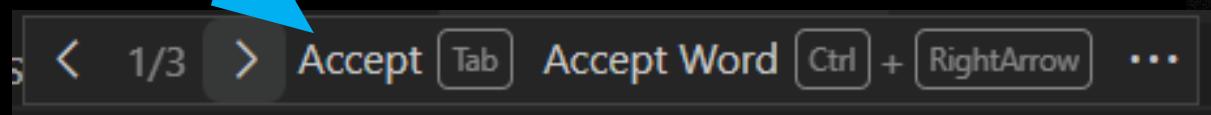


AI-Augmented Coding

- Code Completion over Code Generation
- Great for explaining existing code
- Generally, well-structured and well-formatted



In IDE Help



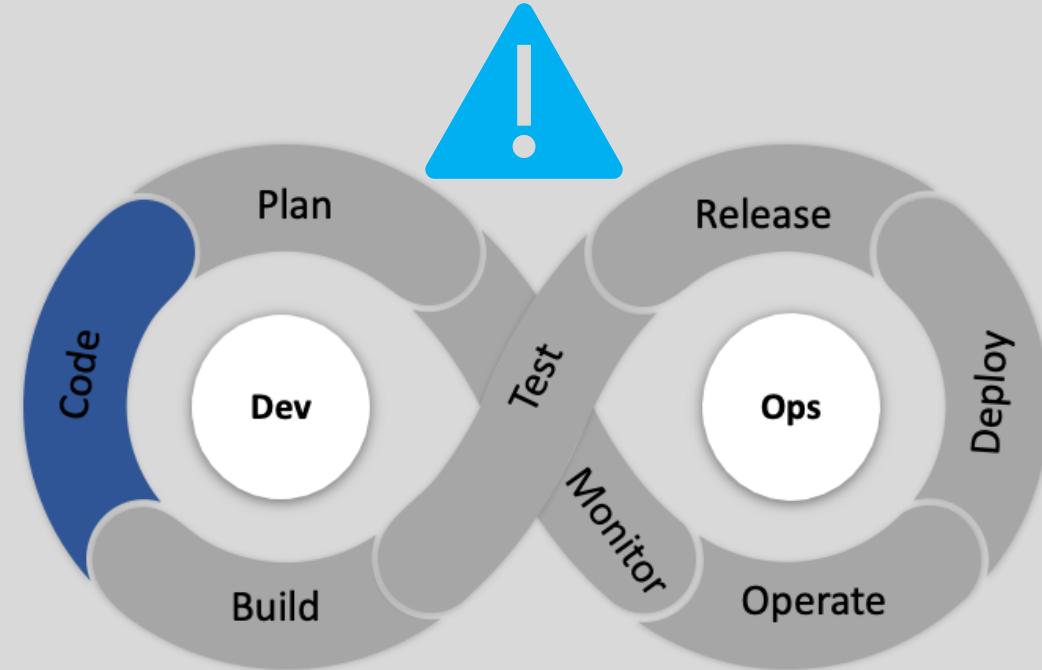
```
def max_sum_slice(xs):  
    """Return the maximum sum of a slice of xs."""  
    max_sum = 0  
    for i in range(len(xs)):  
        for j in range(i, len(xs)):  
            this_sum = 0  
            for k in range(i, j + 1):  
                this_sum += xs[k]  
            if this_sum > max_sum:  
                max_sum = this_sum  
  
    return max_sum
```



AI-Augmented

Coding Considerations

- Unequal productivity gains
- Code Churn
- Less Secure Code
- QA = rigorous testing + humans in the loop



AI can be
unreliable.

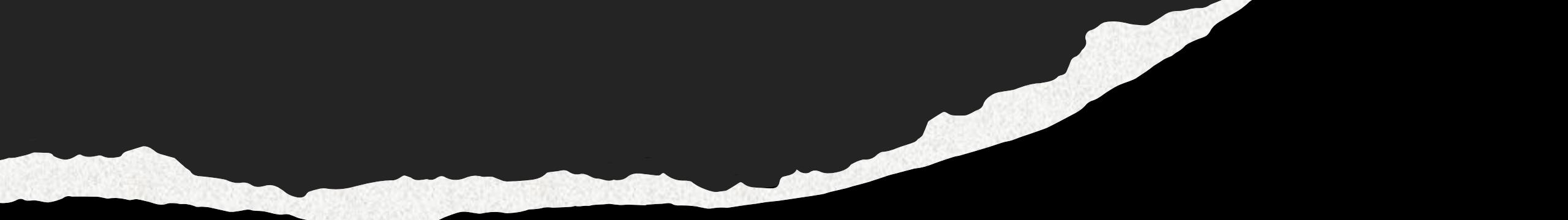
Pay close
attention!



Don't generate code and tests

- Lack of Independent Verification
- Bias and Blind Spots
- Overfitting





Is your organization prepared?



Fix your SDLC first

- Address existing issues
- GAI can magnify existing problems



Back to the basics...





“Do the
Minimum”

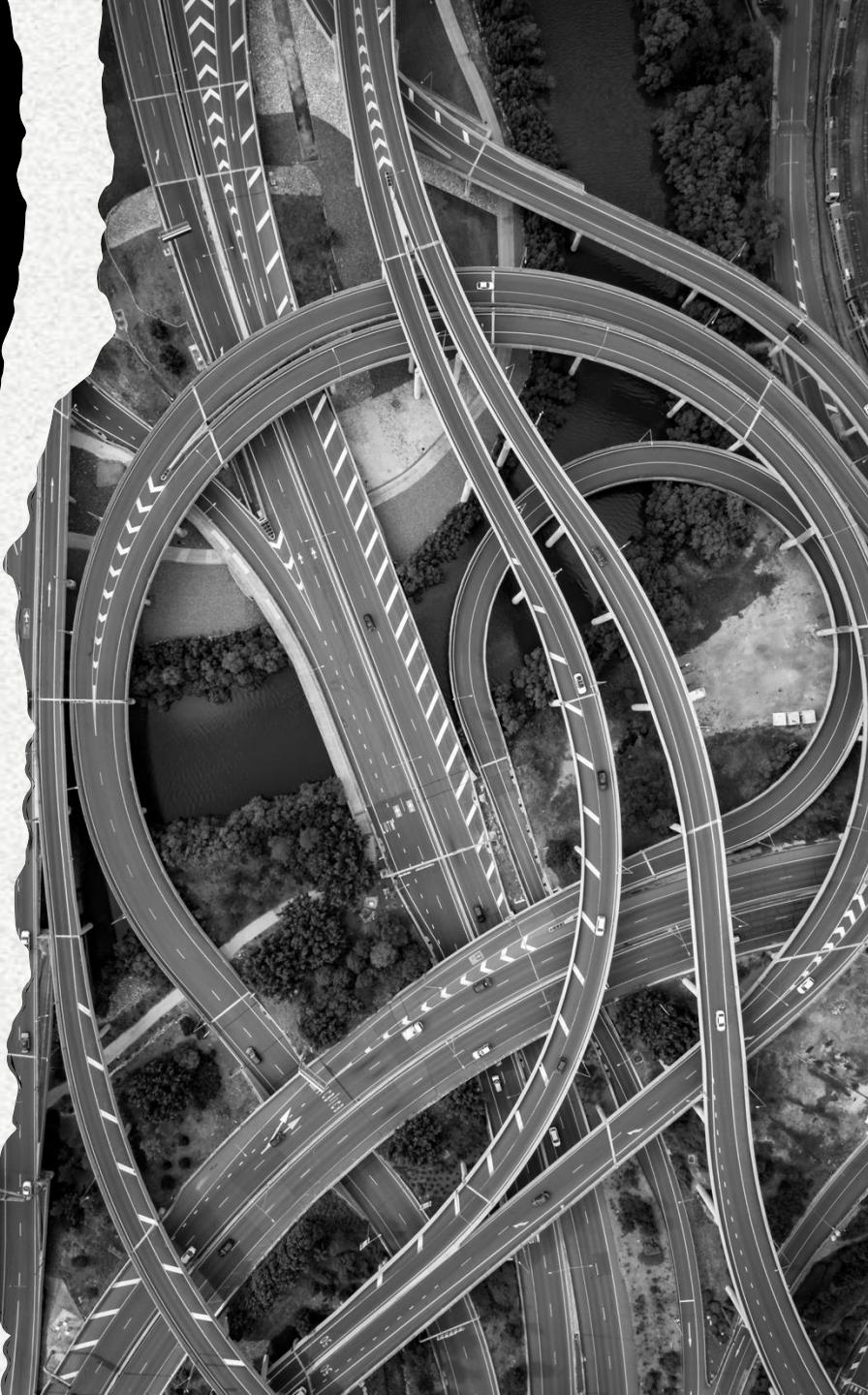


Gotchas to avoid



Adaptation to New Workflows

- Measurements and metrics will waiver
- Training is a must
- Humans resist change





What about productivity?

- Perceived productivity
- Team productivity *not* Individual productivity



The Importance of Context

- AI requires a massive corpus of data
- If you subscribe to a service, you must provide context
- Are you okay with sharing?



Keep Humans in the Loop!

Leading practices for today's AI-augmented SDLC

- Keep humans in the loop
- Everything in source control including prompts
- Secure your vulnerabilities
- Don't provide your private info/IP into public AI engines

The Big Picture

Adding AI to the Enterprise

- AI Strategy
- Governance and Managing Risk
- Ask Questions of AI Suppliers

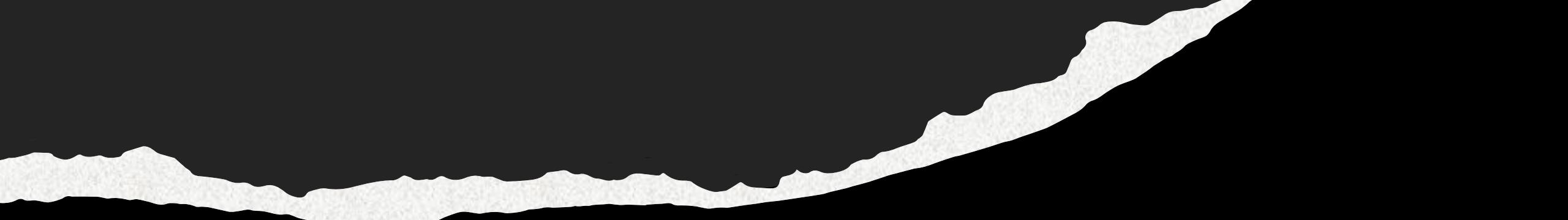


Choose when and where to start





AI-Augmented
Designing Today's [^] Software Engineering Tool Chain

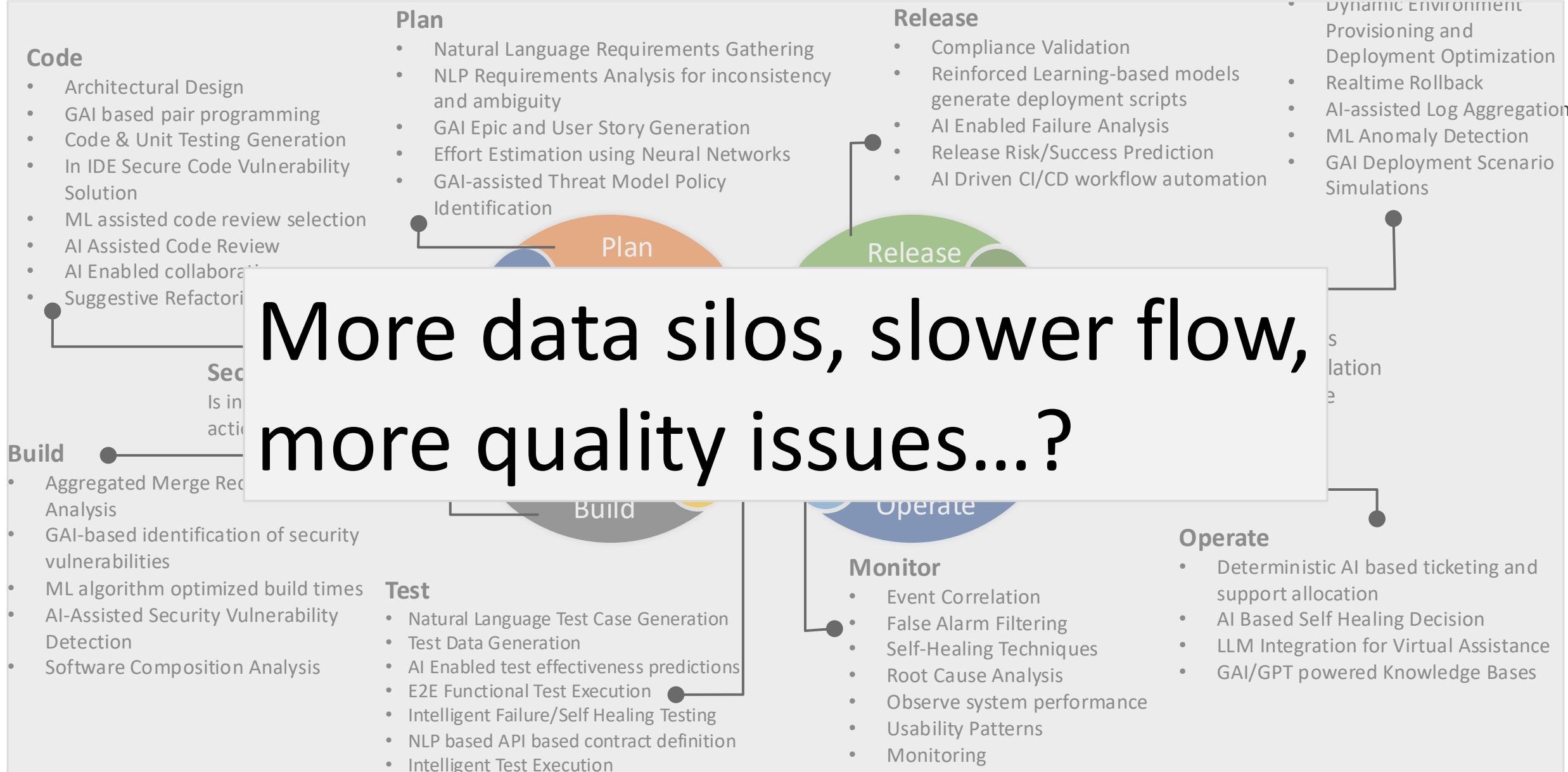


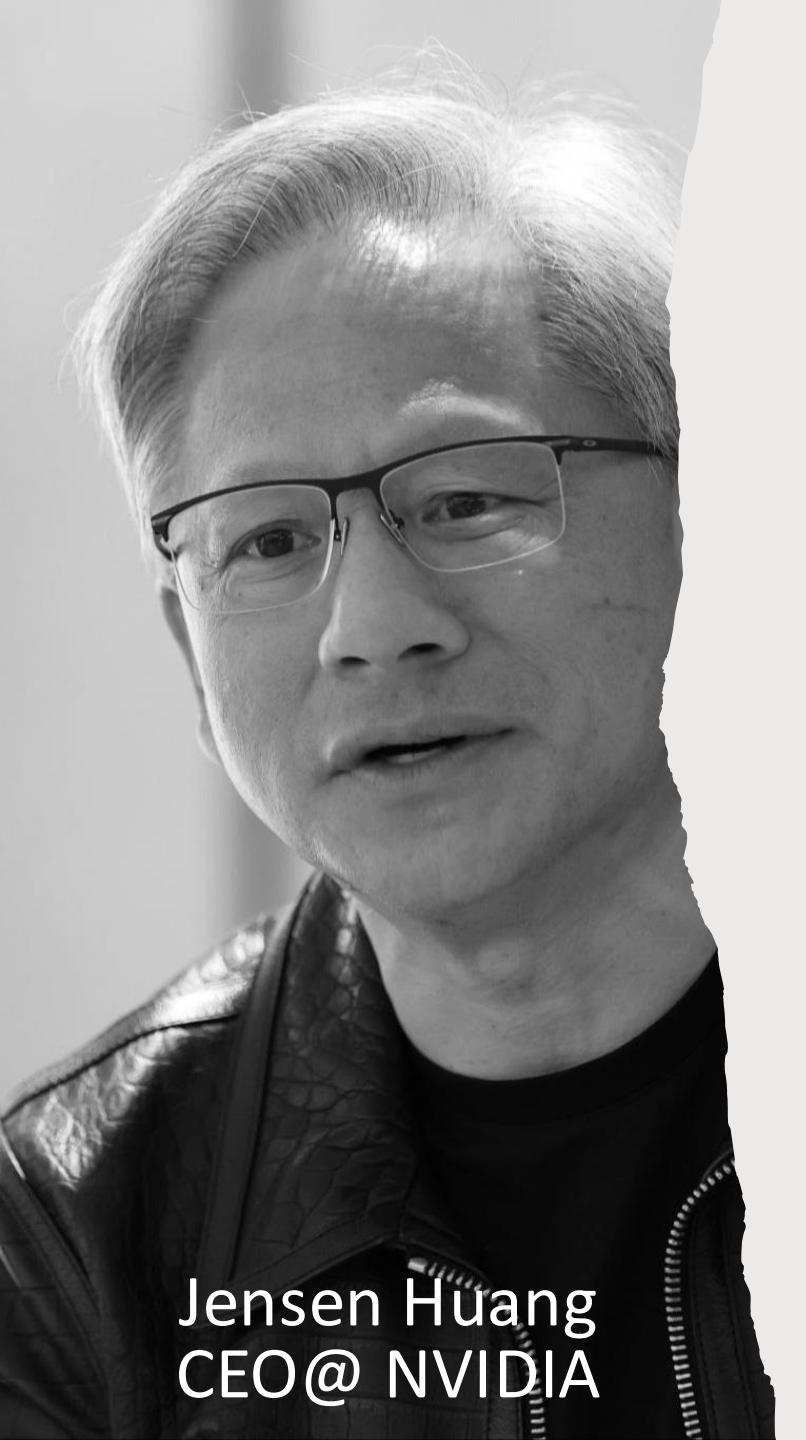
Looking Ahead

The Evolving Role of Digital Platforms

- Making it hard for humans to make mistakes
- Codify leading practices
- “Pro Code”
- The jumping off point for GAI-augmentation and future agentic capability

What does the SDLC look like over the next few years?



A black and white portrait of Jensen Huang, CEO of NVIDIA. He is wearing glasses and a dark zip-up jacket.

But what about
this...

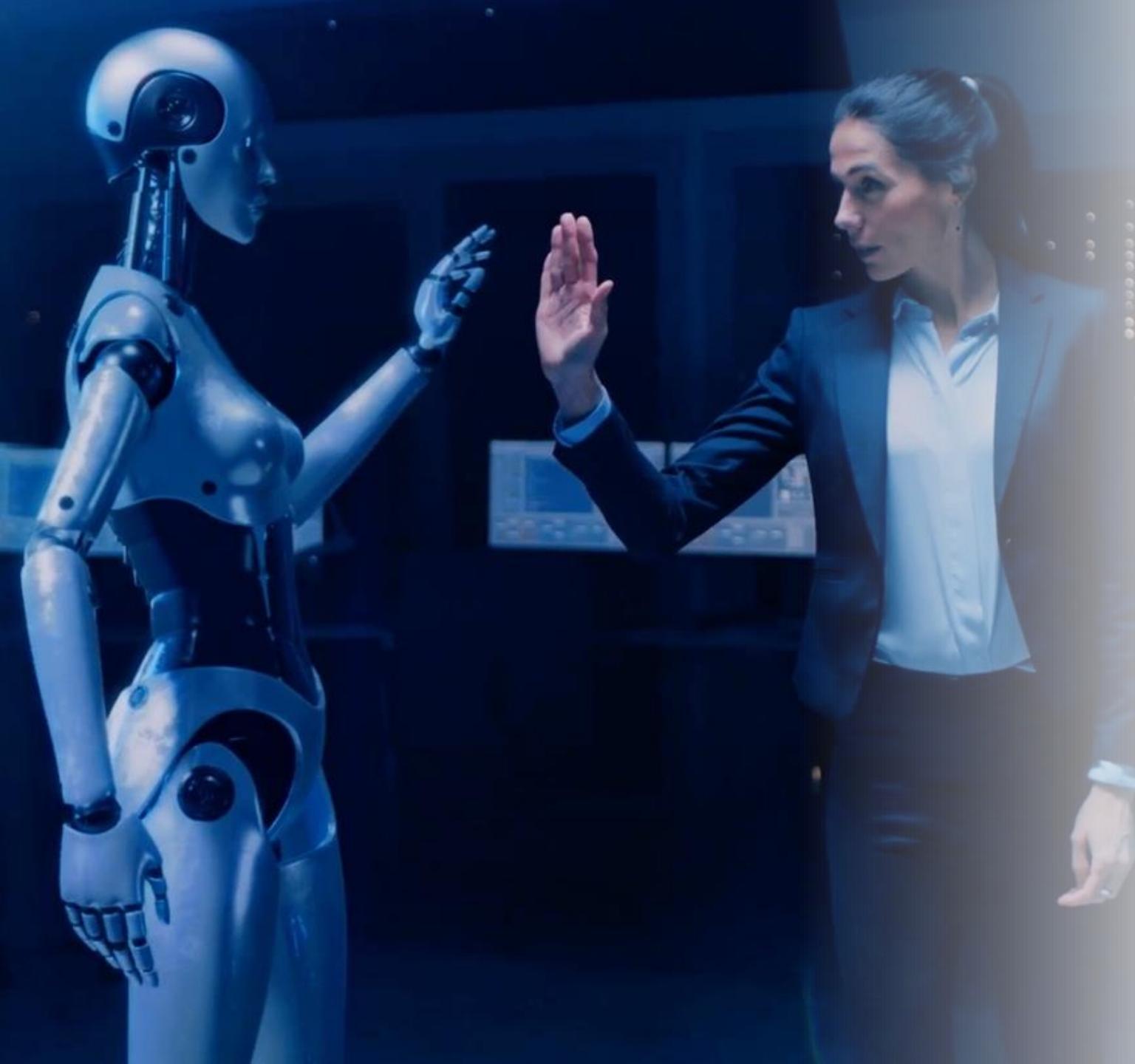
Is the future of
coding dead?

Jensen Huang
CEO@ NVIDIA

A black and white portrait of Scott Wu, CEO of Cognition AI. He is wearing glasses and a light-colored button-down shirt.

When will AI-
engineers join the
team?

Scott Wu
CEO@ Cognition AI

A woman in a dark suit and light blue shirt stands facing a large, metallic humanoid robot. They are both reaching out with their right hands towards each other, as if in a handshake or a gesture of interaction. The background is dark and appears to be a control room or laboratory setting with various screens and equipment visible in the distance.

AI/Human Teaming

Who will we
optimize for?
Humans? AI
Agents?

We can't put the genie back in the bottle

- Prompt engineering as a discipline
- Ethics of prompts
- Who owns the generated outcomes
- Human-Machine teaming
- Software team performance
- Trust and reliability in software outcomes





Call to Action – Your Next Steps

- Make Cybersecurity as your highest priority
- Enable research and discovery for GAI usage
- Establish on reasonable guardrails
- Ask your GAI providers about
 - model quality
 - security
 - roadmap

What I need from you...

- How do you think the SDLC will change?
- How is your organization preparing?
- What are you personally focusing on?
- Share your organization's story and lessons learned
- Share out new use cases and new tools





What matters are the humans.



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References

Academic Research, Industry Reports, Market Analysis

Given the extensive bibliography, the content has been moved to a separate file for readability and ease of use.



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