

# Working Effectively with AI in Software Development

## Mental Models, Patterns, and Practical Workflows

Your Name

Your Organization

December 5, 2025

Duration: 1.5 hours (40 min presentation + 50 min demo)

# You're Already Using AI

You're likely already using AI for:

- Autocomplete suggestions while typing
- Answering questions about APIs and syntax
- Generating boilerplate code
- Explaining errors

## Today's Goal

Being more **systematic and intentional** about AI use

# How Language Models Work: Tokens

## What they are:

- Text broken into chunks
- Processed sequentially
- One token at a time

## Why it matters:

- Context window = working memory
- Relevance volume
- Code  $\neq$  prose

## Key Insight

Showing code is more efficient than describing it

# Probabilistic Generation

*"Models predict the most likely next token,  
then the next, then the next"*

**Three consequences:**

- ① **Non-deterministic:** Same input → different outputs
- ② **No "knowing":** Predicting plausible continuations
- ③ **Variable confidence:** Some outputs are guesses

**Why this matters:** Verification is essential

# Mental Model: Knowledgeable but Literal

## AI is like a very literal assistant:

- Broad knowledge, lacks *YOUR* context
- Does exactly what you ask (not what you meant)
- Won't push back unless prompted
- Takes instructions literally

## When it helps:

- Getting started
- Initial drafts

## When it fails:

- Implicit requirements
- Domain decisions

# Mental Models: Pattern Matcher & Generator

## The Pattern Matcher:

- Excels with familiar patterns
- Works well: examples provided, conventions exist
- Struggles: novel problems, ambiguous requirements

## The Confident Generator:

- Generates plausible text regardless of accuracy
- Won't say "I don't know"
- Can't distinguish confidence levels

Always Verify

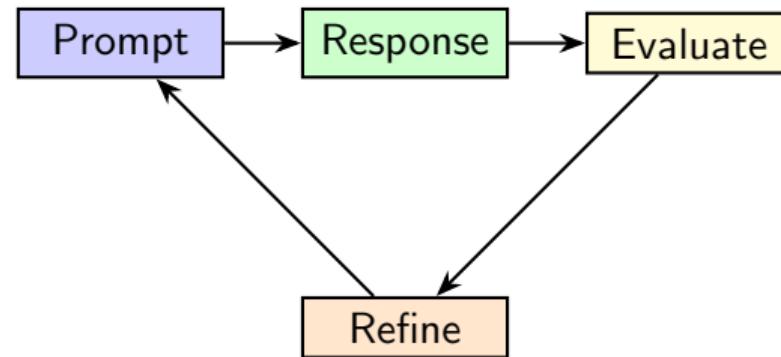
You need to verify, not just review

## Effective AI Use

Understanding + Communication + Verification

- **Understand:** How they actually work
- **Communicate:** What you really need
- **Verify:** Trust but verify always

# The Feedback Loop



- Working with AI is iterative
- 2-3 iterations typically gets you to quality

# Principle 1: Be Specific

## Vague:

```
Write a function  
to process data
```

## Specific:

```
Write a function that  
takes user objects,  
returns verified  
email addresses
```

**Key:** Be precise about outcome, not verbose about method

# Principles 2-4

## 2. Provide Context

- Relevant code, constraints, purpose, environment

## 3. Show, Don't Tell

- "Make it follow REST conventions"
- [Show example] "Create similar for /posts/:id"

## 4. Break Down Complex Tasks

- "Build an authentication system"
- Data model → Password functions → Login endpoint

# Pattern 1: Structured Request

```
## Task  
[Clear problem statement]  
  
## Current Code  
[Paste relevant code here]  
  
## Requirements  
- Specific constraint 1  
- Specific constraint 2  
  
## Constraints  
- Technology limits  
- Style requirements
```

**Structure creates clarity**

## Pattern 2: Iterative Refinement

**Process:** Broad → Specific → Implementation → Refinement

**Example sequence:**

- ① "Three approaches to implement caching"
- ② "Expand approach #2"
- ③ "Write the invalidation logic"

**Why it works:**

- Each step builds on verified results
- Reduces wasted iterations

## Pattern 3: Rubber Duck

### Use case: Decision making

```
Approach A vs B for permissions:  
- A: JSON array on user record  
- B: Separate permissions table  
- Context: ~10k users, rare changes,  
  query on every request  
What tradeoffs should I consider?
```

### Result: Structured analysis of options

Use AI to think through decisions, not just implement them

# Handling Poor Results

## **Four strategies:**

- ① **Add More Context** – AI might be missing information
  - ② **Provide Negative Examples** – Show what you DON'T want
  - ③ **Ask for Alternatives** – "Current approach doesn't work because..."
  - ④ **Correct and Continue** – Point out specific issues

Iteration is built-in. 2-3 rounds gets you to quality

# Anti-Pattern: Prompt Dumping

## DON'T:

```
[10,000 line codebase]  
"Fix the bug"
```

## DO:

```
[Relevant 50 lines]  
"Throws null when  
array is empty.  
Add guard clause."
```

Context pollution degrades output quality

# AI Strengths vs Limitations

## STRENGTHS

- Pattern recognition
- Error interpretation
- Security patterns
- Best practices

## LIMITATIONS

- Business logic
- Architecture
- Your context
- Race conditions

AI excels at mechanical analysis.

Human judgment essential for context

# Code Review Workflow

## PRE-COMMIT

- You ask AI to review your changes
- Address obvious issues before human review

## DURING REVIEW

- Verify complex logic
- Explain unfamiliar patterns

## POST-MERGE

- Generate release notes
- Update documentation

*AI as first pass, humans for context-dependent decisions*

# Review Prompts

## Template:

Review this [type] code for:

- [Concerns: security, performance]
- [Language/framework] best practices

[paste code]

## Variations:

- **Comparative:** "Compare these and find differences"
- **Focused:** "Security review only"

# Debugging: Error Interpretation

## Template:

```
I'm getting this error:  
[error message and stack trace]
```

Happens when: [trigger]

Relevant code: [paste code]

Question: What could cause this?

Structures information and reduces hallucination

# Debugging Techniques

| Technique            | When to Use            |
|----------------------|------------------------|
| Hypothesis generator | Systematic elimination |
| Rubber duck++        | Validate your theory   |
| Trace explainer      | Understand execution   |
| Fix validator        | Verify your fix        |
| Comparative          | Find differences       |

Example: "Why works: [code A], Why doesn't: [code B]"

# Debugging Workflow

## BEFORE

- ✓ Exact errors
- ✓ Repro steps
- ✓ Relevant code

## DURING

- Hypotheses
- Most likely first
- Iterate

## VERIFY

- Understand why
- Side effects?
- Test edges

## Augment, Don't Replace

| USE FOR             | AVOID FOR              |
|---------------------|------------------------|
| Variable inputs     | Deterministic ops      |
| Pattern recognition | High-stakes decisions  |
| Natural language    | Guaranteed correctness |

# Three Essential Patterns

## 1. Generate and Review

- AI generates → Human reviews → System applies

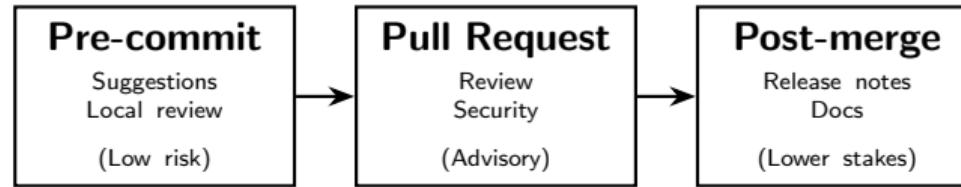
## 2. Triage and Route

- AI classifies → System routes → Humans handle

## 3. Augment and Assist

- Human works → AI suggests → Human decides

# CI/CD Integration Points



Each stage has different risk/benefit tradeoffs

# Pipeline Considerations

## FAIL-SAFE DESIGN

- Don't break pipelines on AI failures
- Make AI steps optional

## COST CONTROL

- Limit to key branches
- Cache results

## OBSERVABILITY

- Log decisions
- Track false positives

## DATA EXPOSURE

- What goes to AI services?
- Filter sensitive files, redact secrets

## SUPPLY CHAIN RISK

- Review AI suggestions
- Don't auto-apply changes

## FEEDBACK LOOPS

- Record dismissals
- Monitor false positive rate

# Threat Categories

## APPLICATION

- Authorization
- Access control

## AI LAYER

(*our focus*)

- Prompt injection
- Data exposure

## INFRASTRUCTURE

- API security
- Data storage

# Key Threat: Prompt Injection

## Warning

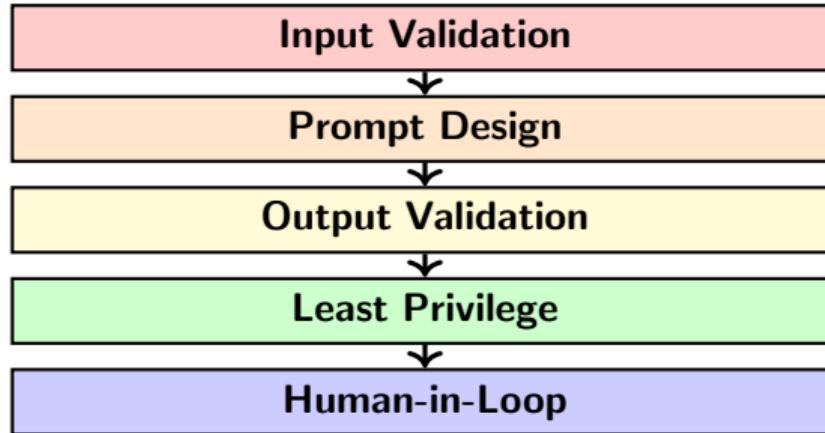
**No complete solution exists.** Goal: reduce risk, limit impact

**The problem:** AI can't reliably distinguish between user input and instructions

### Attack types:

- ① Direct injection (in user input)
- ② Indirect injection (in data sources)
- ③ Jailbreaking (roleplay attacks)

# Defense in Depth



Multiple layers, not single solution

# Practical Guidance

## DO:

- ✓ Review code carefully
- ✓ Watch for anti-patterns
- ✓ Redact sensitive data
- ✓ Consult security team

## DON'T:

- Blindly accept
- Paste credentials
- Assume AI knows threats
- Use AI alone

**Watch for:** SQL concatenation, missing validation, hardcoded credentials

# What We Covered

- **Foundation** – How models work, mental models
- **Prompting** – 4 principles, 3 patterns
- **Code Inspection** – Review & debug workflows
- **Automation** – Patterns, CI/CD, reliability
- **Security** – Threats, defense, guidelines

*Now let's see it in practice...*

# Live Demo

## We'll walkthrough:

- ① Effective prompting in action
- ② Code review and debugging workflow
- ③ Using these tools day-to-day

**Questions are always welcome**

# Thank You!

Questions?