Drawing Figures with AI/LLM

Apaper – Translating Structured Text to Visual Diagrams

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The Problem

From Concept to Figure

Traditional Approach

- Manual drawing tools
- Pixel-based images
- Hard to version control
- Difficult to modify
- Time-consuming iteration

AI-Assisted Approach

- Generate library code
- Metadata-rich formats
- Git-friendly text files
- Easy modification
- Rapid iteration

Core Concept

Library Code Generation

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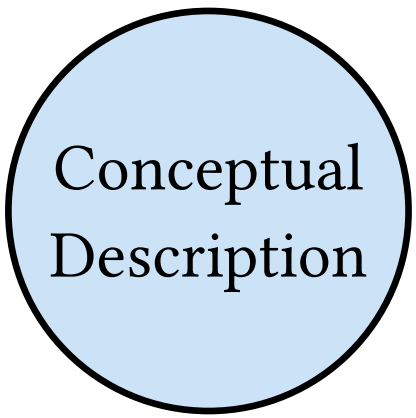
Key Insight: Libraries encode structure and semantics, not just pixels.

The Approach



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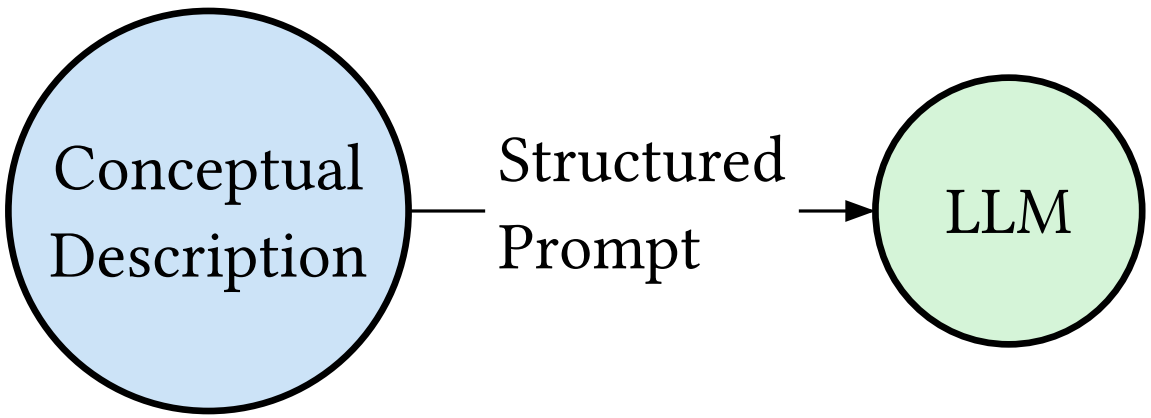

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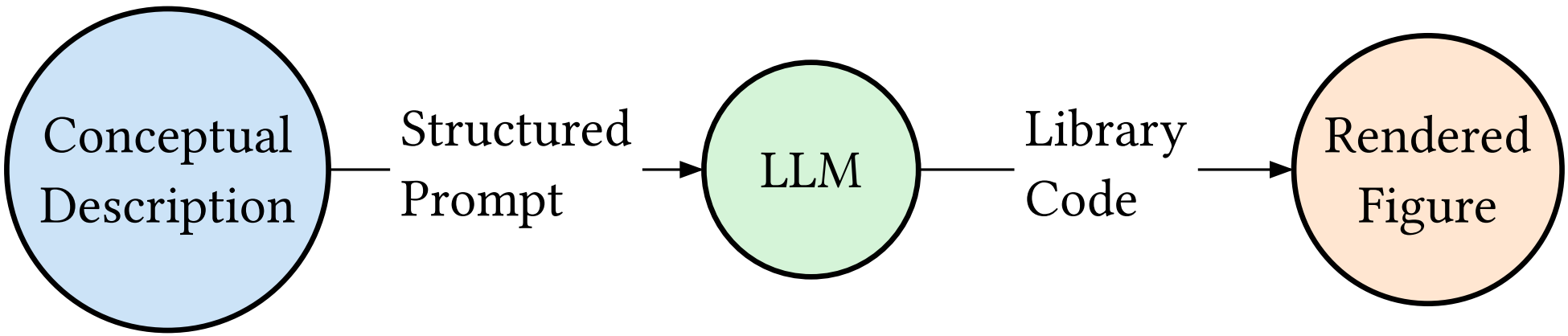

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Prompt Engineering

Key Components of a Good Prompt

Example from `figure-tikz.md`[1]:

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1. **Pure relative positioning only**
2. **NO anchor-based offsets** — avoid manual coordinates
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4. **Row-based layout** — structure as logical rows
- `minimum width`: 1.4–2.2cm
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Prompt = Expert knowledge + Constraints + Anti-patterns

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Prompt Structure

```
You are a TikZ/LaTeX Expert.

## Design Principles
[Best practices and constraints]

## Required Libraries
[Dependencies to include]

## Code Structure Template
[Skeleton with style definitions]
```

```
## Robust Patterns
[Recommended approaches]

## Anti-Patterns to Avoid
[Common mistakes]

## Task
Create a TikZ figure for: $ARGUMENTS
```

This structure works for any figure library (TikZ, Mermaid, CeTZ, etc.)

Iterative Refinement

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→ LLM outputs TikZ code following your prompt’s constraints

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Compile and render the generated code to see the actual figure.

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If YES → You're done! ✓

If NO → Continue to next step...

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Each issue reveals a missing constraint in your prompt.

Step 4: Update Prompt

Refine the prompt based on issues found:

Add constraints:

```
- Use relative positioning only (no xshift/yshift)
- Maximum width: 8.5cm for single column
- Node spacing: 0.6cm vertical, 1.8cm horizontal
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Add anti-patterns:

❌ Avoid: `above right=-0.1cm of node.south`

✅ Use: `below=of node` with separate row

Step 5: Iterate

Generate → Evaluate → Find Issues → Update Prompt

Each issue discovered → prompt improvement → better future outputs

Result: A refined prompt that generates good figures consistently.

Broader Context

This Pattern Everywhere

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Common thread: Encode expert knowledge in structured prompts

Why It Works

Without Prompt Engineering

- Generic LLM output
- Inconsistent style
- May violate constraints
- Requires manual fixes
- Not reusable

With Prompt Engineering

- Expert-level output
- Consistent patterns
- Respects constraints
- Ready to use
- Reusable template

Summary

Key Takeaways

- Generate code, not pixels for figures
- Use structured prompts with constraints and examples
- Iterate to refine both output and prompt
- Apply to any figure library (TikZ, Mermaid, CeTZ, Fletcher)
- Same technique as SKILLS and MCP servers

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Core insight: Prompt engineering = Encoding expert knowledge

Quality of output $\propto$ Quality of prompt

Resources

- Example TikZ prompt:
  `github.com/jiahaoxiang2000/deeper-paper`
  `.opencode/command/figure-tikz.md`
- Typst libraries:
  - CeTZ: `typst.app/universe/package/cetz`
  - Fletcher: `typst.app/universe/package/fletcher`
- LaTeX TikZ: `tikz.dev`
- Mermaid: `mermaid.js.org`