Generative AI and Variability
A Research Vision

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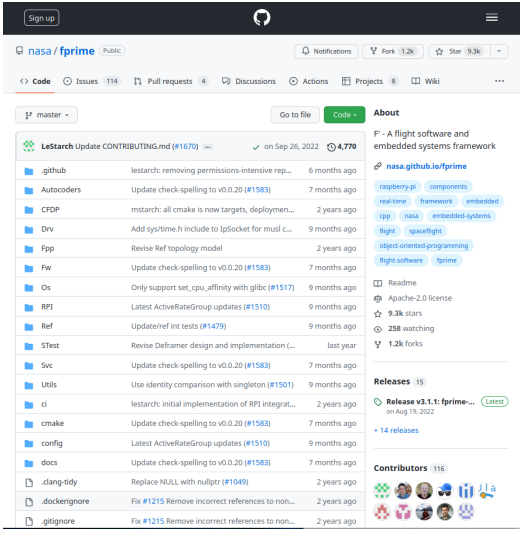
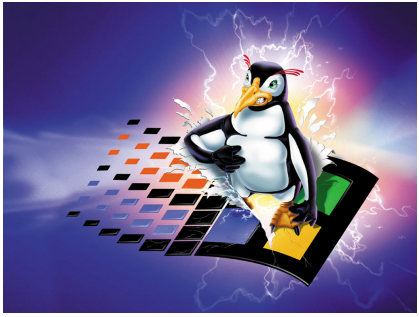
Current State of

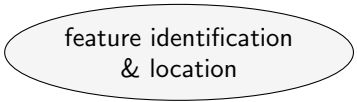
Managing Variable-Intensive Software

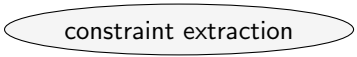
SOTA: Large (Evolving) Variability-Intensive Software





Problem





Problem

variability modeling

feature identification & location

annotative approaches

constraint extraction

feature-oriented, transformative

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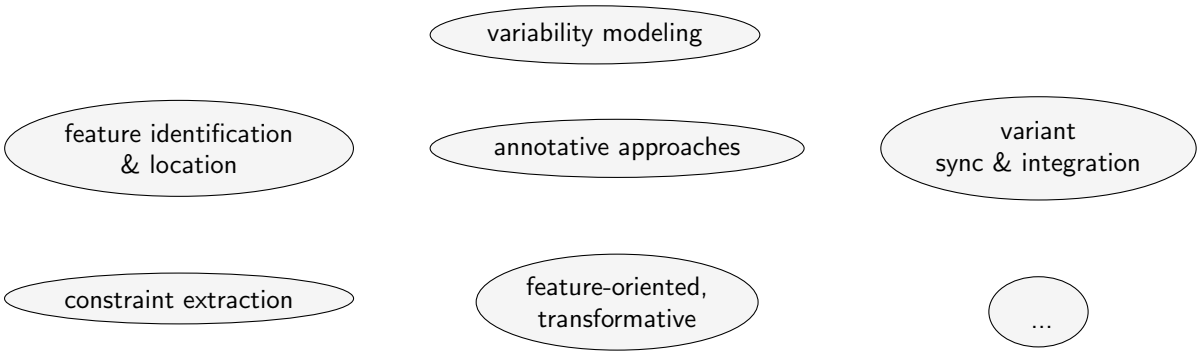
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Availability and Generalization Power of Generative AI

Business / Tech

A year after ChatGPT's release, the AI revolution is just beginning

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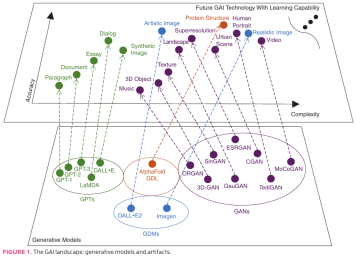

FIGURE 1. The GAI landscape: generative models and artifacts.

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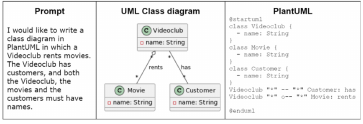


Fig. 2 Prompt used to ask ChatGPT to generate a UML class diagram of a video club system, and the resulting model

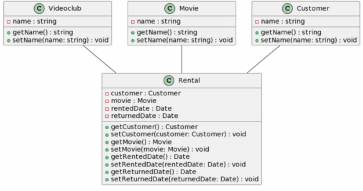
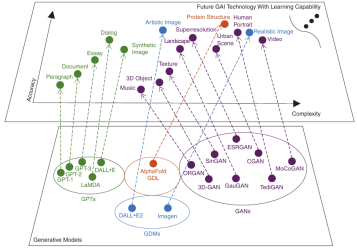


Fig. 3 Another model generated by ChatGPT in response to exactly the same prompt, but in a different session



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On Programming Variability with Large Language Model-based Assistant

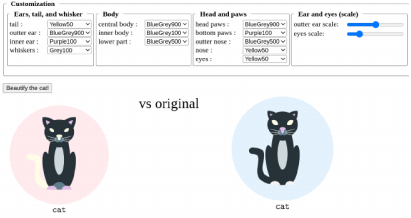
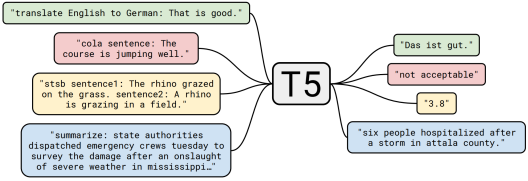


Figure 1: End-user customization of Cat TikZ code

What does it need from research to support maintaining variability-intensive software systems with Generative AI?

Background

Generative AI – Large Language Models



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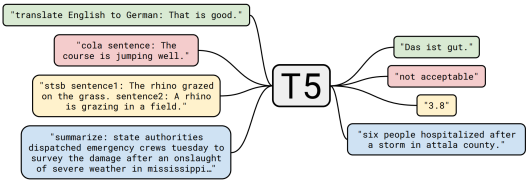

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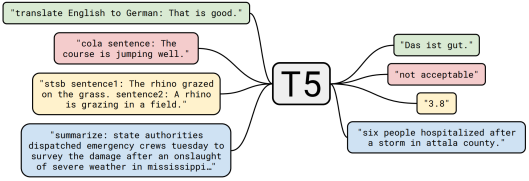

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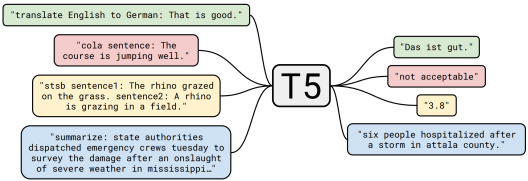

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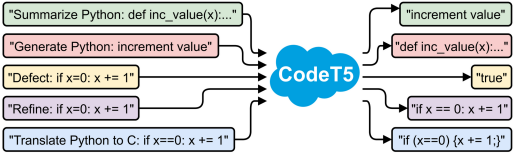

Generative AI for SE: pre-trained on several programming languages

- defect & clone detection
- code summarization
- code translation,
- ...

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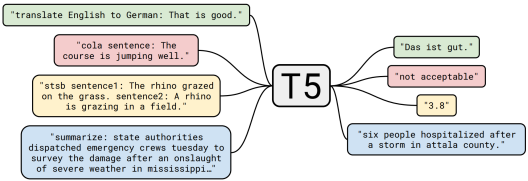

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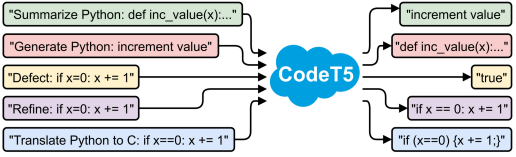

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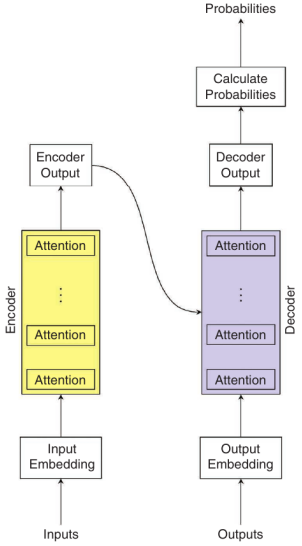

context window defines size of input and output (in tokens)

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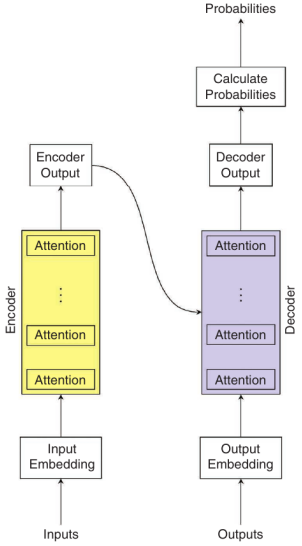

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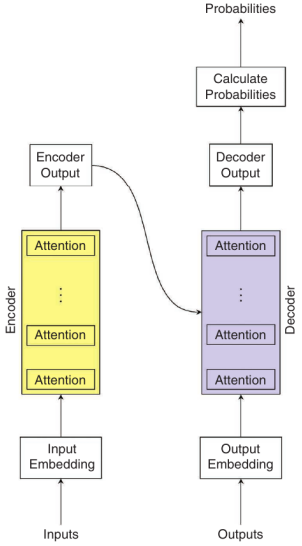

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Further tuning through hyperparameters (temperature, learning rate, ...)

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Idea

How can we assess success of Gen-AI-enabled development of variability-intensive software?

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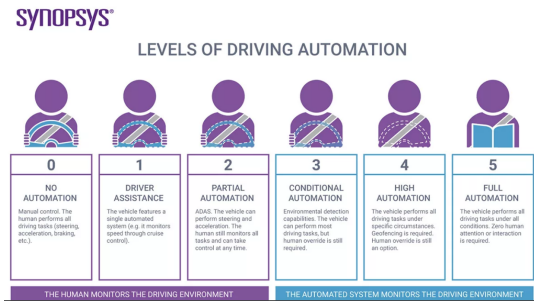

Levels and Characteristics

How can we **classify** and assess progress
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Automation	level of manual intervention

*not a specific variability-intensive task

Automation Levels

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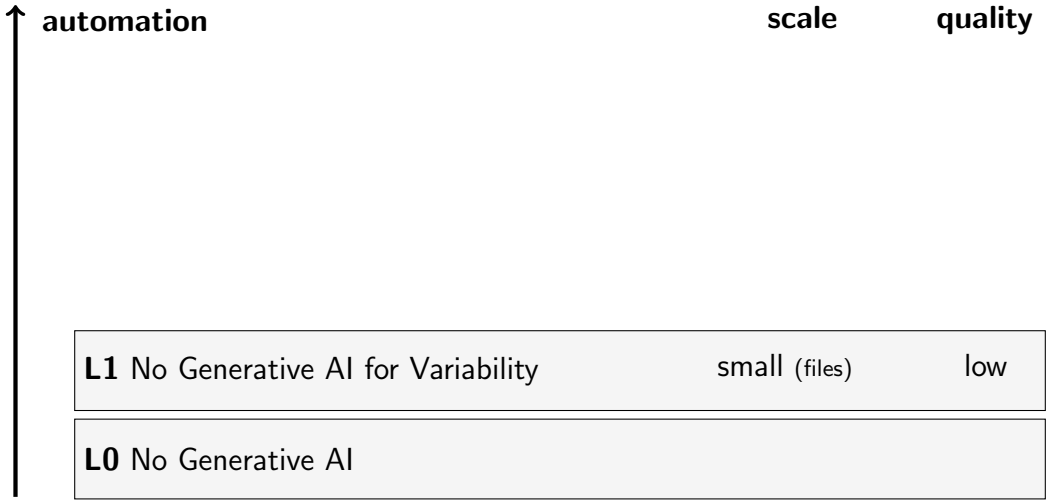
automation

scale

quality

L0 No Generative AI

Automation Levels



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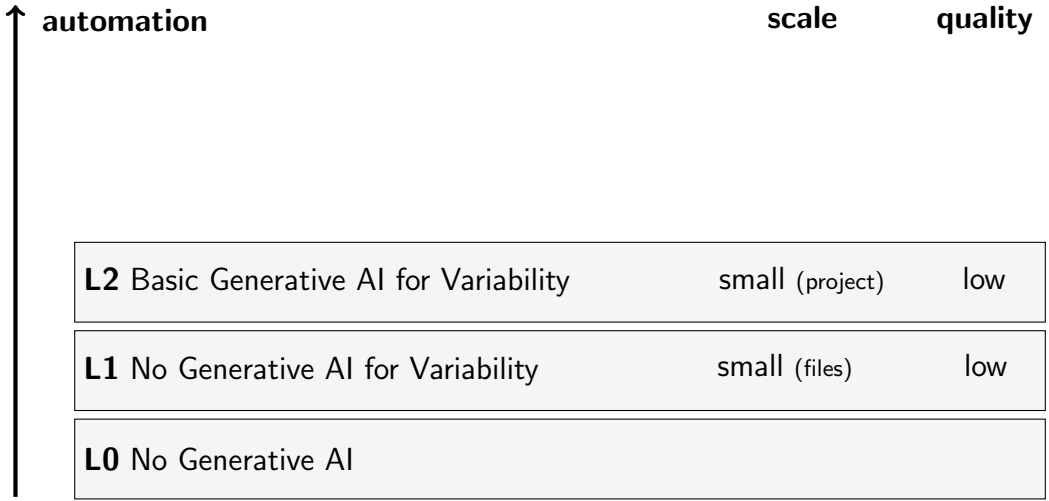

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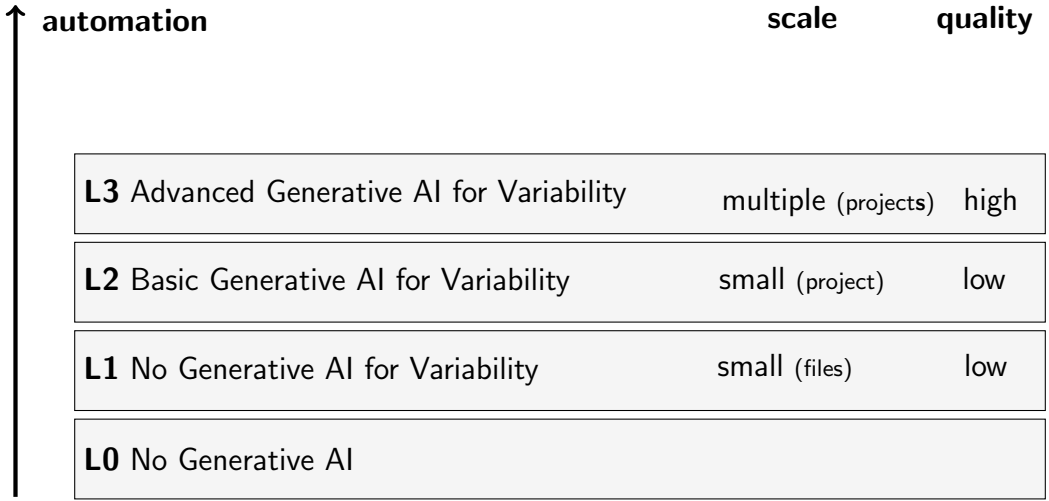

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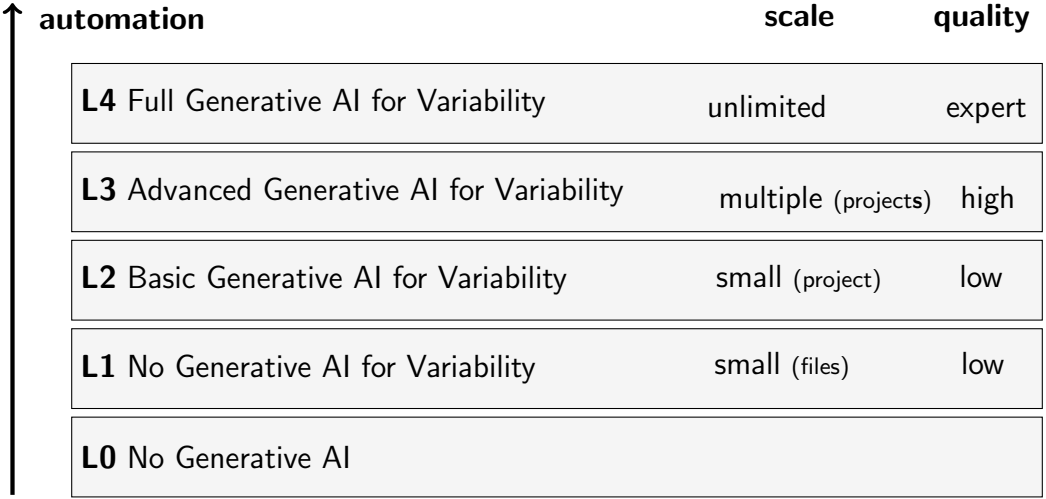

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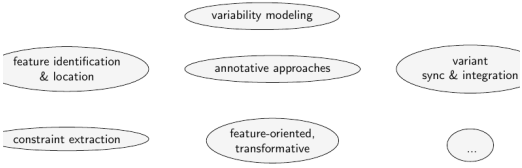
increase reliability
→ reasoning for results, certainty values

What's next?

exercise the levels for one SPL technique

explore combination of classical SPL techniques with Gen-AI support

Summary



language-specific, hard to analyze large systems, hard ot maintain consistently ...

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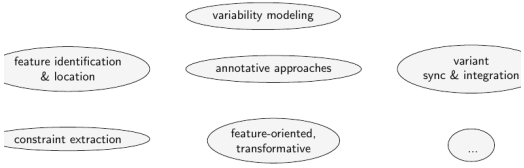

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automation	scale	quality
L4 Full Generative AI for Variability	unlimited	expert
L3 Advanced Generative AI for Variability	multiple (projects)	high
L2 Basic Generative AI for Variability	small (project)	low
L1 No Generative AI for Variability	small (files)	low
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Thanks!

Feedback, Questions, ...?