▲ Hochschule Harz
Hochschule für angewandte Wissenschaften

INF FAKULTÄT FÜR INFORMATIK

Finding Lost Features in Cloned Systems

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Agenda

Motivation

Mapping Process

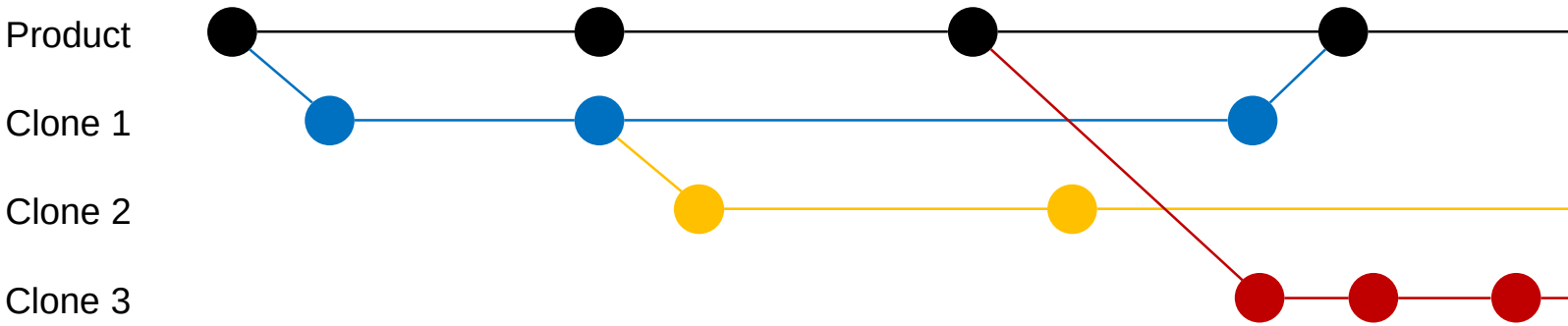
Evaluation

Conclusion

Software Reuse in Practice

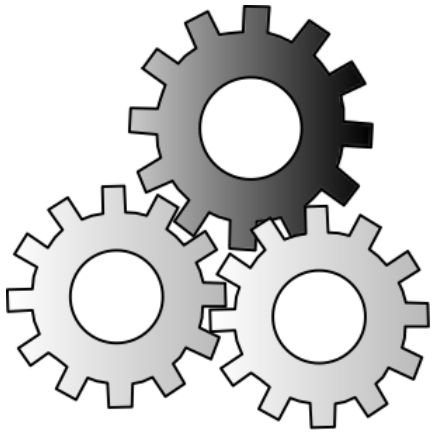
- Software reuse and customizing via cloning

- Potential problems?
  - Clones
  - Change propagation
  - Quality

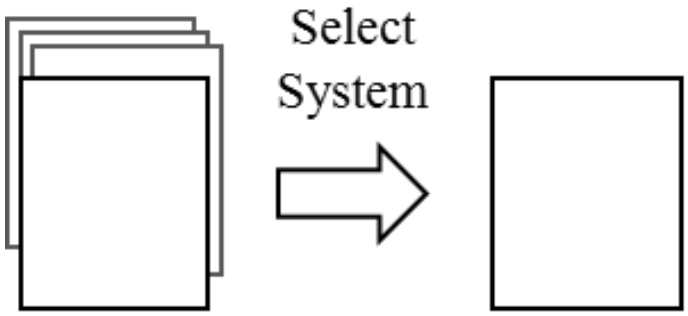


Improving the Situation

- Extract features into reusable artefacts / improve clone management
- What happens if knowledge about the clones is mising?
- Automated analysis:
  - Feature location
  - Code clone detection
  - …
- Still requires manual work!

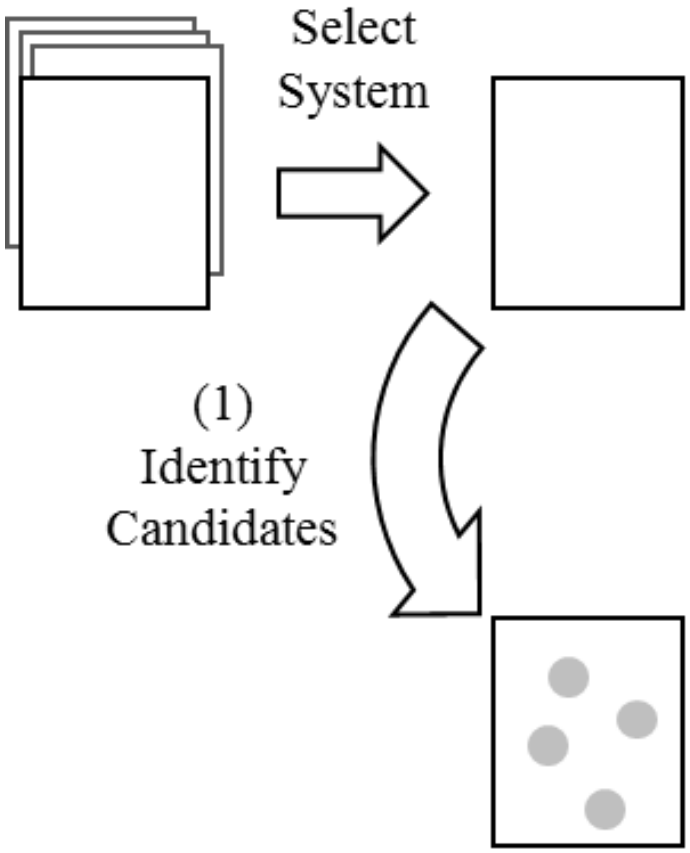


Mapping Process



- Idea:
  - Language and tool independence
  - Step-wise to evaluate immediate results
  - Each considered clone analyzed once

Mapping Process



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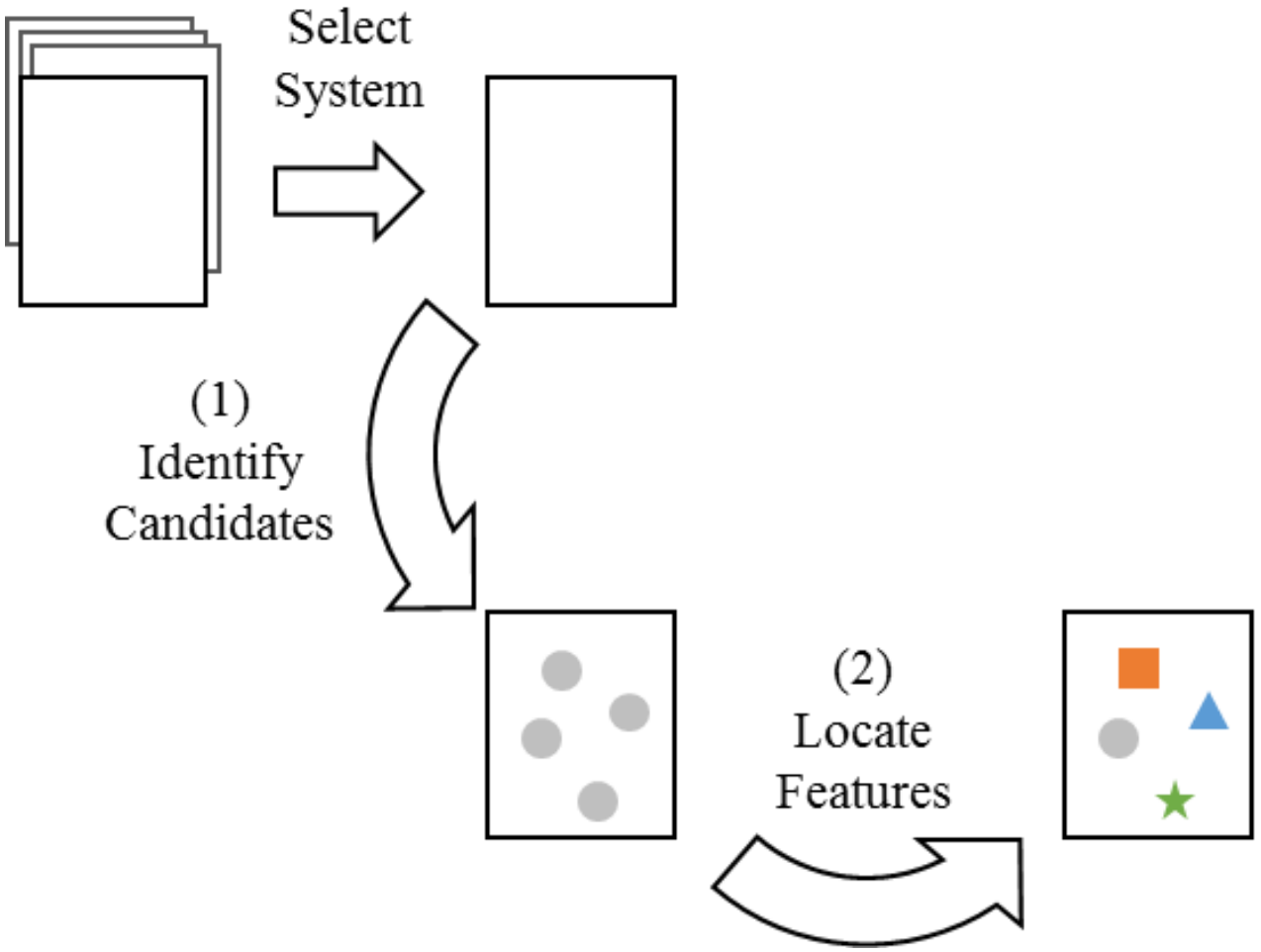

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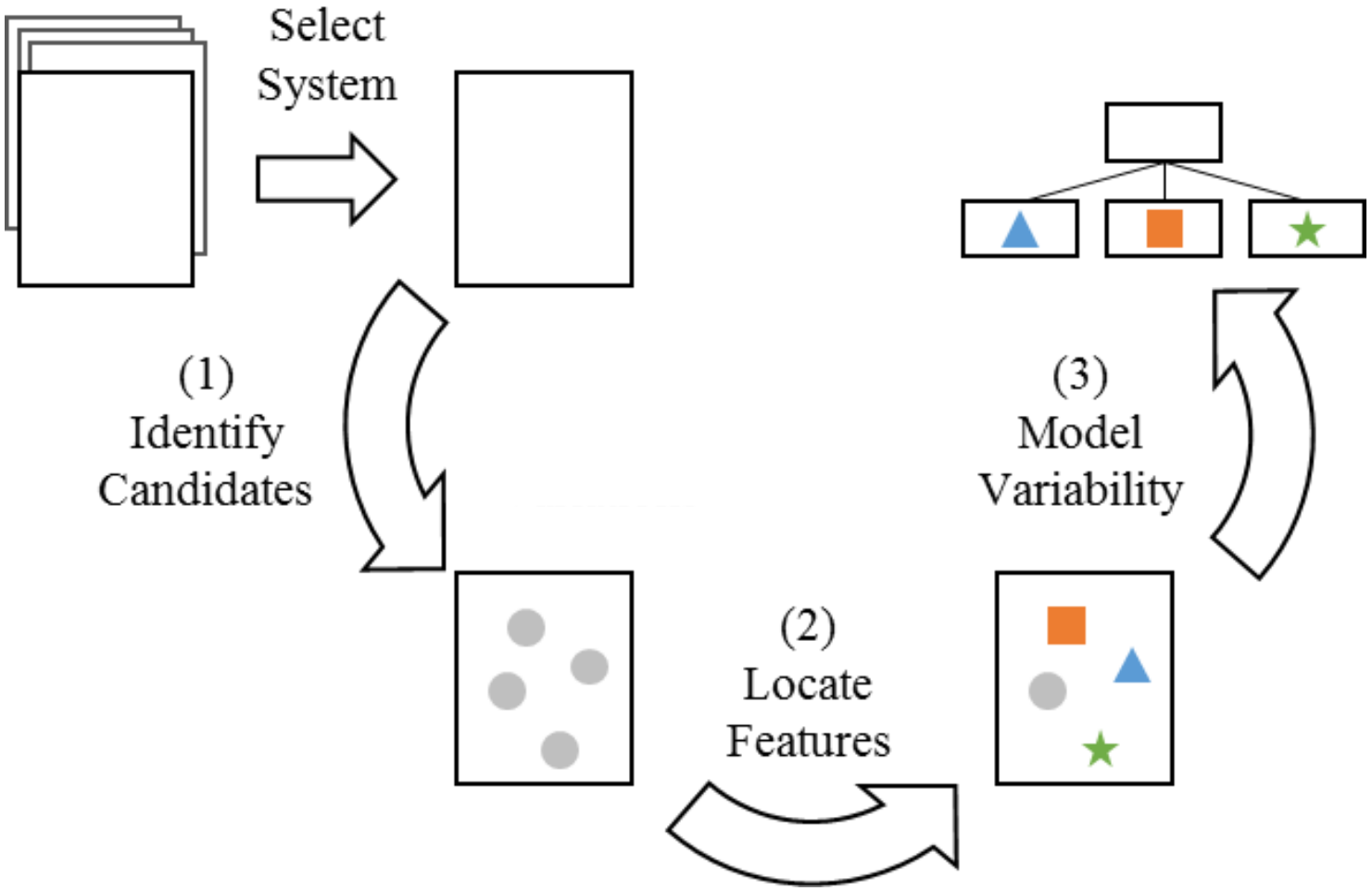

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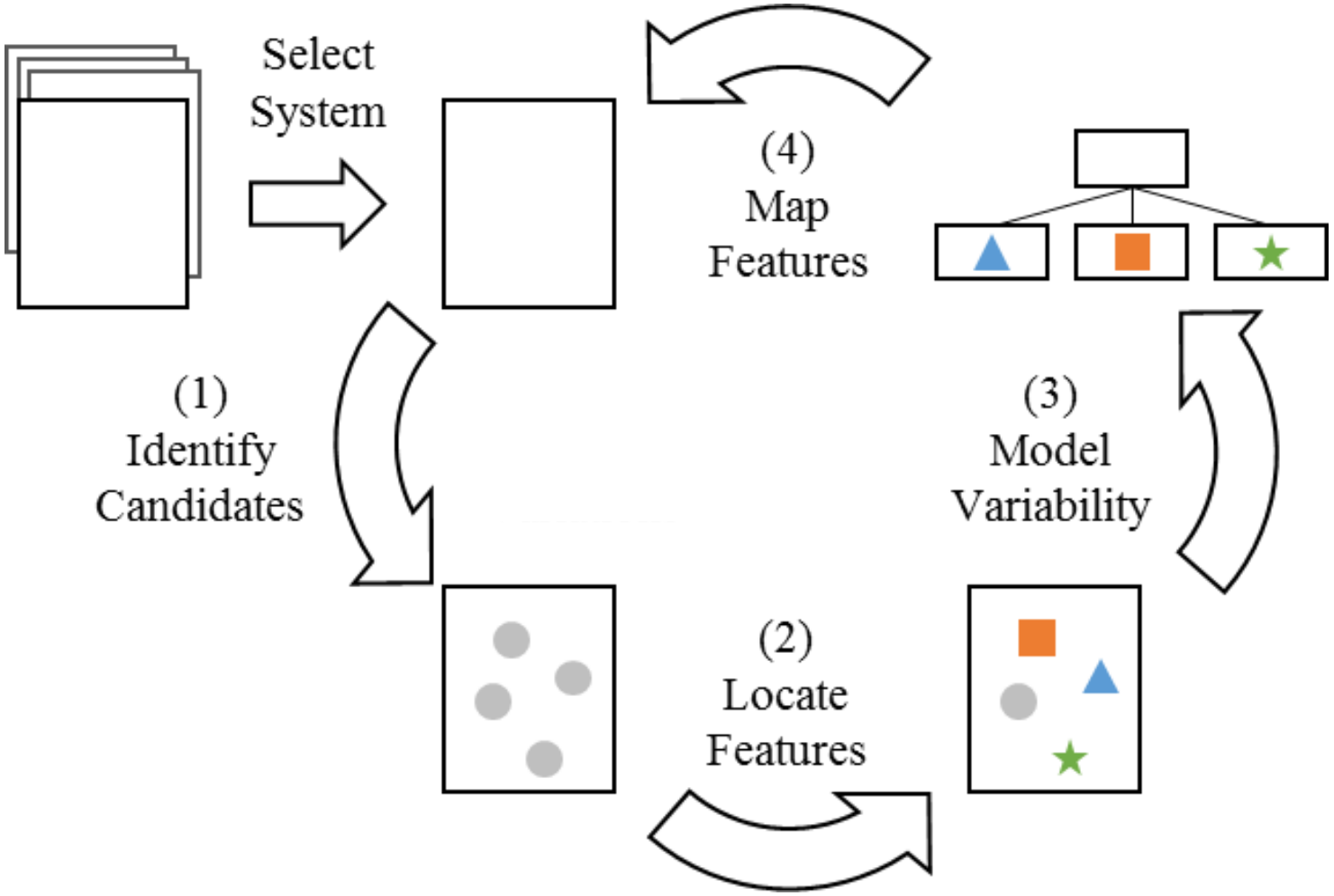

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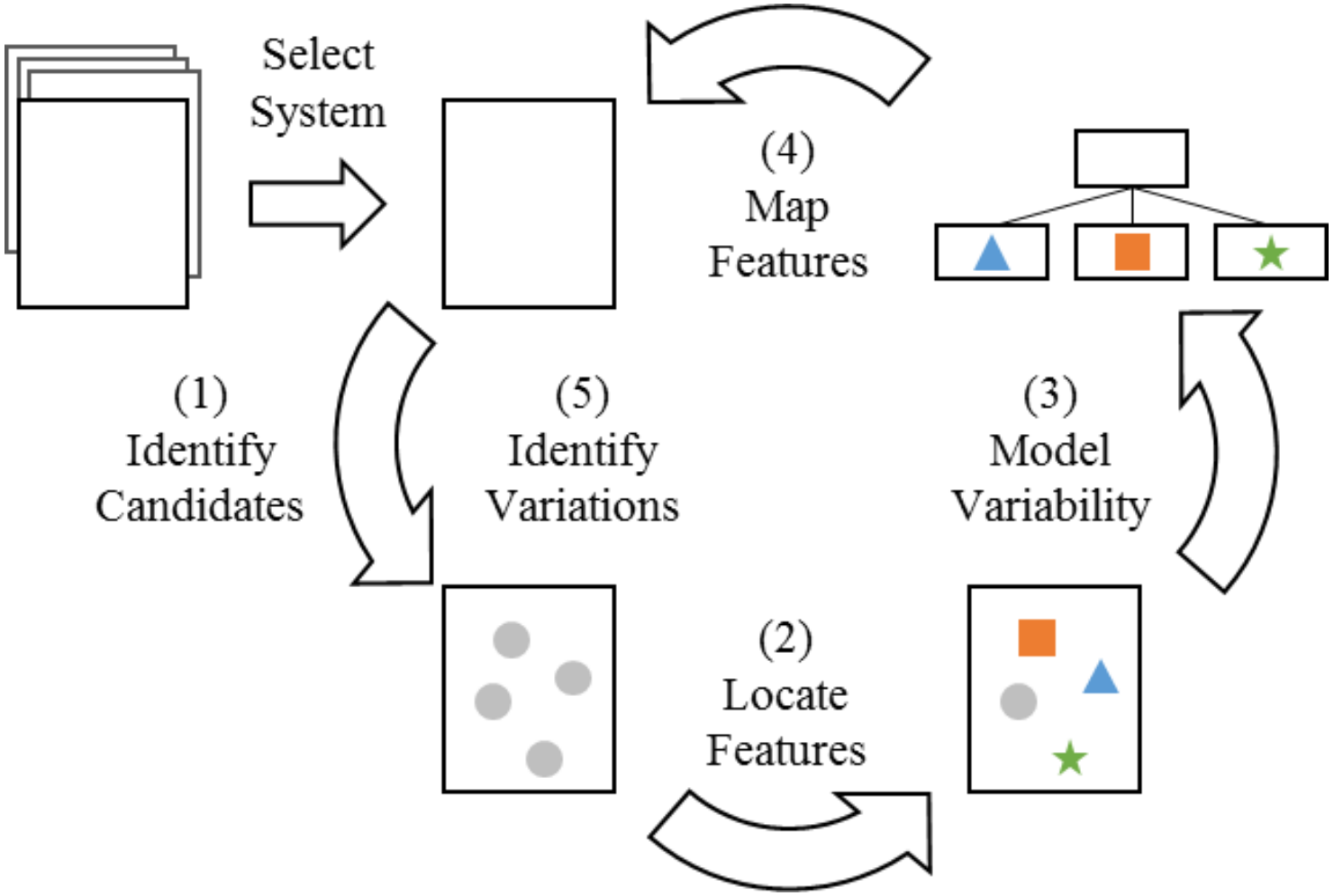
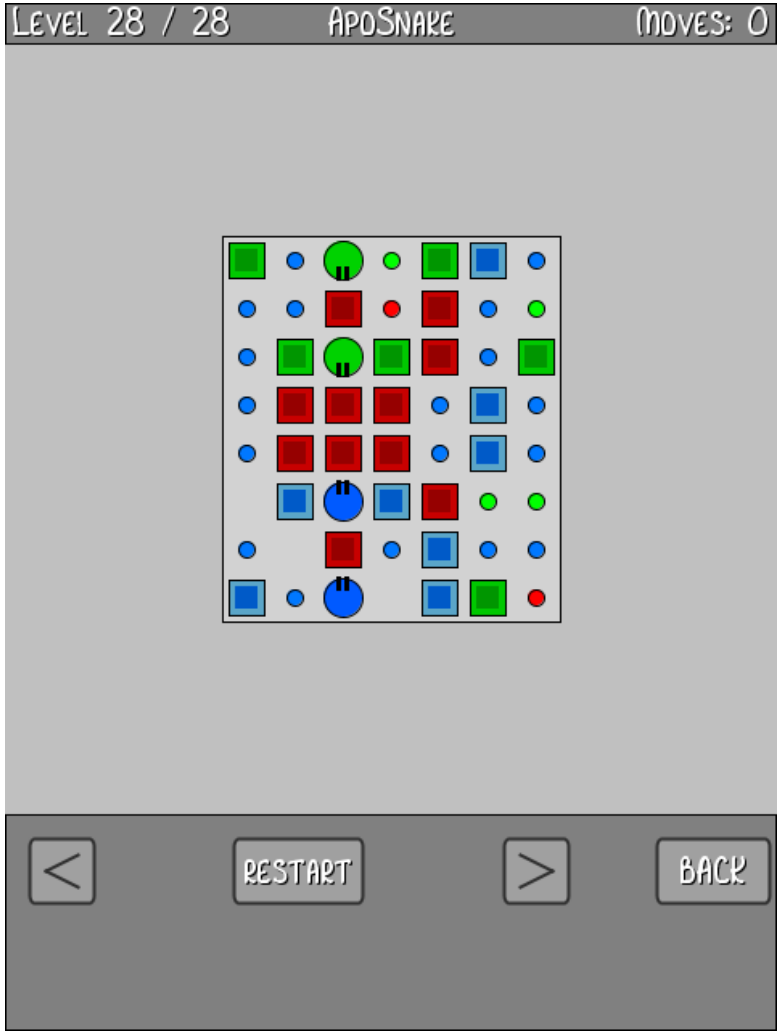


Evaluation Setup

- Tools
  - Clone Detective
  - Visualization prototype
- Apo Games
  - Five cloned Java (Android) games
  - Reference study of one author [Fenske et al. SANER 2017]
- Used one clone as analysis system



Reference Study

- Completely automatic refactoring
  - Rename instance method
  - Pull-up to common feature

- 15 common and 5 unique features

System	Base #SLOC	Migrated #SLOC	ΔSLOC
Dice	2,504	1,346	1,158
Clock	3,584	2,696	888
MonoDroid	6,483	5,490	993
Snake	2,946	1,786	1,160
MyTreasure	5,322	4,483	839
Common	-	1,779	-
Total	20,839	17,580	-15.6%

Research Questions

RQ1 - How much of the extracted code in the reference study do we identify?

RQ2 - How do the differences between our mapping and the reference study look like?

RQ3 - How does a feature model for the subject systems look like?

Results

Feature	Function	#Classes	∑SLOC				
			Dice	Clock	MonoDroid	Snake	MyTreasure
Base	Core functionality	2	275	275	275	199	275
Editor	Create levels	1	61	34	0	27	0
Game	Game objects	8	347	129	118	253	20
Load	Load levels	2	282	282	282	282	267
Menu	Menu	2	295	61	201	93	0
Puzzle Chooser	Select levels	2	121	111	0	121	0
Save	Save levels	1	17	17	17	17	17
Total			1,398	909	893	992	579

RQ1 – Extracted Code

– In Dice and Clock we found more common code

– In Snake and MyTreasure we found less common code

➢ Manual analysis identified more common code in initial clone

➢ But expensive to identify common code among all clones

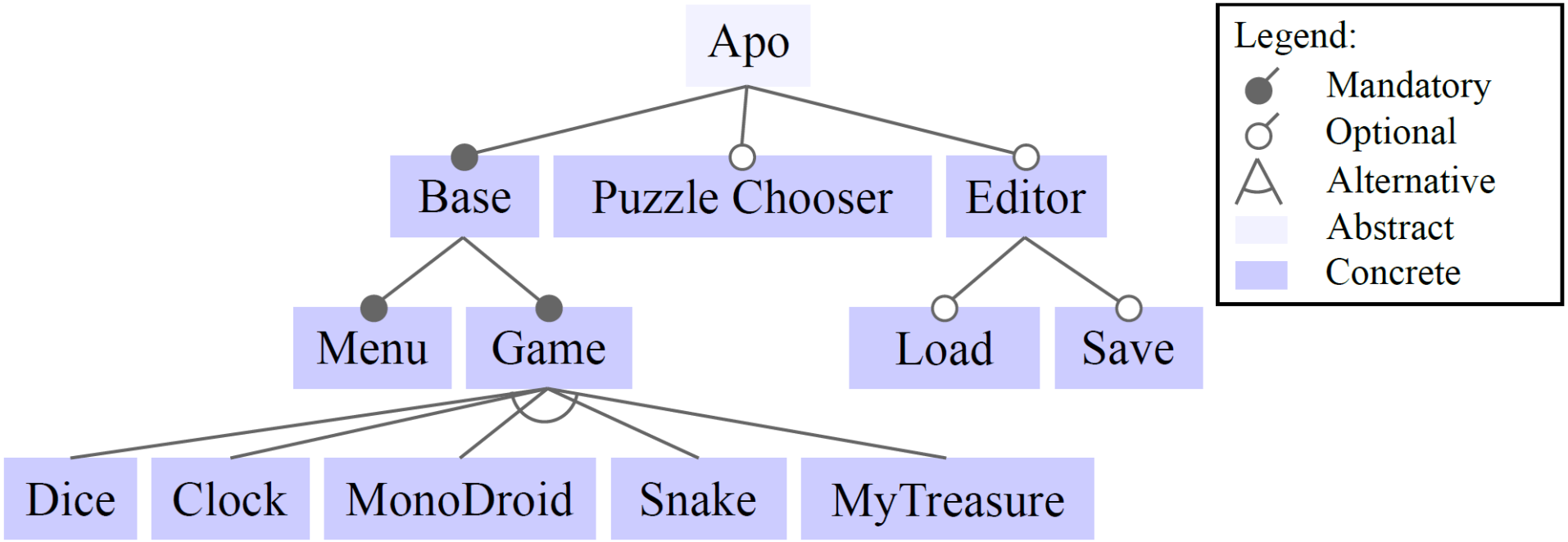
RQ2 – The Differences

- Manual analysis found more but smaller common code parts

- Automatic refactoring extracted common but also non-feature code

➢ Incomplete and scattered features with automatic refactoring
  - Automatic: 619 SLOC feature among all clones
  - Manual: ???

RQ3 – The Feature Model



Conclusion

– Analyzing features in cloned systems is an essential task …

– … but full automation seems unfeasible

– We proposed a semi-automatic process to guide developers

– Implementation and further evaluations in the future

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