

On breaking the curse of dimensionality in reverse engineering feature models

Configuration Workshop 2015
September 10th

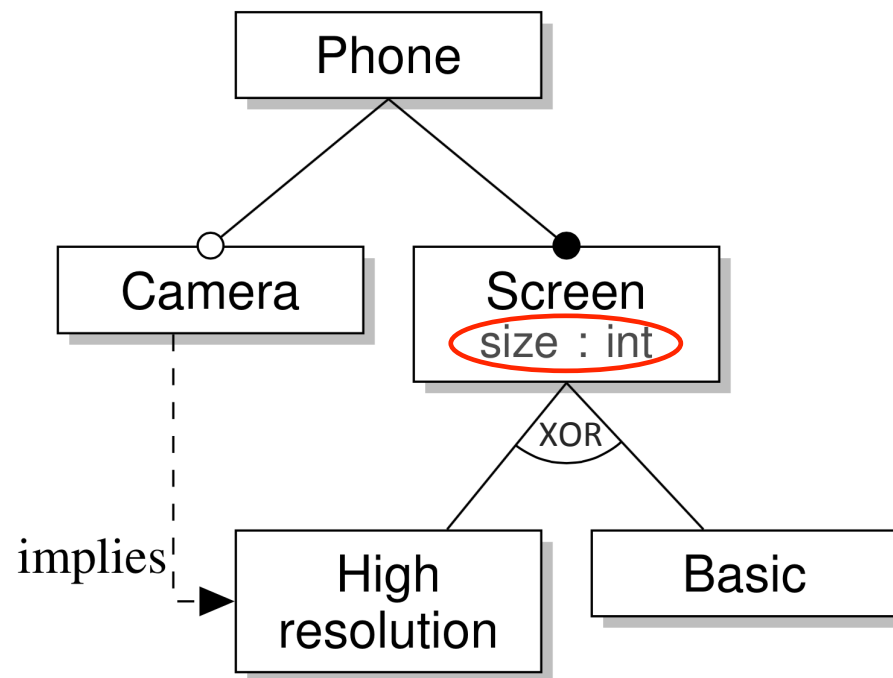
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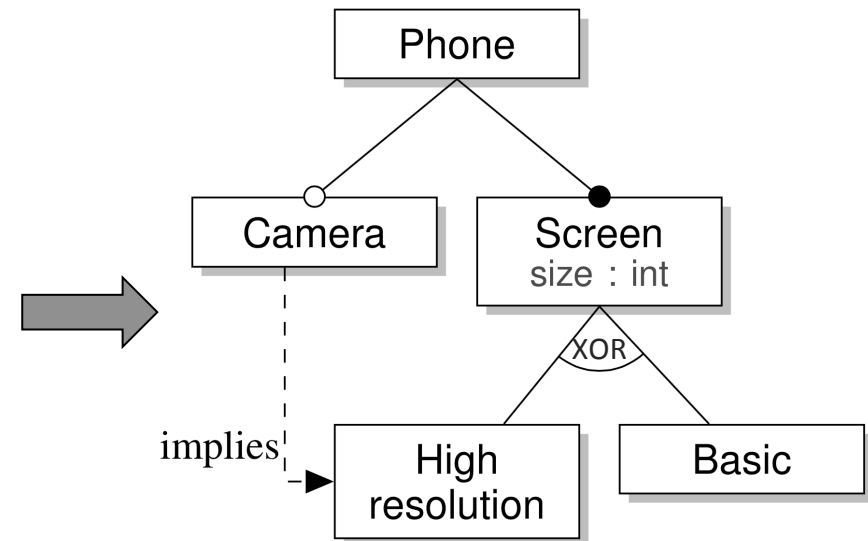
Feature Model



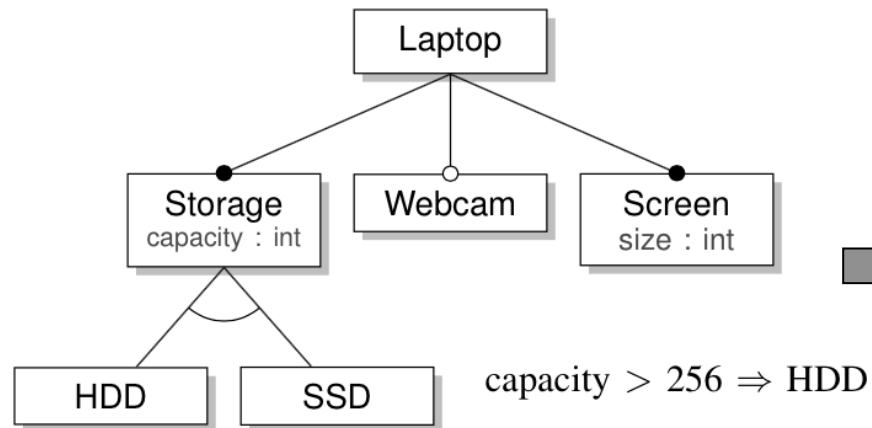
Camera	High resolution	Basic
X	X	
	X	
		X

Feature Model Synthesis

Camera	High resolution	Basic	size
X	X		8
X	X		7
	X		6
		X	7
		X	7



Engineering Configuration systems



The screenshot shows a web-based configuration system interface. At the top, there are four tabs: 'Image quality', 'Low light settings', 'Ergonomics' (selected), and an unlabeled tab. The 'Ergonomics' tab is active, displaying the following settings:

- Ergonomics quality:** Three radio buttons: 'Any degree of quality' (unselected), 'Above average ergonomics only' (selected), and 'Outstanding ergonomics only' (unselected).
- Screen:**
 - Screen size:** Four radio buttons: '2.8"' (unselected), '3.0"' (selected), '3.2"' (unselected), and 'Any size' (unselected).
 - Screen dots:** A horizontal slider with a yellow marker positioned towards the right end.
- Viewfinder:**
 - Viewfinder coverage:** Three radio buttons: '95%' (unselected), '100%' (selected), and 'Any coverage ratio' (unselected).
 - Magnification:** A horizontal slider with a yellow marker positioned towards the right end.
 - Viewfinder type:** A dropdown menu with 'electronic' selected.

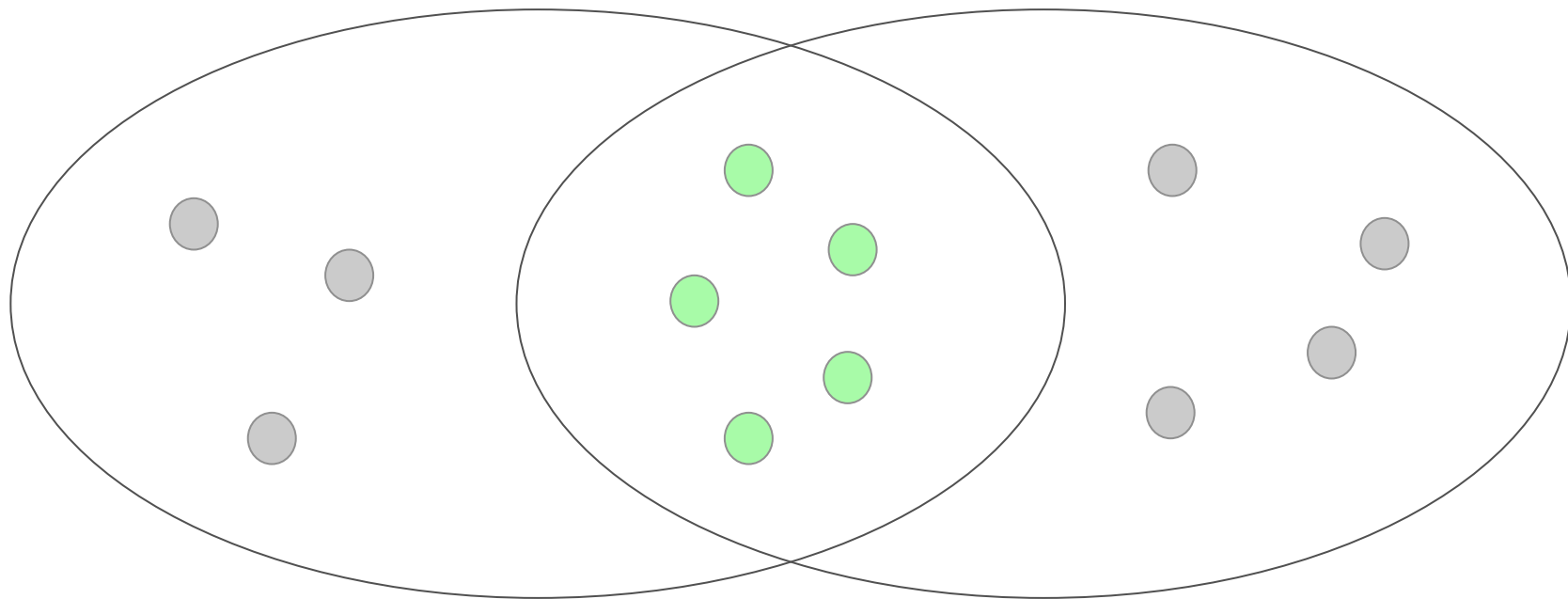
Configuration System

Solution Space Definition

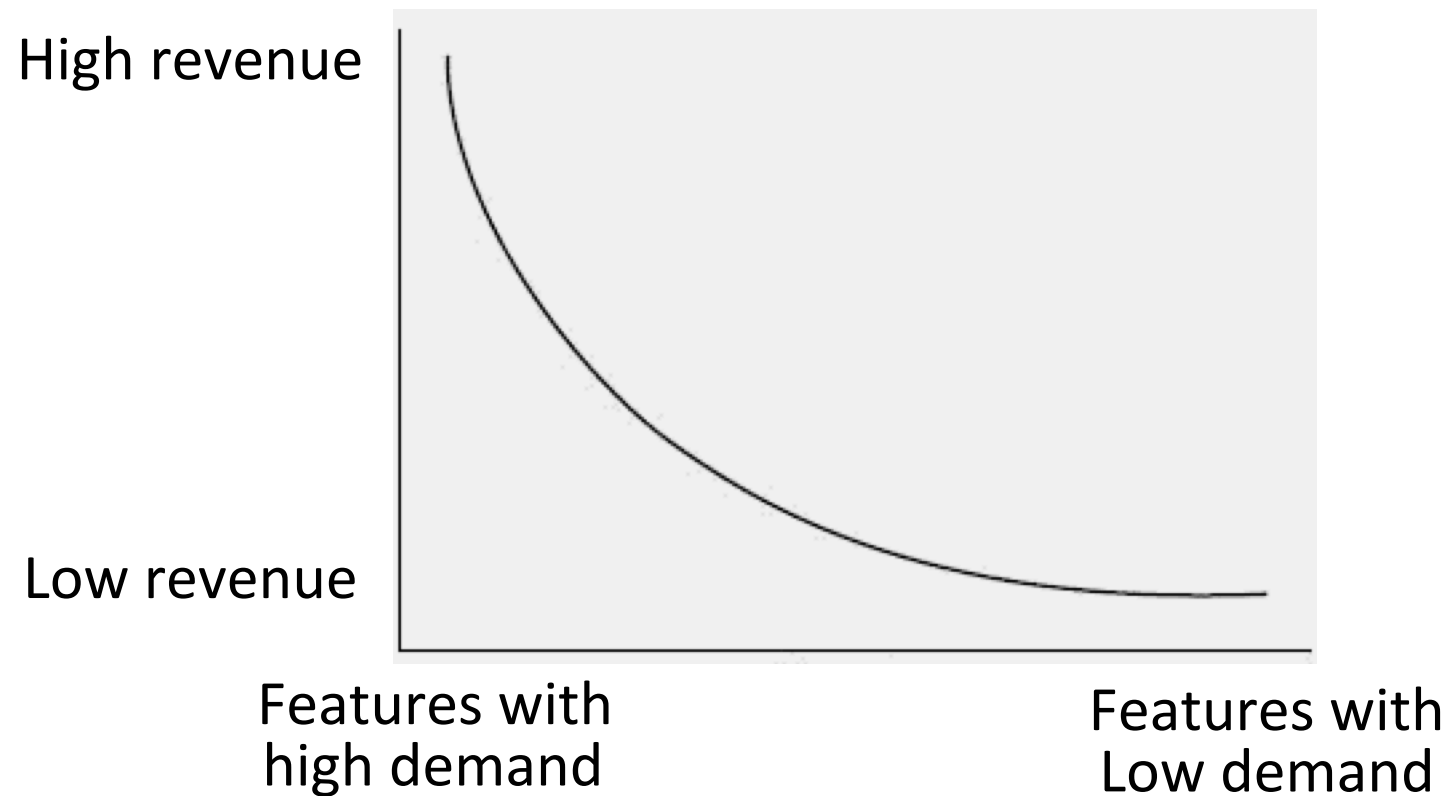
Customer and Supplier Alignment

Required variability

Supported variability



Understanding your Competition



Solution Space Definition

Customer demand



Competitors



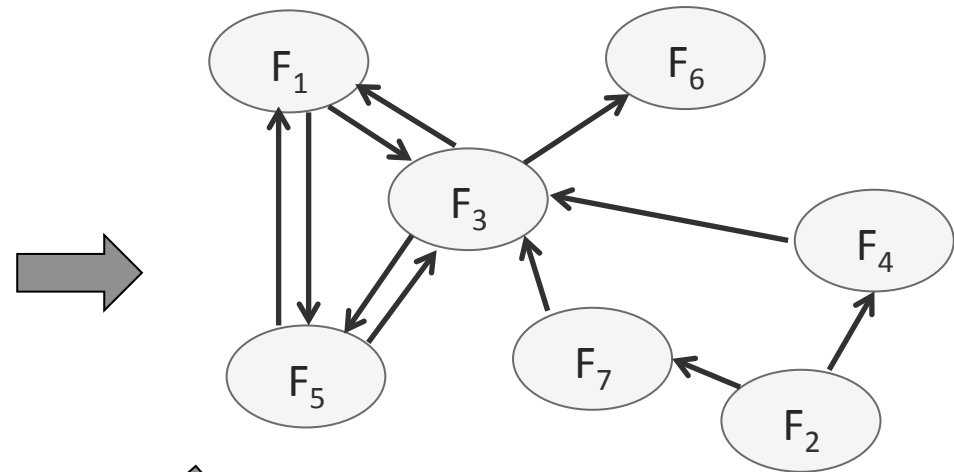
Constraints



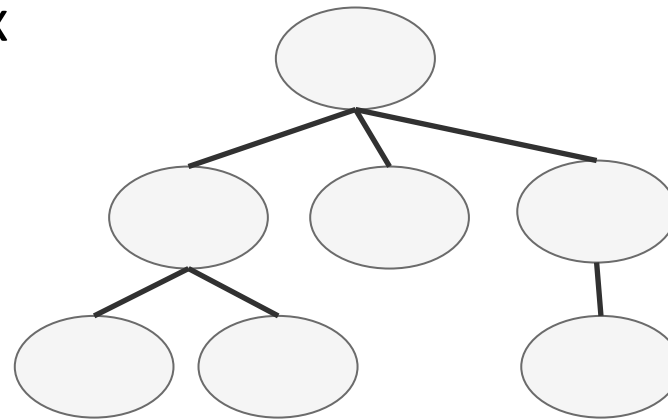
Feature Model Synthesis

	F_1	F_2	...	F_m
P_1	X	-	...	X
P_2	-	X	...	X
...
P_n	X	X	...	-

Product-by-Feature
Matrix

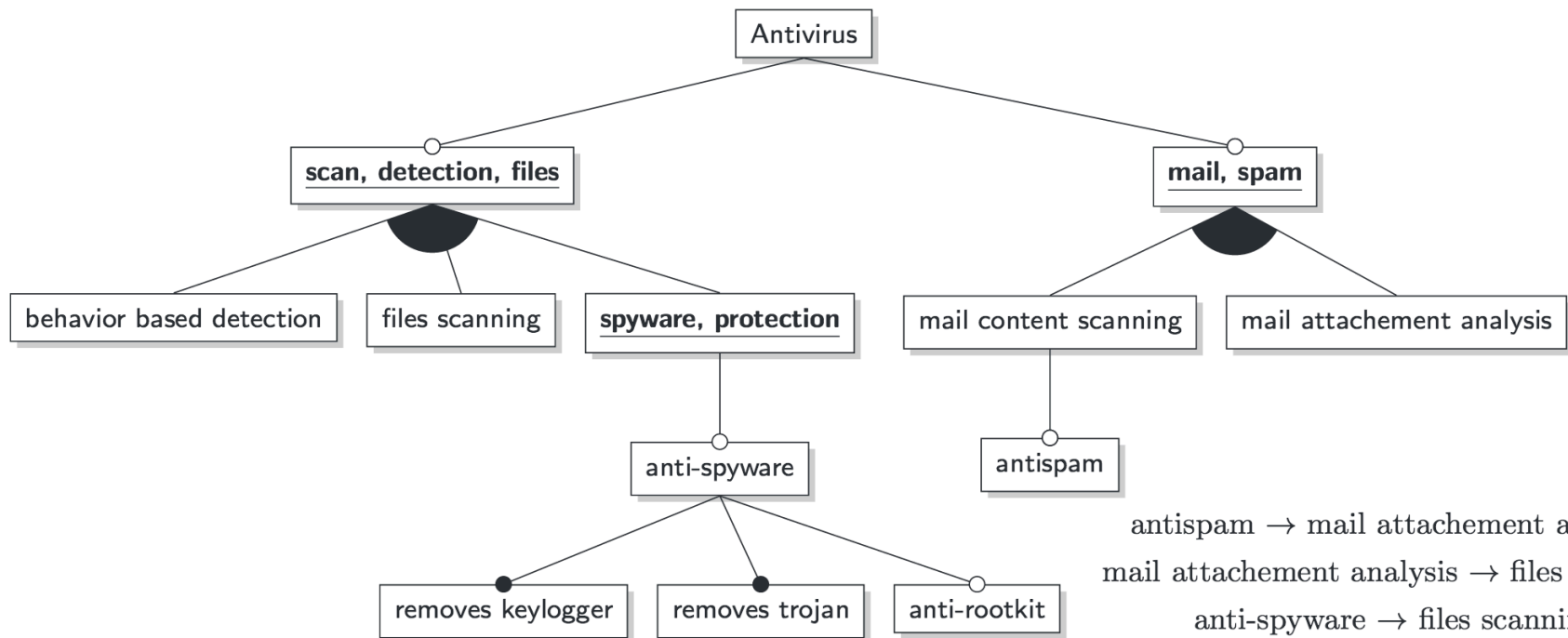


Implication Graph



Feature Diagram

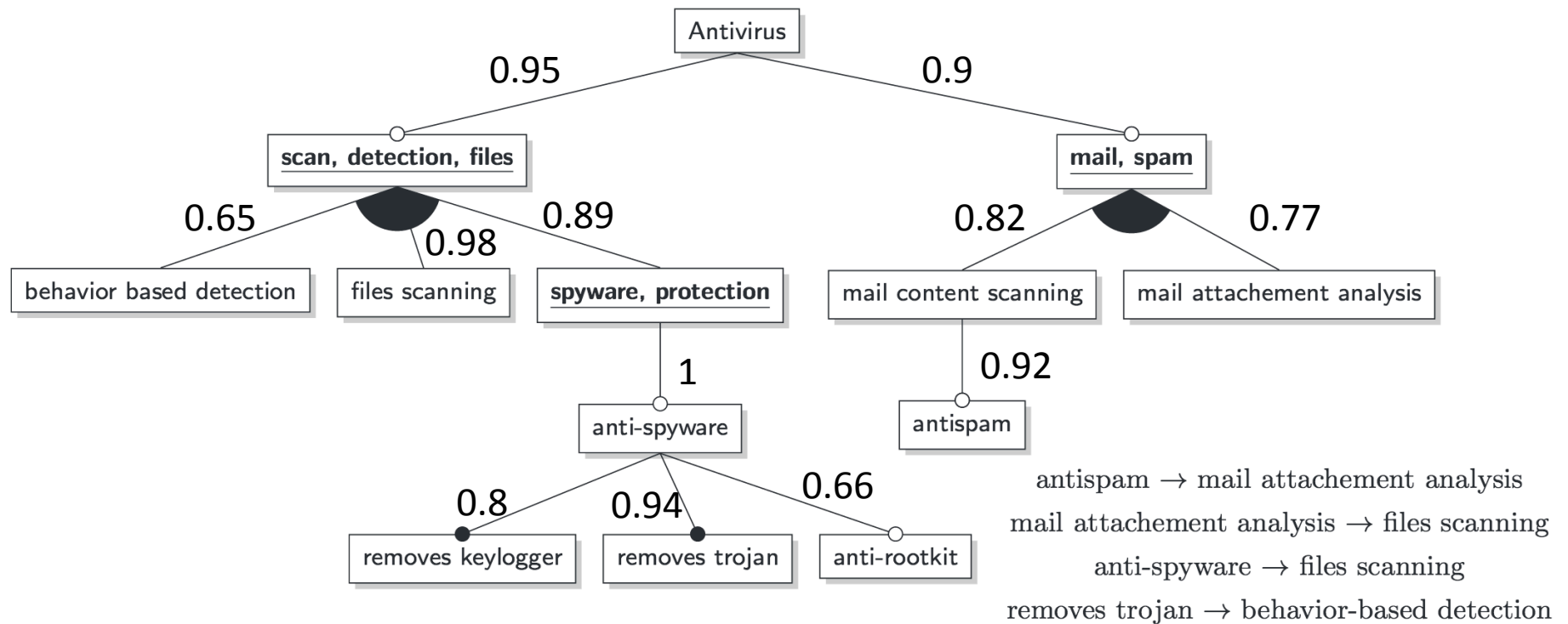
Feature Model Synthesis



antispam → mail attachment analysis
 mail attachment analysis → files scanning
 anti-spyware → files scanning
 removes trojan → behavior-based detection

Feature Model

Probabilistic Feature Models



Probabilistic Feature Model

Research Directions

1. Evaluation of FM synthesis procedures
2. Support the use of background knowledge

Evaluating FM Synthesis

What does the **fit to the dataset** tells us about the quality of the FM?

Evaluating FM Synthesis

An FM is extracted in order to support **Use Cases**

➔ Its quality should be evaluated wrt. these use cases

Evaluation criteria should be

- Task-specific
- Domain-specific

Background Knowledge

In machine learning, **using only data** to build a new theory has been considered a **bad practice** referred to as “*data-fishing*”

Extracting FMs is a **high-dimensional problem**

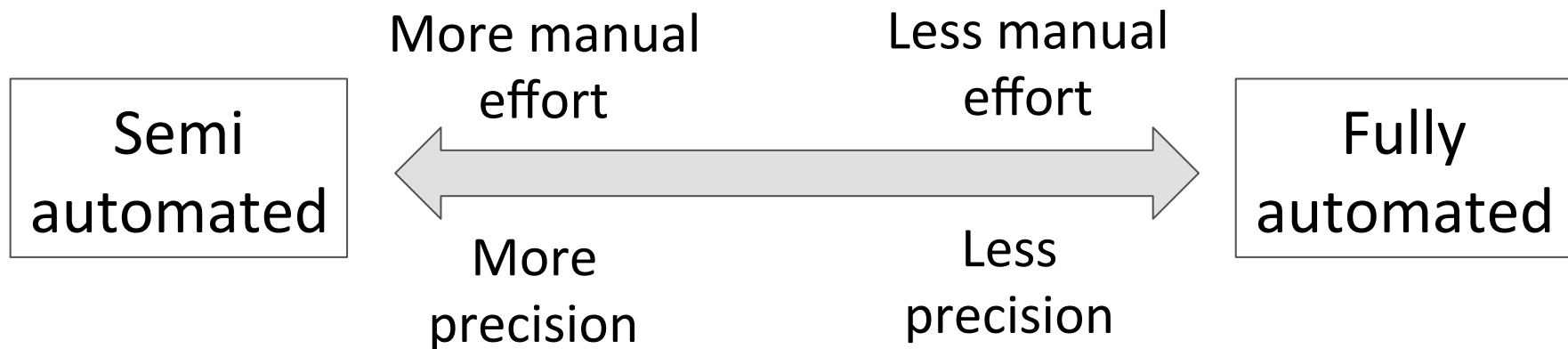
→ Existing knowledge can be used to reduce dimensionality

Background Knowledge

- Ontologies
- Documentation
- Experts
- Web resources

Automation

Fully manual FM synthesis is tedious and error-prone



Feature-Model Driven Engineering

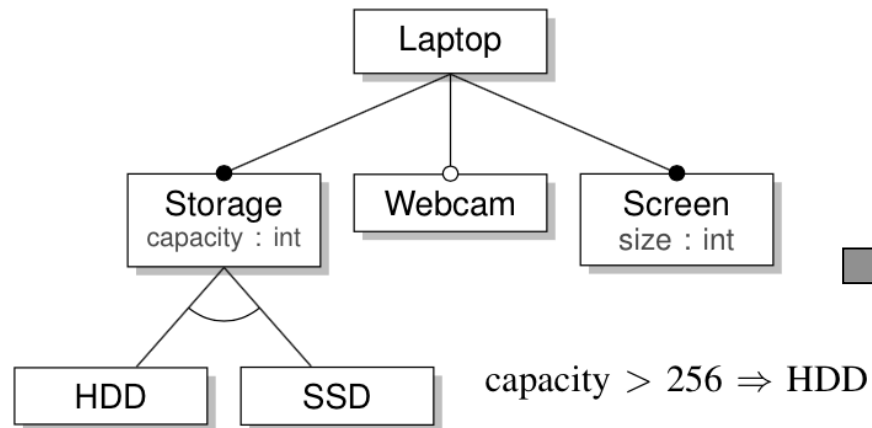


Image quality | Low light settings | **Ergonomics**

Ergonomics

Ergonomics quality
☐ Any degree of quality
☒ Above average ergonomics only
☐ Outstanding ergonomics only

Screen

Screen size ☐ 2.8" ☒ 3.0" ☐ 3.2" ☐ Any size

Screen dots

Viewfinder

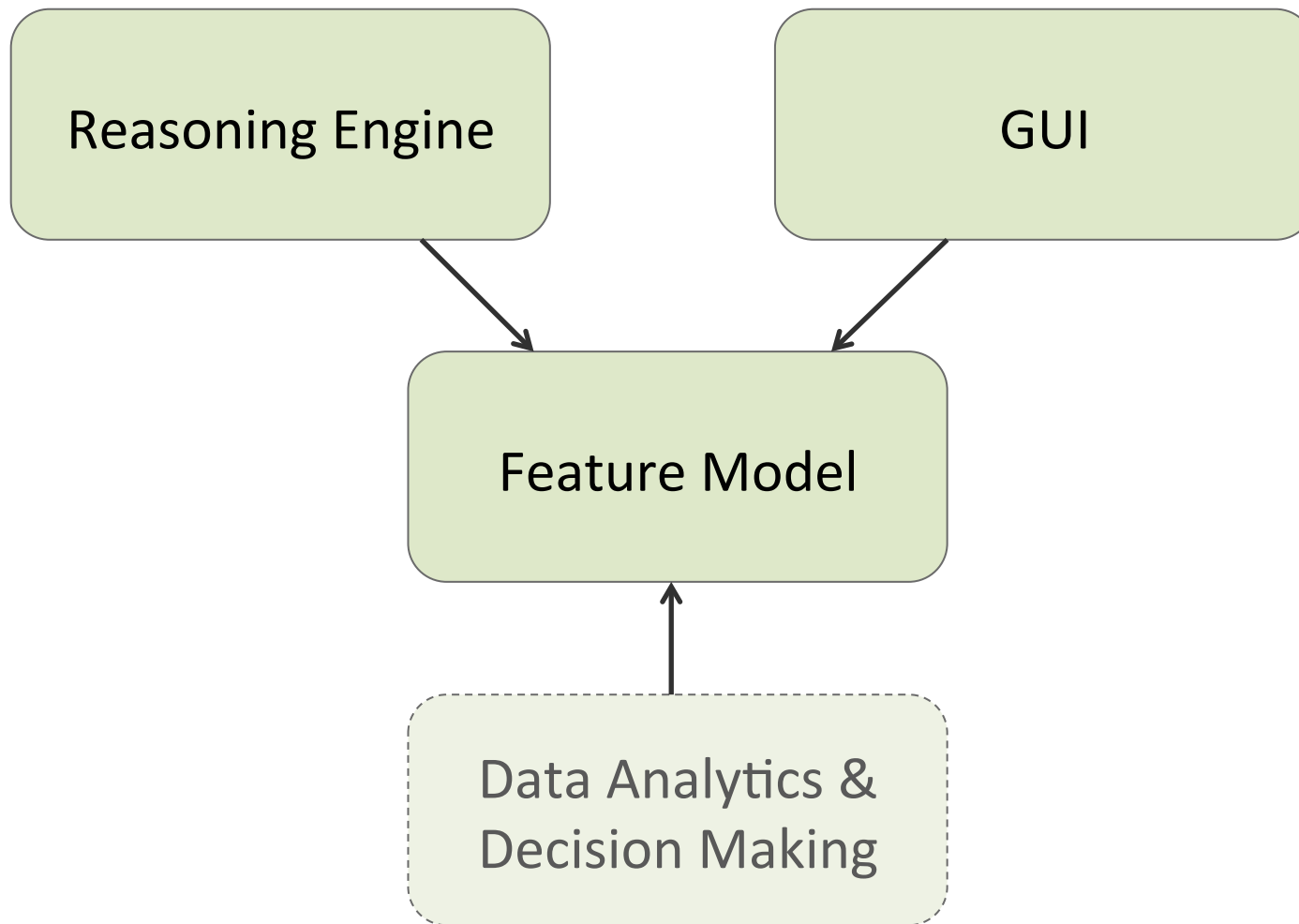
Viewfinder coverage ☐ 95% ☒ 100% ☐ Any coverage ratio

Magnification

Viewfinder type

Configuration System

Feature-Model Driven Engineering



Thank you

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