Reconstruction of Cardinality-Based Feature Models

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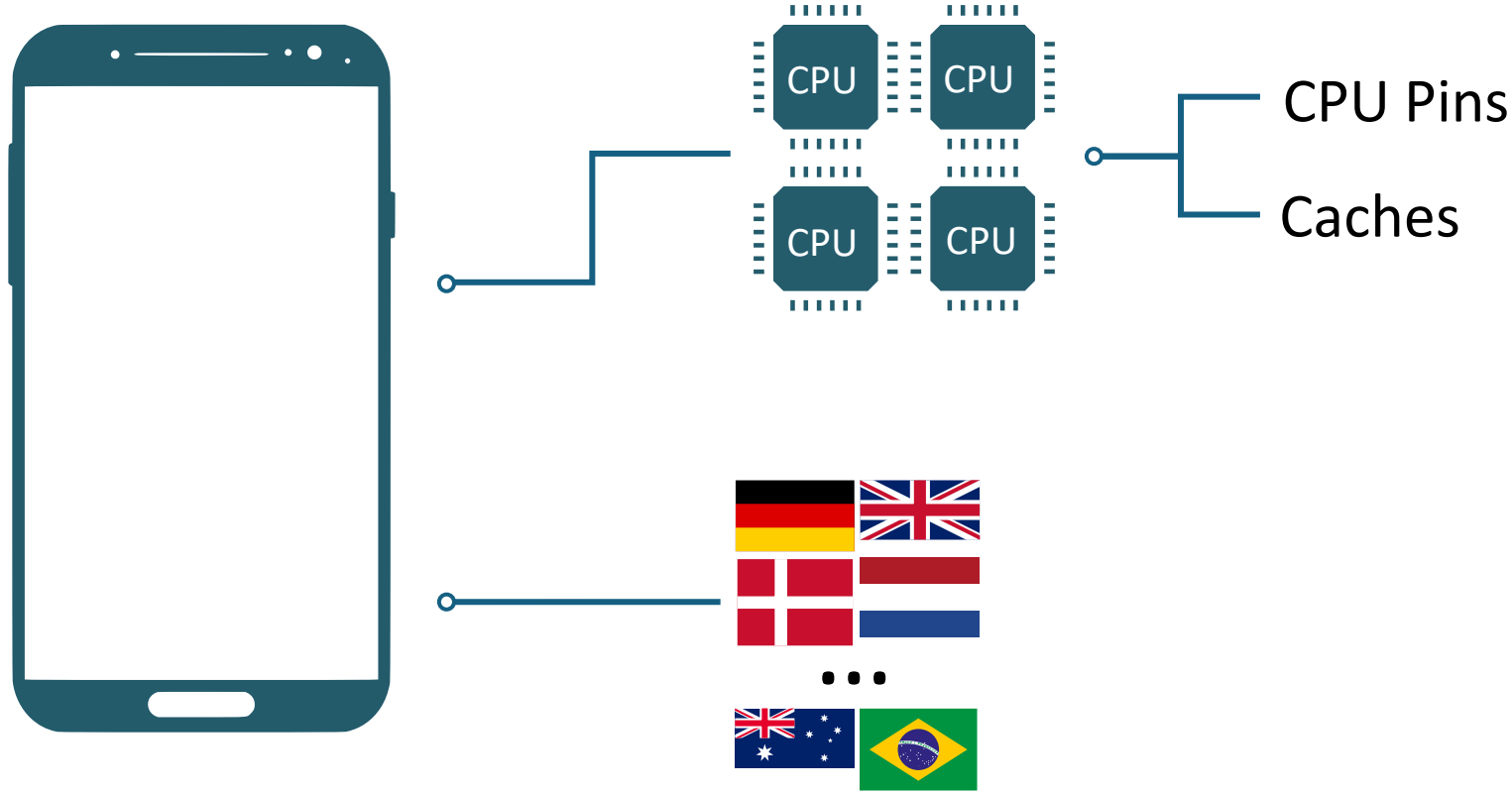
March 25, 2026
FOSD’26 – Odense, Denmark

Peer reviewed Paper: Weiß et al. Reconstruction of Cardinality Constraints for Multi-Instance Configuration Spaces. Variability 2026

Illustrating example: configurability of a smartphone

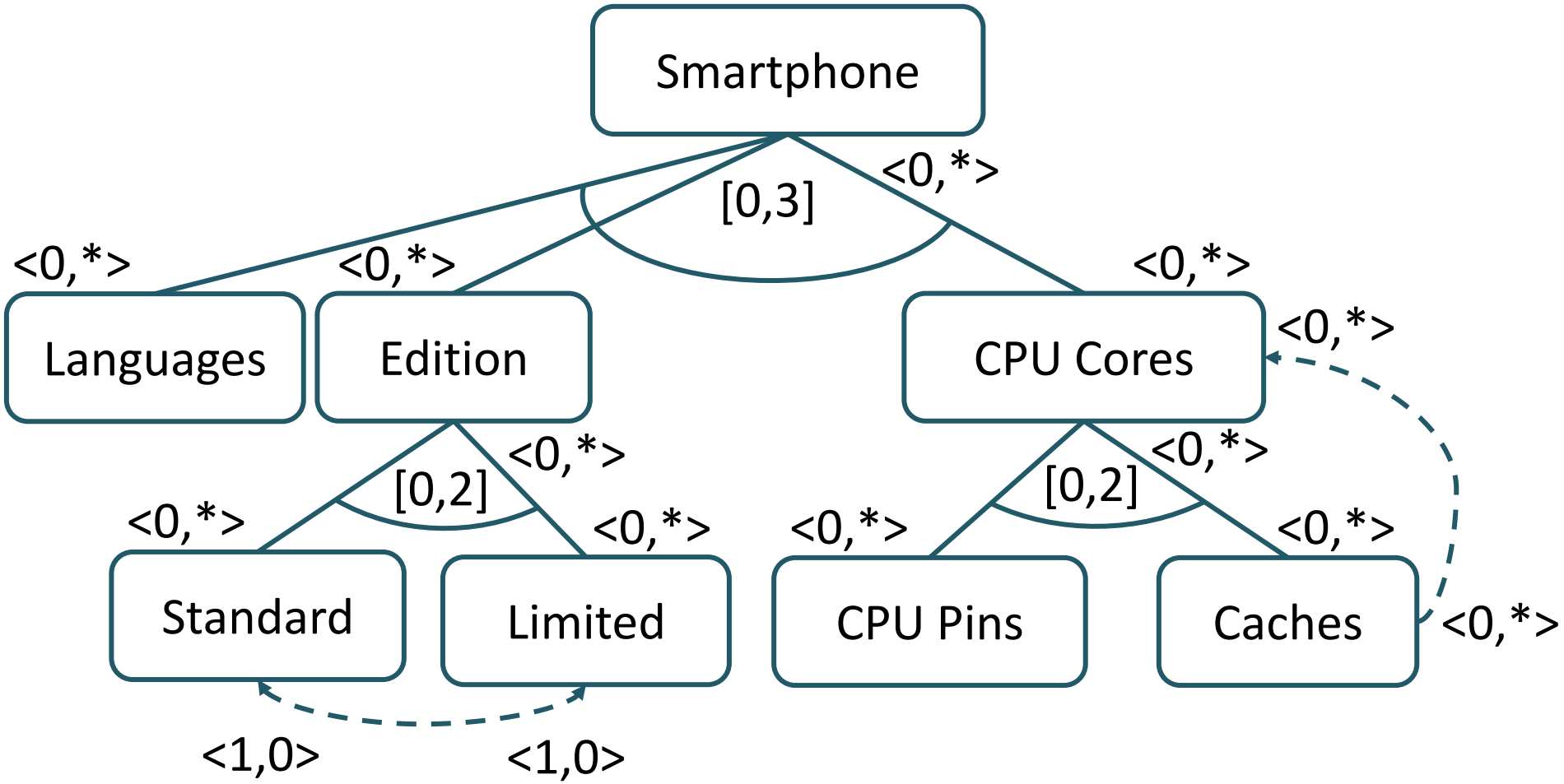


Sources: https://pixabay.com & https://flagpedia.net

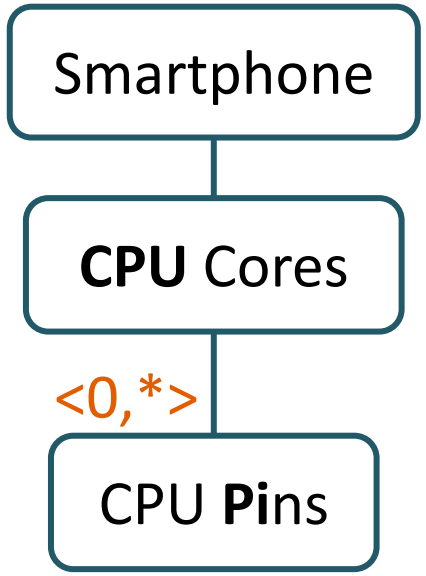
Smartphones in the notion of multiset configurations

k_i	Smartphone	Languages	Edition	Standard	Limited	CPU Cores	CPU Pins	Caches
1	1	1	1	1	0	2	7	0
2	1	41	1	1	0	3	6	3
3	1	64	1	1	0	4	19	0
4	1	1024	1	0	1	6	13	7
5	1	0	1	0	1	7	28	6
6	1	387	1	0	1	8	34	3

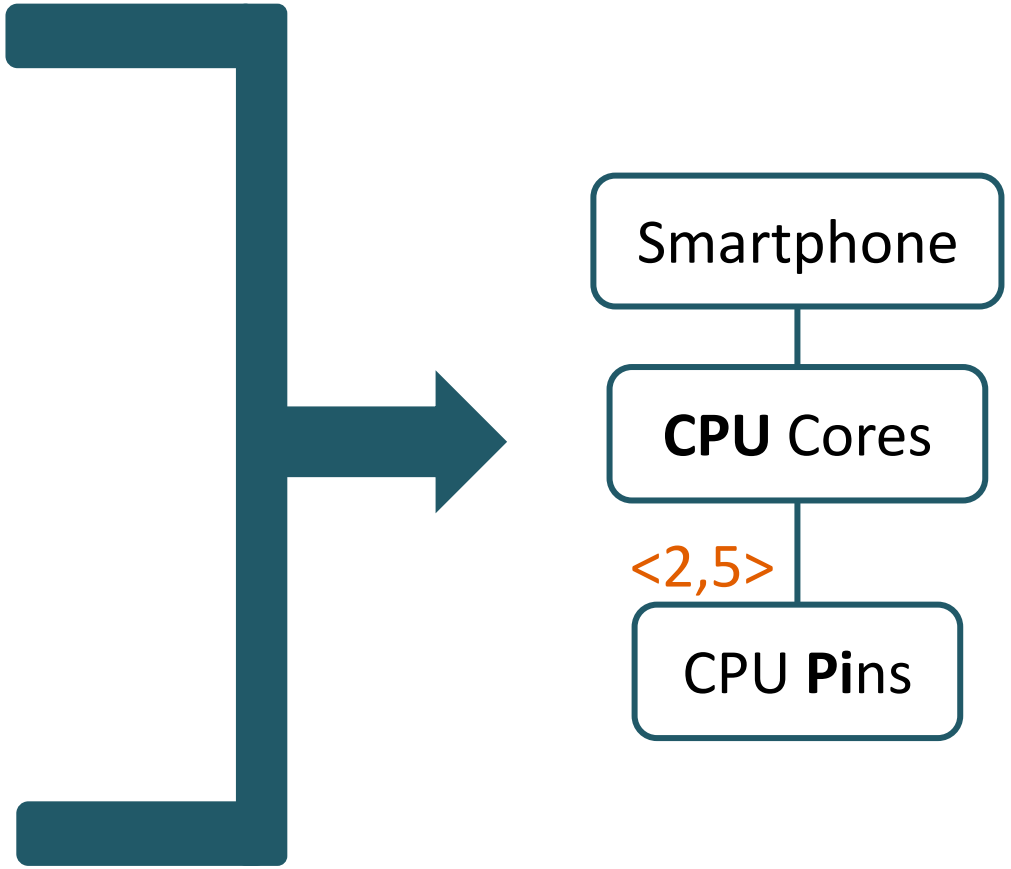
Step 1: Creating a base CFM



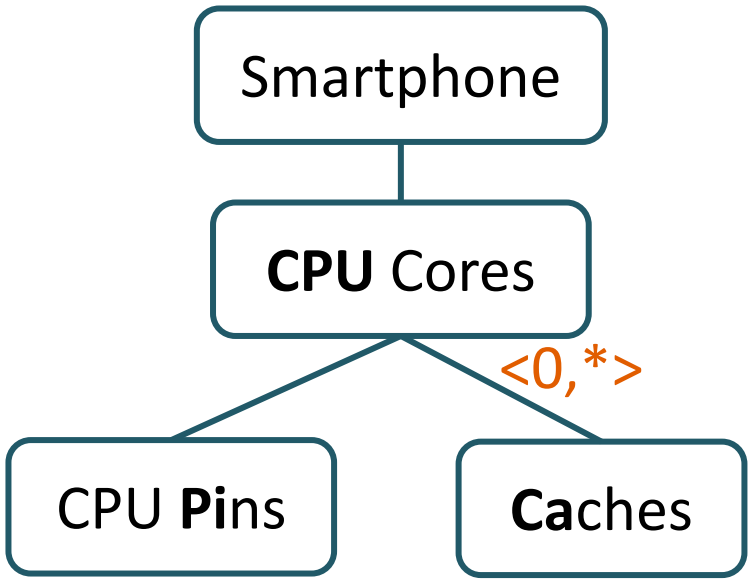
Step 2.1: Reconstructing the Feature instance cardinalities



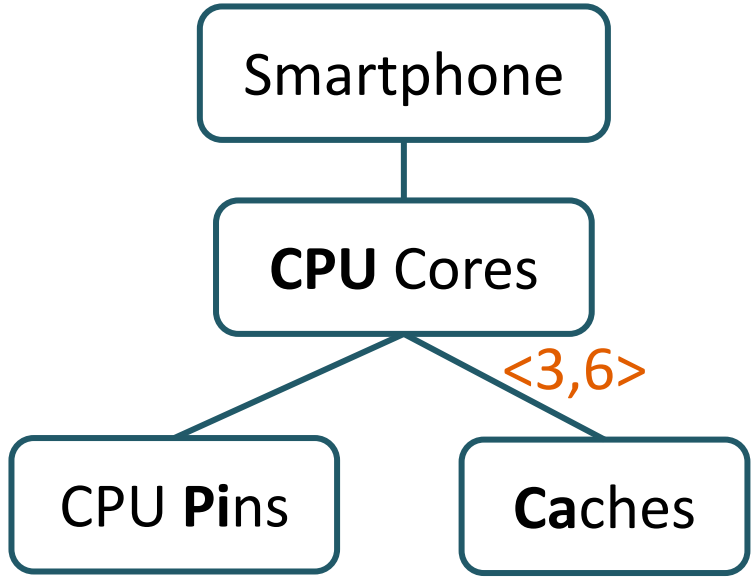
k_i	CPU	Pi	Ratio
1	2	7	3.5
2	3	6	⌊2⌋
3	4	19	⌊4.75⌋
4	6	13	2.16
5	7	28	4
6	8	34	4.25



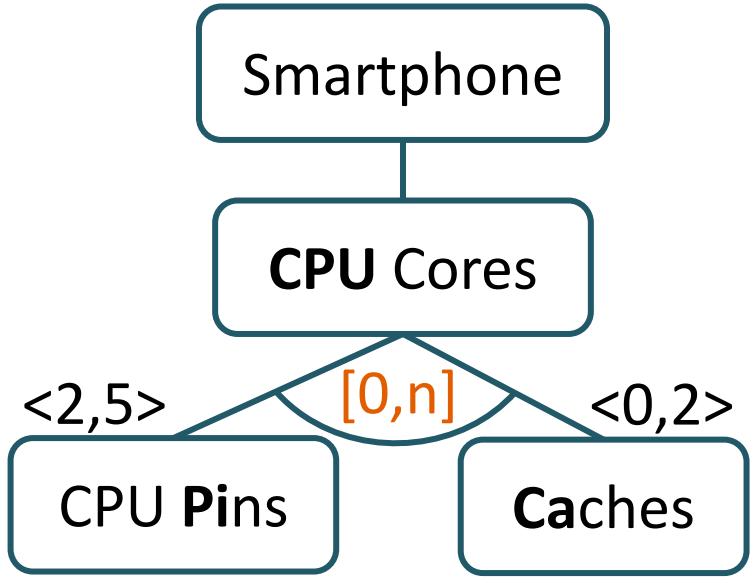
Step 2.2: Reconstructing the Group instance cardinalities



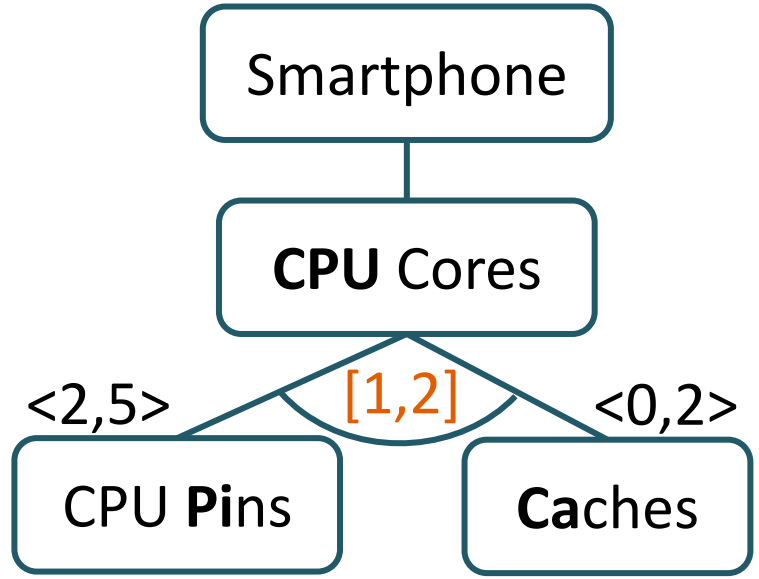
k_i	CPU	Pi	Ca	Ratio
1	2	7	0	3.5
2	3	6	3	[3]
3	4	19	0	4.75
4	6	13	7	3.33
5	7	28	6	4.85
6	8	34	3	[5.28]



Step 2.3: Reconstructing the Group type cardinalities

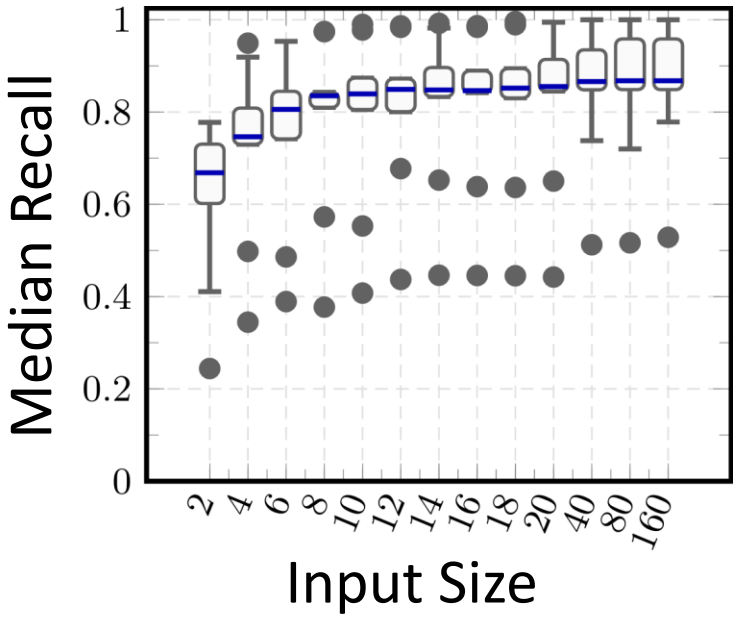


k_i	CPU	Ca	Ca Types	Ratio Types
1	2	0	0	0
2	3	3	[1.5]	[0.66]
3	4	0	0	0
4	6	7	[3.5]	[0.66]
5	7	6	3	[0.43]
6	8	3	[1.5]	[0.25]

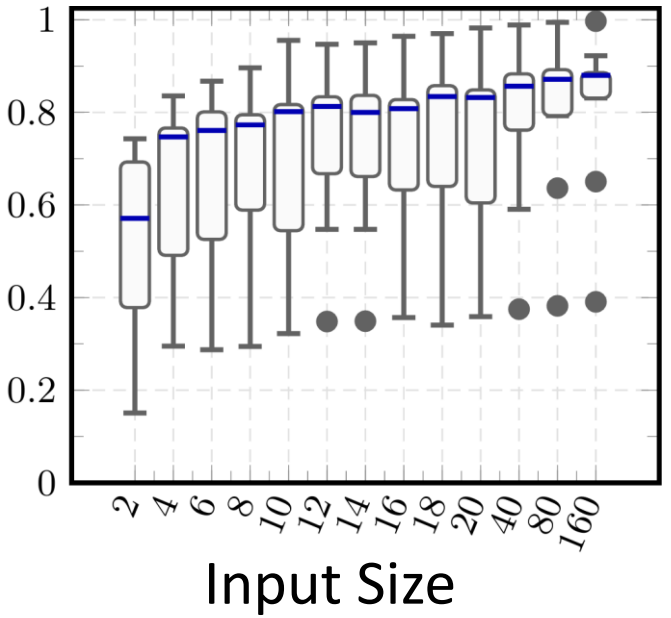


RQ: Recall and Precision on cardinality intervals

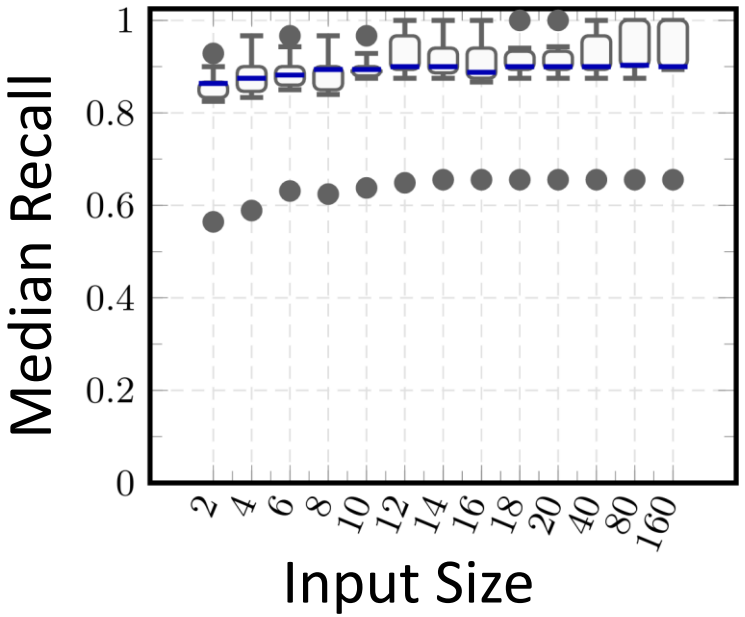
Feature instance cardinalities



Group instance cardinalities

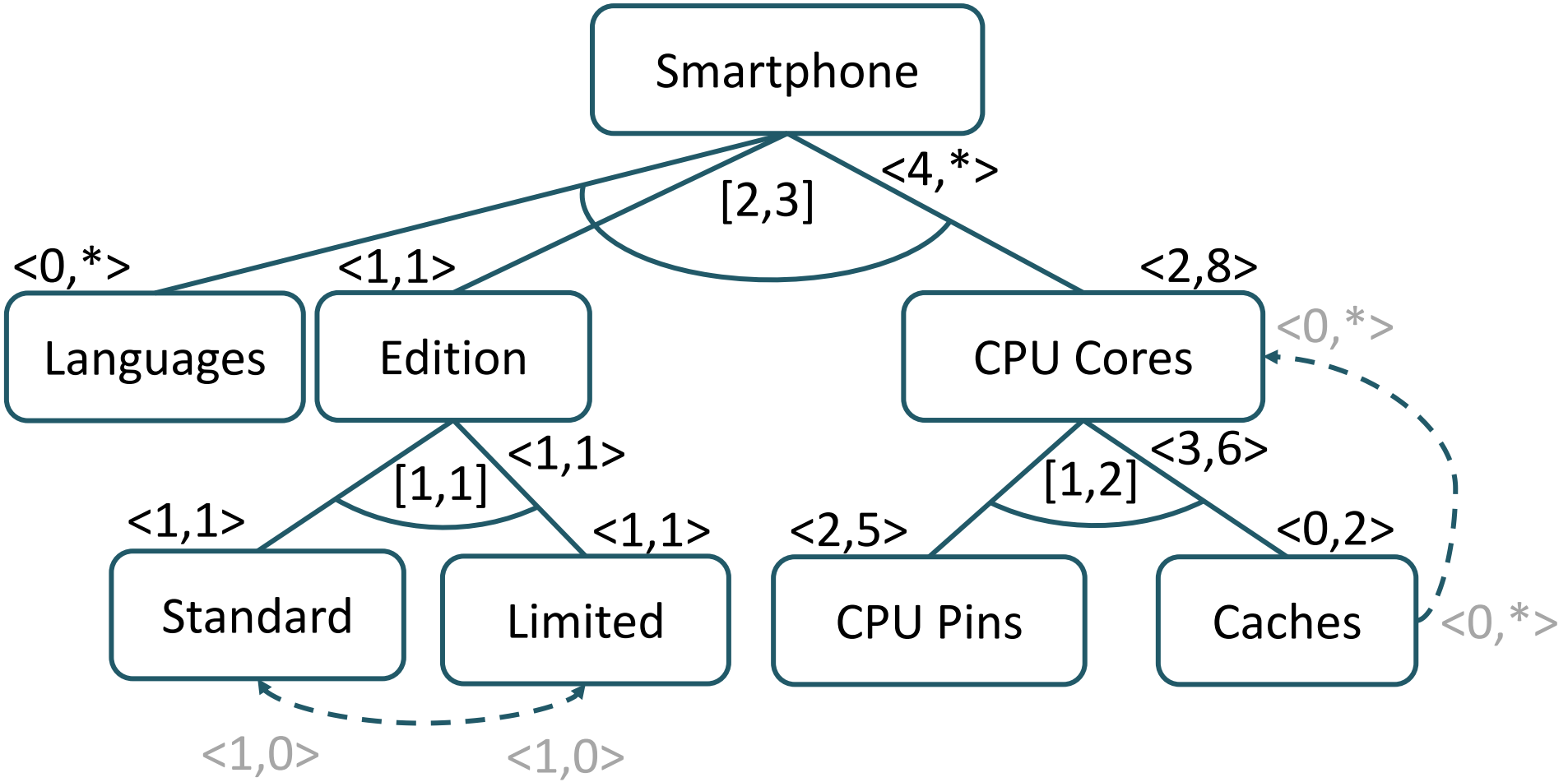


Group type cardinalities



- Precision of 1 on cardinality intervals if every feature is selected at least once.

Conclusion and Future Work



- Improve the reconstruction of a feature hierarchy.[1]
- Improve the reconstruction of cross tree constraint cardinalities.
- Improve the reconstruction of the *.

[1] She, Steven, et al. "Reverse engineering feature models." *(2011)*