

DryadSynth: A Concolic SyGuS Solver

Xiaokang Qiu

(joint work with Kangjing Huang and Yanjun Wang)

Purdue University

SYNT Workshop

July 22, 2017

DryadSynth

Explicit + Symbolic search (similar to Sketch-AC)

Decision-tree representation (similar to EUSolver)

One solver for two tracks: CLIA + Invariant

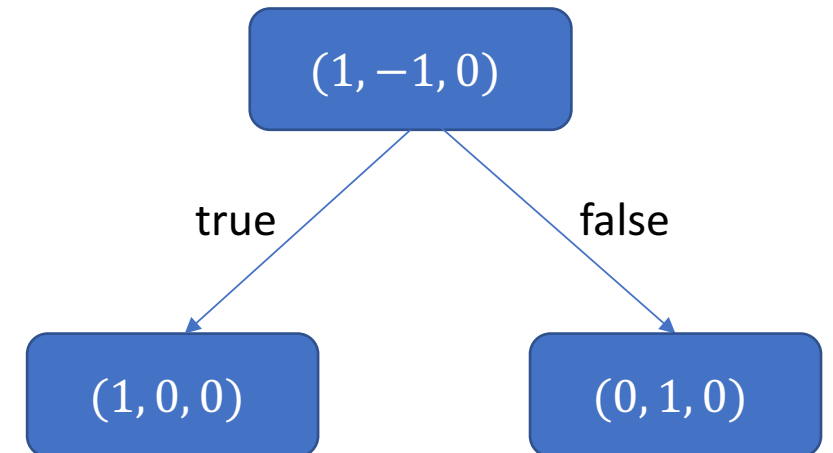
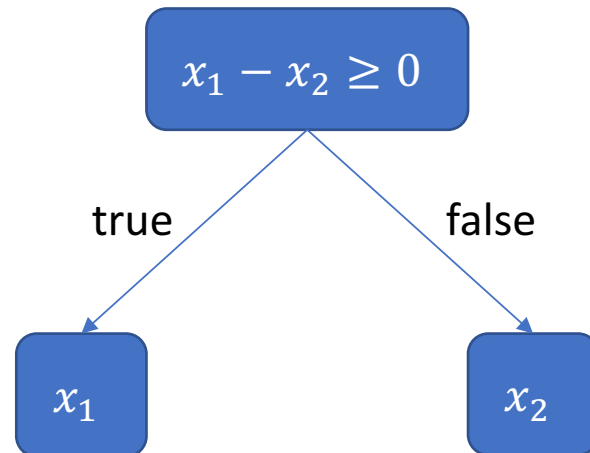
Lightweight implementation based on Z3 (< 2KLOC)

Decision-Tree Representation

$\text{max2}(x_1, x_2) \stackrel{\text{def}}{=} \text{if } x_1 \geq x_2 \text{ then } x_1 \text{ else } x_2$

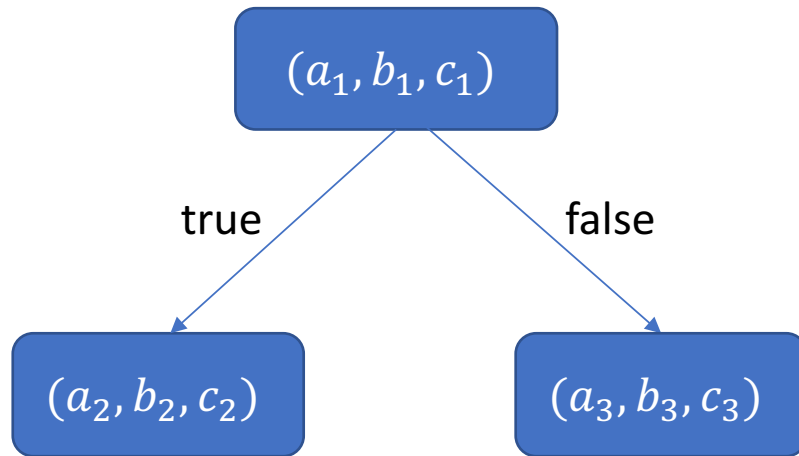
represented as coefficient vectors:

$$(a, b, c) \stackrel{\text{def}}{=} ax_1 + bx_2 + c$$



Symbolic Search for Fixed Tree Height

$h = 2$:



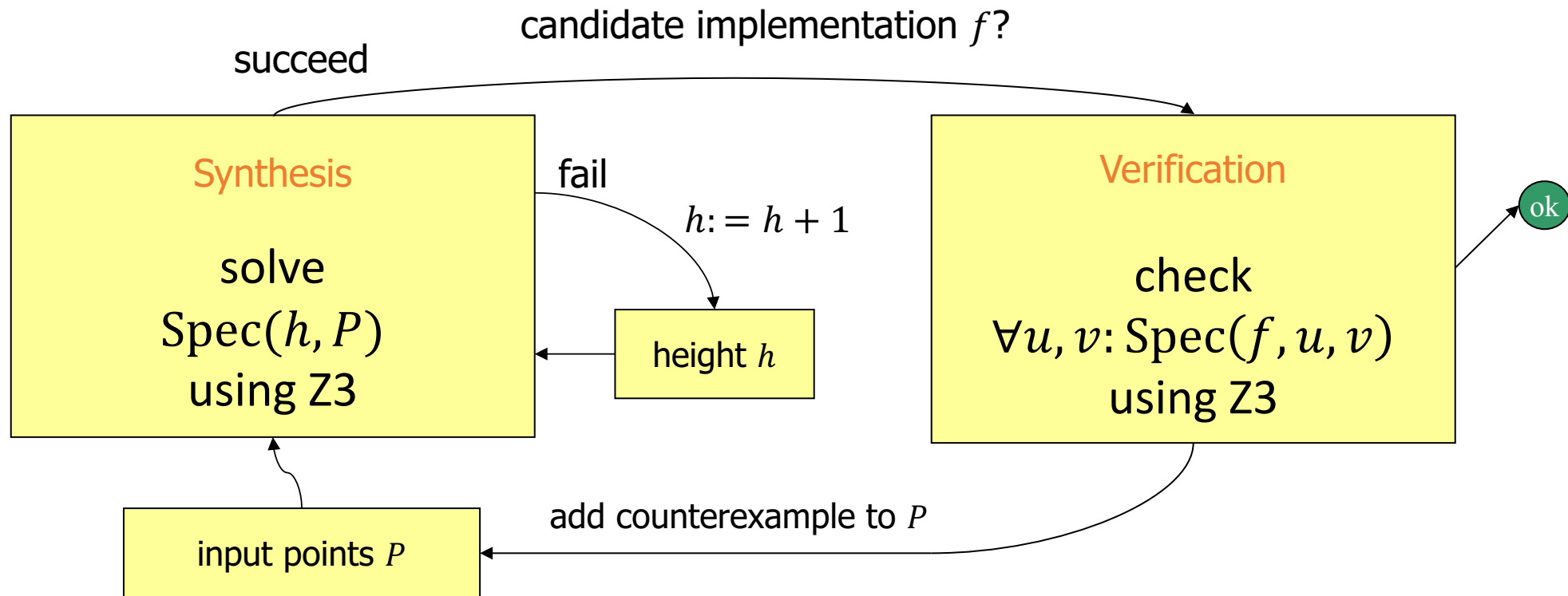
For a concrete input point:

$$\begin{aligned} \text{max2}(5, 7) &\stackrel{\text{def}}{=} \text{if } 5a_1 + 7b_1 + c_1 \geq 0 \\ &\quad \text{then } 5a_2 + 7b_2 + c_2 \\ &\quad \text{else } 5a_3 + 7b_3 + c_3 \end{aligned}$$

For a set of input points P , check

$$\text{Spec}(h, P) \stackrel{\text{def}}{=} \bigwedge_{(u,v) \in P} \text{Spec}(\text{max2}(u, v), u, v)$$

Enumerate from Smallest Height in CEGIS



Optimizations

Parallelization

- search heights $(1, \dots, n)$ in parallel
- If a height has no solution, switch to the next unsearched height

Staged search for a height h

- search coefficients from $\{0, 1, -1\}$ only
- if no solution, search coefficients between $[-C, C]$ only (C is the largest/smallest constant in Spec)
- if no solution, search all possible coefficients

Thank you!