

#8: EuPhony

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EECS 700: Introduction to Program Synthesis



Euphony: strengths

- Efficient way to guide search by a probabilistic grammar
 - Much better than DeepCoder's sort-and-add
 - First to use A* and propose a sound heuristic
- Transfer learning for PHOGs
 - Abstraction is key to learning models of code!
- Extend observational equivalence to top-down search

Euphony: weaknesses

- Requires high-quality training data
 - for each problem domain!
- Transfer learning requires manually designed features

Paper Discussion: Euphony

- **Q2:** What does Euphony use as behavioral constraints?
Structural constraint? Search strategy?
 - IO Examples (or first-order formula via CEGIS)
 - PHOG
 - Weighted top-down search via A*

Euphony

- **Q3:** What would these productions look like if we replaced the PHOG with a PCFG? With 3-grams?

PHOG:

$S[\text{“-”}, \text{Rep}] \rightarrow \text{“.”} \quad 0.72$
 $S[\text{“-”}, \text{Rep}] \rightarrow \text{“-”} \quad 0.001$
 $S[\text{“-”}, \text{Rep}] \rightarrow x \quad 0.12$
 $S[\text{“-”}, \text{Rep}] \rightarrow S + S \quad 0.02$

...

PCFG:

$S \rightarrow \text{“.”} \quad 0.2$
 $S \rightarrow \text{“-”} \quad 0.2$
 $S \rightarrow x \quad 0.3$
 $S \rightarrow S + S \quad 0.2$

...

Sequential 3-grams:

$S[x, \text{“-”}] \rightarrow \text{“.”} \quad 0.72$
 $S[x, \text{“-”}] \rightarrow \text{“-”} \quad 0.001$
 $S[x, \text{“-”}] \rightarrow x \quad 0.12$
 $S[x, \text{“-”}] \rightarrow S + S \quad 0.02$

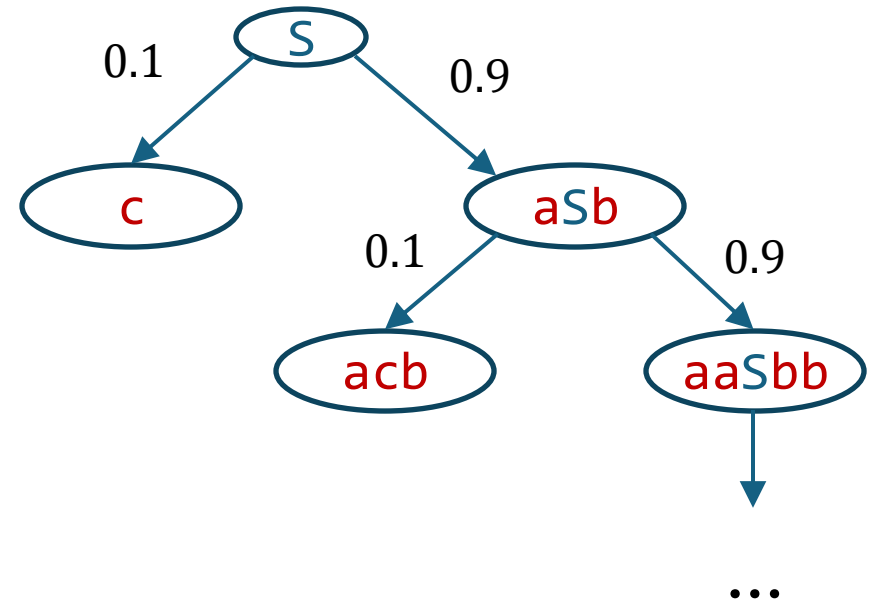
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- Do you think these other probabilistic models would work as well as a PHOG?

Euphony

- **Q4:** What does $h(S) = 0.1$ mean? Why is it the case?

$S \rightarrow a S b \quad 0.9$
 $S \rightarrow c \quad 0.1$



Euphony

- **Q5:** Give an example of sentential forms n_i , n_j and set of points pts such that n_i and n_j are equivalent on pts but not weakly equivalent

$$n1 = x + "." \quad n2 = "." + x \quad pts = ["."]$$

$$n1 = \text{Rep}("-", x, "-") + S \quad n2 = "." + \text{Rep}(x, "-", "-") + S$$

$$n1 = "-" + S \quad n2 = "-" + "." \quad pts = ["-"]$$

$$n1 = \text{Rep}("-", "-", S) \quad n2 = S$$

$$n1 = \text{Rep}(".", "-", S) \quad n2 = "."$$

$$n1 = N + 2 \quad n2 = 1 + N + 1$$