How to Exploit Structure while Solving Weighted Model Integration Problems
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**Exploiting structure in discrete-continuous probabilistic inference** can lead to **exponential-to-linear speed-ups** in inference time.

**Weighted Model Integration:**
- Calculate the weight of an SMT-formula given a weight function.
- Generalizes weighted model counting (Boolean formula) to the discrete-continuous domain

\[ 2xy \preceq (x<0) \land (x<1) \land (y<1) \lor ((x>y) \land (y>1/2)) \]

**λ-SMT: search vs. compilation**
- Find the set of all satisfying assignments

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<th>PA</th>
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<th>Symbo</th>
<th>PRAISE</th>
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<tr>
<td>λ-SMT DPLL Compilation</td>
<td>✓</td>
<td>XADD</td>
<td>XSDD</td>
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**Integration**
- Numeric: Latte
- Symbolic: XADD, PSL (Tree), Exp. Tree

**Factorized Solving**
1. Compile SMT formula to XSDD (λ-SMT).
2. Statically analyze circuit.

![Diagram](image)

**Algorithm 1** Factorized Integration

1: world-weight \( \omega \)
2: procedure vol(XSDD \( D \), vars \( x \))
3: if \( x = \emptyset \) then
4: return \( \left| D \right| \)
5: else if \( D \) is terminal then
6: return \( \int D \prod_{x \in x} \omega_x(x)dx \)
7: else if \( D = \bigvee_{D_1, D_2} \) then
8: \( r_1 \) = vol(D_1, x \cap \bar{x})
9: \( r_2 \) = vol(D_2, \bar{x} \cap x)
10: return \( \int r_1 \cdot r_2 \prod_{x \in x} \omega_x(x)dx \)

![Graphs](image)