Optimal Synthesis of Michelson Bytecode

Intership at Nomadic Labs

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Catalog

Smart Contract and *gas*

Smart Contracts consumes *gas*, which is a kind of abstract resource and purchased with crypto-money.

What are the roles of gas:

- discouraging denial-of-service attacks
- incentivizing honest programs to run efficiently

Michelson

Michelson is the domain-specific language used to write smart contracts on the Tezos blockchain. Two main properties of Michelson is:

- stack based
- strongly typed

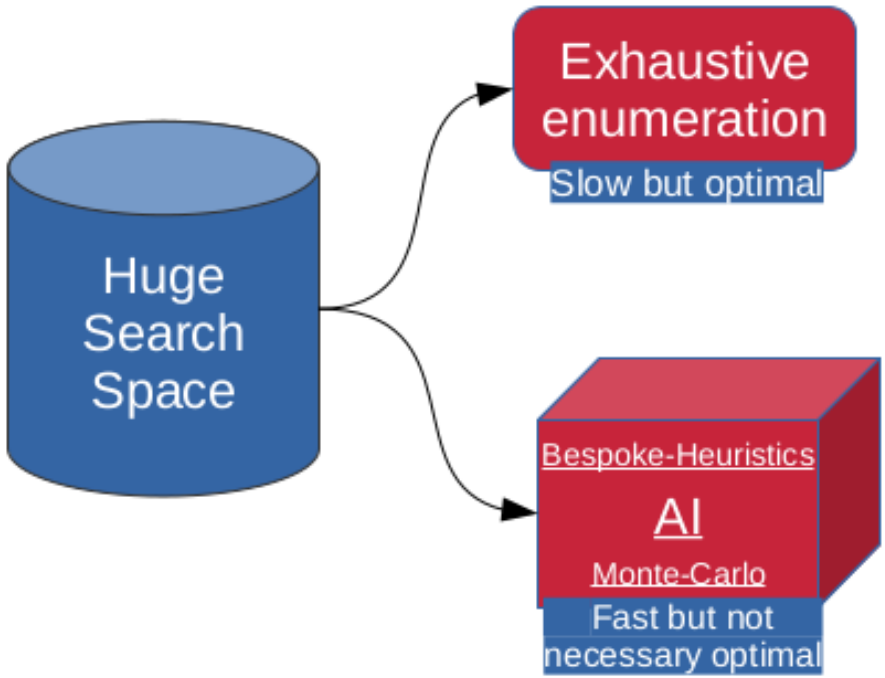
Simple example

parameter unit;
storage unit;
code CDR; NIL operation; PAIR;

Optimization & Super-optimization

Goal of optimization: reducing the gas required by the smart contracts.

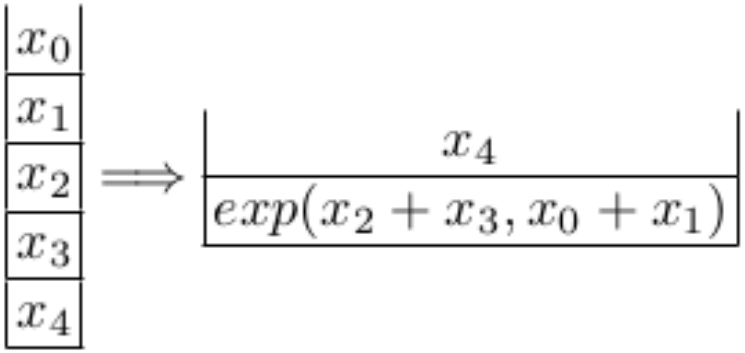
Super-optimization[1]: finding global optimizations to program structure whihc might be missed by local transformations



Max-SMT Method

MAX-SMT[2]: they use basic blocks and try to give a semantic model for these basic blocks and assign a cost using the cost model. (Two phases)

1. Extracting Stack Functional Specifications(SFS)



2. The Synthesis of Optimized Blocks

Encode the problem as a Max-SMT problem - using Max-SMT optimizer as a black box with an important gain in efficiency.

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- **Synthesizing an expression/ an objective function** : I/O relations;
- **Solving through search heuristics** : S-metaheuristics

Example tool: *Xyntia*[3] - AI-based blackbox deobfuscator

Further steps

- *Benchmark Collection*, means we could benchmark the optimization performance of different metaheuristics.

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- *Translation Validation*, verifies the semantic equivalence after the optimization.

Expectation

Our blackbox method could

- optimize the Michelson byte-code
- be efficient / fast
- perform solidly with different metaheuristics
- be verified by semantic equivalence

References


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Thank you !

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