R-TVM, a polyhedral mapper for TVM

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Relay/Halide vs Polyhedral: a fraternal battle

Started out as an image processing battle
  - Halide[H13] vs PolyMage[P15]

Transferred to ML optimization
  - TVM [T18] vs R-Stream.TF [R17], followed by several efforts including by Amazon, Facebook, Google, Huawei, Intel, NVIDIA, and academia.

Polyhedral:
  - Relies more on (potentially costly) modeling, less on autotuning
  - Controversial claims about expressiveness, transformations portfolio, ...
- Closest approach is Huawei’s AKG[A21]

- Let TVM take care of the subgraph partitioning problem
  - TVM defines which layers should be mapped conjointly
  - Can use Relay to do some transformations (mostly unused)

- Let polyhedral map each subgraph
  - Subgraph codegen’d to C (next slide)
  - Polyhedral optimization to target
Codegen: mod to the BYOC path

Minor mods:
- Arrays generated as multi-dimensional (C99 VLA)
- Normalization of parameter passing
- #pragma rstream map
Preliminary results & future work

Correct x86 results on a BERT proxy and ResNet18 using OpenMP

- Demonstrates proof-of-concept

Future experiments: tuning, more mixing, more targets & networks

- Let Relay optimize some layers, R-Stream others
- CUDA, OpenCL
- More NLP, Vision
- Recommendation models
References


