TVM at Qualcomm Adreno

Siva
TVM journey with Adreno GPU

Evaluation:
- Basic 1D texture base experiments.
- Auto tuning & Cache strategy
- **2.56x** speedup over vanilla TVM.
- Published with IOWCL (https://www.youtube.com/watch?v=jedW0cjNTDk)

OctoML Collaboration:
- More enhancements for Adreno.

Other Initiatives:
- OpenCL ML with TVM.
- TVM backend for MLPerf.

DNN Training Evaluation:
- TVM enhancements to enable DNN training.
- Mobilenet V1 training over Adreno is functionally working.
- Published with IOWCL (https://www.youtube.com/watch?v=6pYV7T-Jzi8)
OctoML Collaboration

Enhancements:

- OpenCL image objects are implicitly backed by texture cache.
- Friendly layouts to take advantage of OpenCL vectorization.
- Brand new schedules to drive the codegen with these changes.
- Finally, the magic of AutoTVM to bring out the best possible kernels.

Thanks Thierry Moreau, Chris Sullivan and OctoML Team for making it happen.
About OpenCL ML

- An OpenCL extension (cl_qcom_ml_ops) that accelerates Machine Learning at the Op level.
- Leverages deep knowledge of the Adreno GPU for significant performance benefits.
- C based DNN API with compatibility to most of the standard frameworks.
- Uses standard OpenCL features like command queues, buffers, events and supports FP16 and FP32 data types.
- Can be interleaved with other OpenCL kernels (i.e. TVM generated kernels) and dispatched to the same command queue.
- Compatible with existing OpenCL extensions for importing memory, controlling performance and controlling data access.

➢ Download the SDK at https://developer.qualcomm.com/blog/accelerate-your-models-our-opencl-ml-sdk
➢ SDK documentation helps with API details, Data layout information and other tools that helps with model conversion from Tensorflow or Tensorflow Lite.
OpenCL ML into TVM via BYOC

Efforts:

• Frontend to transform and offload the subgraphs to OpenCL ML path.
• Codegen extended over existing JSON Codegen.
• OpenCL ML runtime for subgraph execution.
• OpenCL workspace reuse across CLML and default OpenCL runtimes.

Plan:

• OpenCL ML SDK 2.1 with more operators and enhancements is planned for release soon.
• Snapdragon 8 Gen 1 devices would be available across vendors in coming months.
• We are working on a contribution plan to land this feature into community.
TVM backend for MLPerf

About MLPerf:

- Driven by mlcommons community (https://mlcommons.org/en/)
- Has got Android APK (https://github.com/mlcommons/mobile_app_open) that can evaluate the platform performance for various use cases like Image Classification, Object detection, Image Segmentation and Language Understanding.
- Uses well standard datasets to evaluate the models.

Efforts:

- Generic TVM backend inline with MLPerf’s backend interface definition.
Q&A
Thank you!

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