ONNX Development Lab: Develop support for a new/updated operator

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Data and AI
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Outline

- Unit 1: Setup and verify development dependencies
- Unit 2: Develop support for a new/updated op

Unit 1: Setup development dependencies

- **Goal of the unit: At the end of unit 1, you will learn how to install and verify the projects that are required for the ONNX Tensorflow converter development**
- Development dependencies
    - System packages
    - ONNX master
    - Tensorflow 2.1
    - ONNX-TF master
- Step 1.1: setup system packages
    - Install python3, git, cmake, protobuf-compiler libprotoc-dev
    - Verify: python –V returns 3.x.x and check others are installed using dpkg -l

Unit 1: Setup development dependencies

- Step 1.2: setup ONNX master
  - Use git clone to download ONNX from https://github.com/onnx/onnx.git
  - Follow instructions for build from source on https://github.com/onnx/onnx#source (skip conda and pip install onnx)
  - Verify: python -c "import onnx; print(onnx.__version__) " returns 1.7.0
- Step 1.3: setup Tensorflow latest release
  - pip install -U tensorflow
  - pip install -U tensorflow-addons
  - Verify: python -c "import tensorflow; print(tensorflow.__version__) " returns 2.1.0
- Step 1.4: setup ONNX-Tensorflow master
  - Use git clone to download ONNX-TF from https://github.com/onnx/onnx-tensorflow
  - Follow instructions for development installation on https://github.com/onnx/onnx-tensorflow#installation
  - Verify: python -c "import onnx_tf“ doesn’t return errors

Unit 1: Setup development dependencies

- Step 1.5: final verification
  - cd to ~/onnx-tensorflow
  - python util/get_version.py

```
Python version:
3.6.9 (default, Nov  7 2019, 10:44:02)
[GCC 8.3.0]
ONNX version:
1.7.0
ONNX-TF version:
1.5.0
Tensorflow version:
2.1.0
```

Unit 2: Develop support for a new/updated operator

- **Goal of the unit: At the end of unit 2, you will learn all the steps that required to add support for a new/updated ONNX operator to ONNX-Tensorflow converter. In this unit, we are going to use Constant operator in Opset 12 as our target operator to support.**
- Step 2.1: Study the specification of Constant in ONNX to identify changes in opset 12 https://github.com/onnx/onnx/blob/master/docs/Operators.md#Constant
    - Compare Constant-12 with the previous version Constant-11 https://github.com/onnx/onnx/blob/master/docs/Changelog.md#Constant-11
    - Constant-12 accept python primitive type like float, int and string as input attributes in addition to tensor and sparse_tensor in Constant-11

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- Step 2.2: Identify the potential Tensorflow operator to support the new changes in Constant-12 https://www.tensorflow.org/api_docs/python/tf/constant
    - Argument “value” in tf.constant accept constant value or list of any Tensorflow DataType
        - Therefore tf.constant is still efficient to perform the same capability of ONNX Constant-12 op
- Step 2.3: Create your PR development workspace
    - Verify your ONNX package location is point to your ONNX directory not to an egg file
        - pip list | grep onnx
        - If the location is point to an egg file, then please reinstall it with the following commands
        - cd <your-onnx-directory> ; pip install -e .

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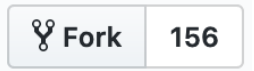
- If you didn't create a fork of ONNX-Tensorflow yet, please create one by clicking 

button on the top right corner of ONNX-Tensorflow repository
- Clone your fork
  - git clone https://github.com/<your-git-user-name>/onnx-tensorflow.git
  - Verify: cd onnx-tensorflow ; ls
- Setup the upstream remote
  - git remote add upstream https://github.com/onnx/onnx-tensorflow.git
  - Verify: git remote -v
- Verify your fork master is up-to-date
  - git checkout master

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- If your master is out-of-date then run the following commands
  - git fetch upstream
  - git merge upstream/master
  - git push origin master
- Create a branch under your fork as your development workspace
  - git checkout -b <your-branch-name>
  - Verify: git branch
- Use your branch to build onnx-tf
  - pip install -e .
  - Verify: pip list | grep onnx-tf

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- Step 2.4: Update test_constant unit test in onnx-tensorflow/test/backend/test_node.py
  - Let's only focus on adding the int64 attribute support for Constant here
  - Add a test case in test_constant to check does the existing Constant handler accept a constant int64 value as an attribute
  - When you are ready to test run your updated test_constant, please run the following command:
    - python test_node.py TestNode.test_constant

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```
def test_constant(self):
  …
  # test sparse tensor
  if not legacy_opset_pre_ver(11):
    …
    result = b.numpy()
    np.testing.assert_equal(result, expected)
  # test int64
  if not legacy_opset_pre_ver(12):
    int_attr = np.int64(108)
    node_def = helper.make_node("Constant", [], ["Y"], value_int=int_attr)
    output = run_node(node_def, [])
    np.testing.assert_equal(output["Y"], int_attr)
```

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- Step 2.5: Update Constant handler in onnx-tensorflow/onnx_tf/handlers/backend/constant.py
    - Define version_12 method to handle Constant in opset 12 and above
        - Need to handle everything opset 11 support
        - Plus the newly added attributes like “value_int”
    - Register your updated handler to onnx-tensorlfow/onnx_tf/opset_version.py file
        - Run onnx-tensorlfow/onnx_tf/gen_opset.py
            - python gen_opset.py
            - Verify: cat opset_version.py | grep Constant
    - Test/debug your updated handler by running your updated Constant unit test in onnx-tensorflow/test/backend/TestNode.py on step 2.4
        - python test_node.py TestNode.test_constant

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```
@classmethod
 def version_12(cls, node, **kwargs):
    if "value" in node.attrs or "sparse_value" in node.attrs:
      return cls.version_11(node, **kwargs)
    elif "value_int" in node.attrs:
      value = node.attrs["value_int"]
      dtype = tf.int64
    return [
          cls.make_tensor_from_onnx_node(node,
                                         inputs=[value],
                                         attrs={"dtype": dtype})
    ]
```

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- After successfully run the unit test of Constant in test_node.py then please verify all the other tests under onnx-tensorlfow/test/backend folder are pass too.
  - python test_node.py
  - python test_dynamic_shape.py
  - python test_model.py
  - python test_onnx_backend.py

  Note: test_onnx_backend.py typically takes between 20 to 40 minutes to complete, depending on hardware configurations

- Step 2.6: Update support status report for Constant
  - Run onnx-tensorflow/onnx_tf/gen_status.py to update the support status
    - python gen_status.py –v master
  - Verify: cat ../doc/support_status.md | grep Constant

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- Step 2.7: Verify all changed files follow the recommended code format
  - Follow instructions for code standard format on https://github.com/onnx/onnx-tensorflow#code-standard
- Step 2.8: Commit all the changes to your branch in your fork
  - git status
  - git add *
  - git commit
  - git push origin <your-branch-name>

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- Step 2.9: Create Pull Request(PR) in ONNX-Tensorflow Repository
    - Navigate your browser to https://github.com/onnx/onnx-tensorflow,
    - Click on the “Compare and pull request” button
    - Click on the “Create pull request“ button
    - Type a title and description of your pull request
    - Click on the “Create pull request“ button to submit it

    Note: If you can’t find the “Compare and pull request” button then run the following steps:

    - Click on the “Pull requests” tab on the top of the page
    - Click on the “New pull request” button
    - Click on the “compare across forks” link
    - Leave the base repo as the master branch and change the head repo to your fork and your branch
    - Click on the “Create pull request“ button

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- Step 2.10: Wait for review and address comment
    - If changes is required in your PR, modify code in your branch then run the following git commands:
        - git status
        - git add *
        - git commit --amend
        - git push -f origin <your-branch-name>

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- If rebase is required, then run the following git commands
  - git stash # if there is uncommitted changes on the current branch then stash it
    else skip to next step
  - git fetch upstream
  - git checkout master
  - git merge upstream/master
  - git push origin master
  - git checkout <your-branch-name>
  - git rebase origin/master
  - git stash pop # if there is a stash then pop it now else skip to next step
  - git commit --amend # if there is no change to the commit then skip to next step
  - git show -1
  - git push -f origin <your-branch-name>