TensorFlow

Курс “Практическое применение по TensorFlow”
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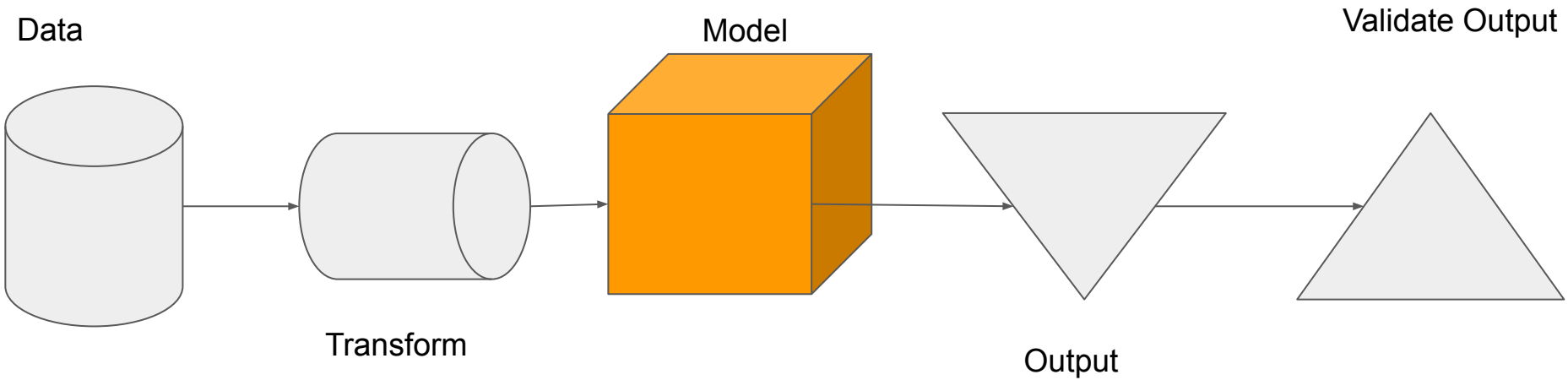
https://github.com/Firyuza/TensorFlowPractice

Common pipeline of problem



TensorFlow 1.x program

Training ResNet50 for image classification

1. Load dataset via keras.datasets
2. Data Input Pipeline through TF FIFOQueue
3. Train ResNet50 via keras.applications
4. Log into Tensorboard
5. **Validate results (Homework)**

TensorFlow 1.x program. Create graph

1. Declare placeholders

```
def __create_placeholders(self):
    self.image_placeholder = tf.placeholder(dtype=tf.float32, shape=(None,
                                                                     cfg.train.image_size,
                                                                     cfg.train.image_size,
                                                                     cfg.train.image_channels), name='image')
    self.image_label_placeholder = tf.placeholder(dtype=tf.int64, shape=(None), name='image_label')
    self.batch_size_placeholder = tf.placeholder(tf.int32, name='batch_size')
    self.augmentation_probability = tf.placeholder(dtype=tf.float32)
    self.phase_train_placeholder = tf.placeholder(dtype=tf.bool)

    self.global_step = tf.Variable(0, trainable=False)

    return
```

For counting passed iterations

TensorFlow 1.x program. Create graph

2. Define process for loading data into FIFOQueue

augmentation probability for image transformations

```
def __prepare_batch(self, images, labels, augmentation_probability):
    elems = tf.convert_to_tensor([False, True], dtype=tf.bool)
    probs = tf.convert_to_tensor([1.0 - augmentation_probability, augmentation_probability])
    rescaled_probs = tf.expand_dims(tf.log(probs), 0)
    indices = tf.multinomial(rescaled_probs, tf.shape(images)[0])
    augment_probs = tf.gather(elems, tf.squeeze(indices, [0]))

    input_queue = tf.FIFOQueue(capacity=100000,
                               dtypes=[tf.float32, tf.int64, tf.bool],
                               shapes=[(cfg.train.image_size,
                                        cfg.train.image_size,
                                        cfg.train.image_channels), (), ()])
    enqueue_op = input_queue.enqueue_many([images, labels, augment_probs])

    nrof_preprocess_threads = cfg.train.nrof_threads
    images_and_labels = []
    for _ in range(nrof_preprocess_threads):
        image, label, augment_prob = input_queue.dequeue()
        image = self.__process_image(image)
        images_and_labels.append([image, label])

    image_batch, label_batch = tf.train.batch_join(images_and_labels,
                                                   batch_size=self.batch_size_placeholder,
                                                   enqueue_many=False)

    return enqueue_op, image_batch, label_batch
```

TensorFlow 1.x program. Create graph

3. Create model

```
self.backbone_model = tf.keras.applications.resnet50.ResNet50(input_tensor=self.images_batch,
                                                               weights='imagenet',
                                                               include_top=False)
backbone_output = self.backbone_model.output
backbone_output = tf.keras.layers.GlobalAveragePooling2D()(backbone_output)
self.logits = tf.keras.layers.Dense(self.nrof_classes)(backbone_output)
```

TensorFlow 1.x program. Create graph

4. Define Loss function that solve your optimization problem

```
self.loss = tf.reduce_mean(tf.nn.sparse_softmax_cross_entropy_with_logits(labels=self.labels_batch,
                                                                          logits=self.logits))
```

TensorFlow 1.x program. Create graph

5. Define optimizer -- does backward propagation and define the rule for updating trainable variables

```
opt = tf.train.AdamOptimizer(cfg.train.learning_rate, beta1=0.9, beta2=0.999)
```

```
self.train_op = opt.minimize(self.total_loss, self.global_step, var_list=self.trainable_variables)
```

6. Run **self.train_op** each training step through **session.run**

TensorFlow 1.x program. Tensorboard

```
tf.summary.scalar('train_accuracy', self.tf_accuracy)
tf.summary.scalar('train_top5_accuracy', self.tf_top5_accuracy)

tf.summary.scalar('cross_entropy', self.loss)
tf.summary.scalar('reg_loss', self.reg_loss)
tf.summary.scalar('total_loss', self.total_loss)
tf.summary.scalar('learning_rate', self.learning_rate)
```

Op that generates all summaries data together

```
self.summary_op = tf.summary.merge_all()
self.summary_writer = tf.summary.FileWriter(cfg.train.logs_base_dir, self.sess.graph)
```

Write summaries data to the disk

TensorFlow 1.x program. Save model

1. Create within graph context Saver:

```
self.saver = tf.train.Saver(tf.global_variables(), max_to_keep=None)
```

2. Save at needed time:

```
checkpoint_path = os.path.join(model_dir, 'model.ckpt')
self.saver.save(self.session, checkpoint_path, global_step=step)
```

3. Restore model:

```
self.saver.restore(self.session, cfg.train.restore_model_path)
```

TensorFlow 1.x program. Training step

1. Think over Data Input Pipeline (how to put and take data each step/epoch)
2. Create loop where you can track each step if it’s needed
3. Log results

TensorFlow 1.x program. Dataset

```
(self.x_train, self.y_train), (self.x_test, self.y_test) =

                                tf.keras.datasets.cifar10.load_data()
```

TensorFlow 1.x program. Check Tensorboard

In terminal write down:

tensorboard --logdir=<*path to your log dir*>

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WALL

RUNS

jects/

0 400 800 1.2k 1.6k 2k

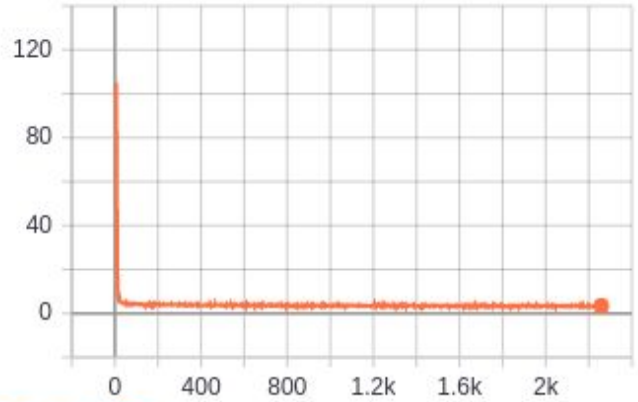
cross_entropy

learning_rate

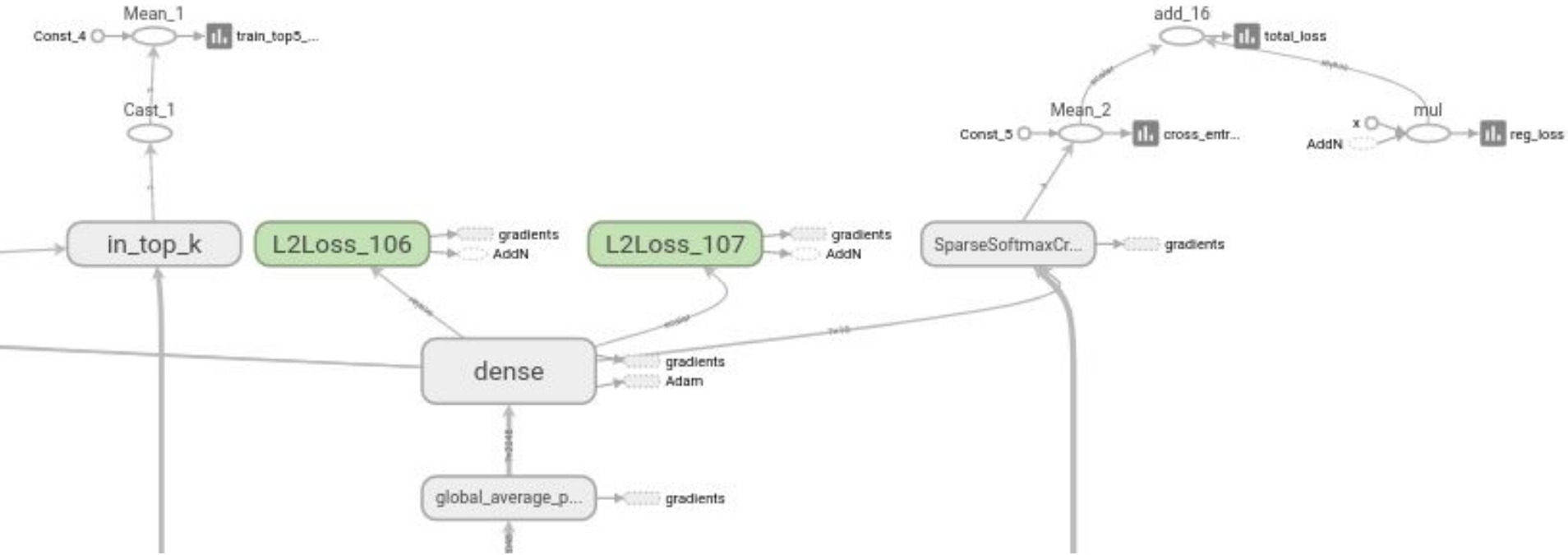
reg_loss

total_loss

total_loss



TensorFlow 1.x program. Graph View



Tensorflow 1.x program + tf.data API

tf.data API cannot be used in classical static graph program (where is used explicitly created Graph and its context).

- Not all types of tensors from graph are supported by Eager Execution.
- Above problem occurs when **model** has to be **saved.**
- Project “static_graph_tf_data” shows failure of such kind of approach.

```
tensorflow.python.eager.core._FallbackException:

This function does not handle the case of the path where all inputs are not already EagerTensors.
```