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Applied Accelerated AI

Scale training on multiple GPUs with PyTorch

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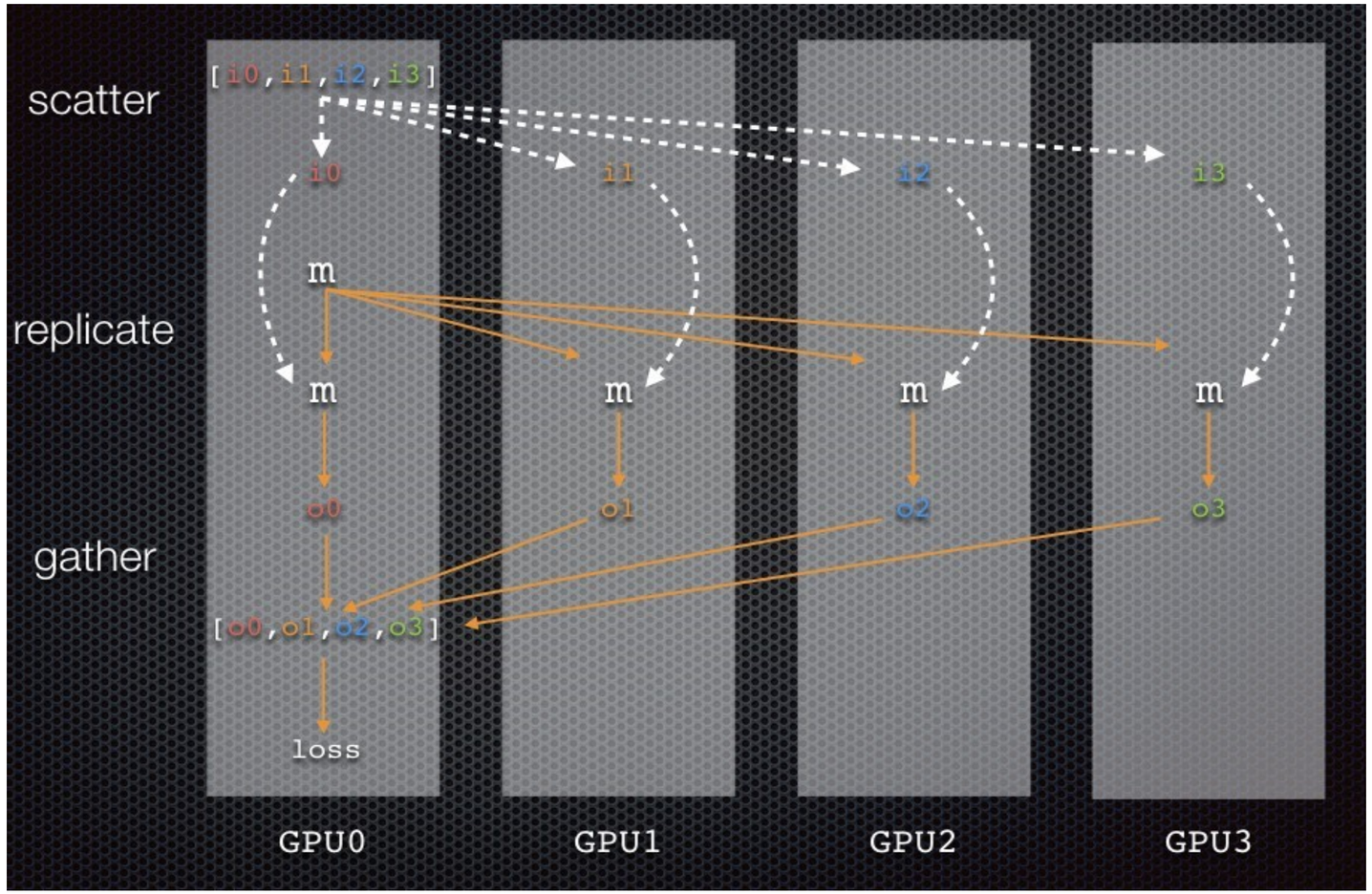
Scale training to multiple GPUs

- Data Parallel – Data distributed across devices
- Model Parallel – Model distributed across devices

Scale training to multiple GPUs

- Single Machine Data Parallel
- Single Machine Model Parallel
- Distributed Data Parallel
- Distributed Data Parallel with Model Parallel
- Distributed Model Parallel

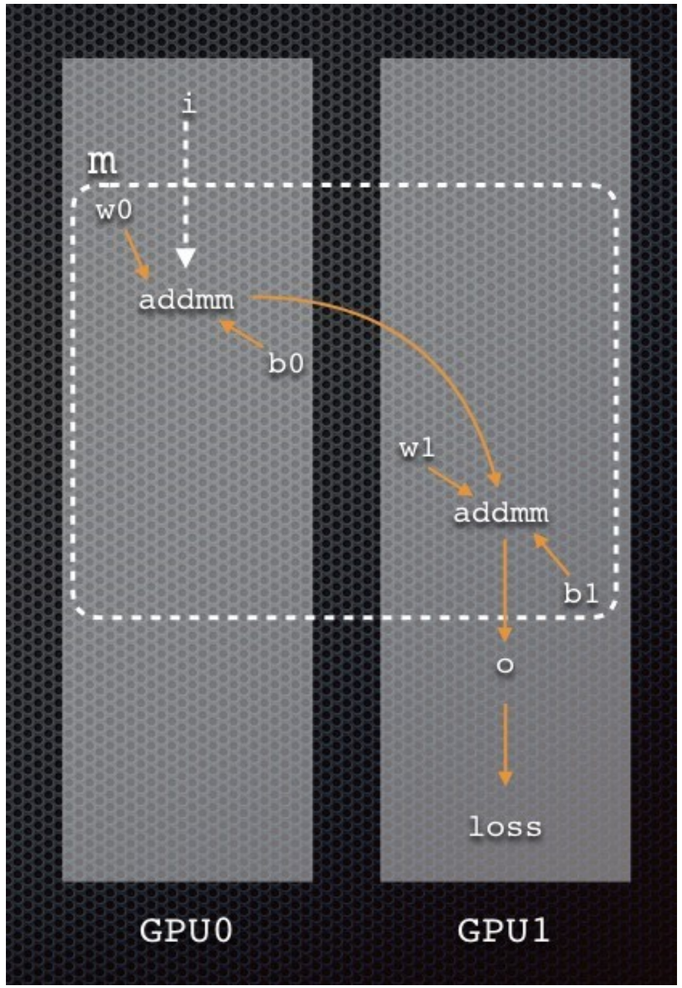
Single Machine Data Parallel




```
model = Net().to("cuda:0")
model = torch.nn.DataParallel(model)

# training loop ...
```

Credit: Vincent Quenneville-Bélair, PhD. Facebook AI.

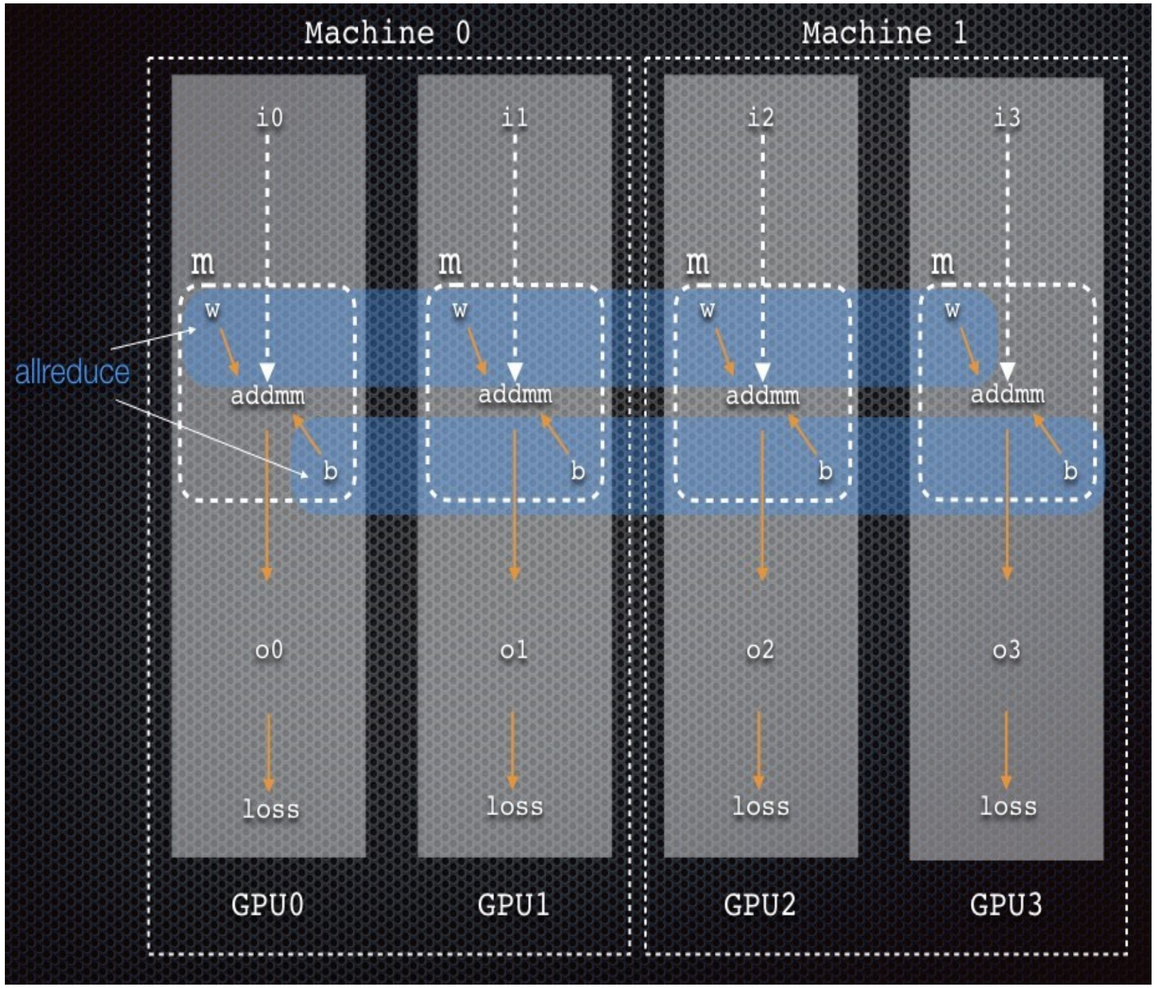
Single Machine Model Parallel



Credit: Vincent Quenneville-Bélair, PhD. Facebook AI.

```
class Net(torch.nn.Module):

  def _init_(self, *gpus):  super(Net)._init
    (self)

    self.gpu0 = torch.device(gpus[0])
    self.gpu1 = torch.device(gpus[1])

    self.sub_net1 = torch.nn.Linear(10, 10).to(self.gpu0)
    self.sub_net2 = torch.nn.Linear(10, 5).to(self.gpu1)


  def forward(self, x):
    y = self.sub_net1(x.to(self.gpu0))
    z = self.sub_net2(y.to(self.gpu1))  # blocking
    return z


model = Net("cuda:0", "cuda:1")


# training loop...
```

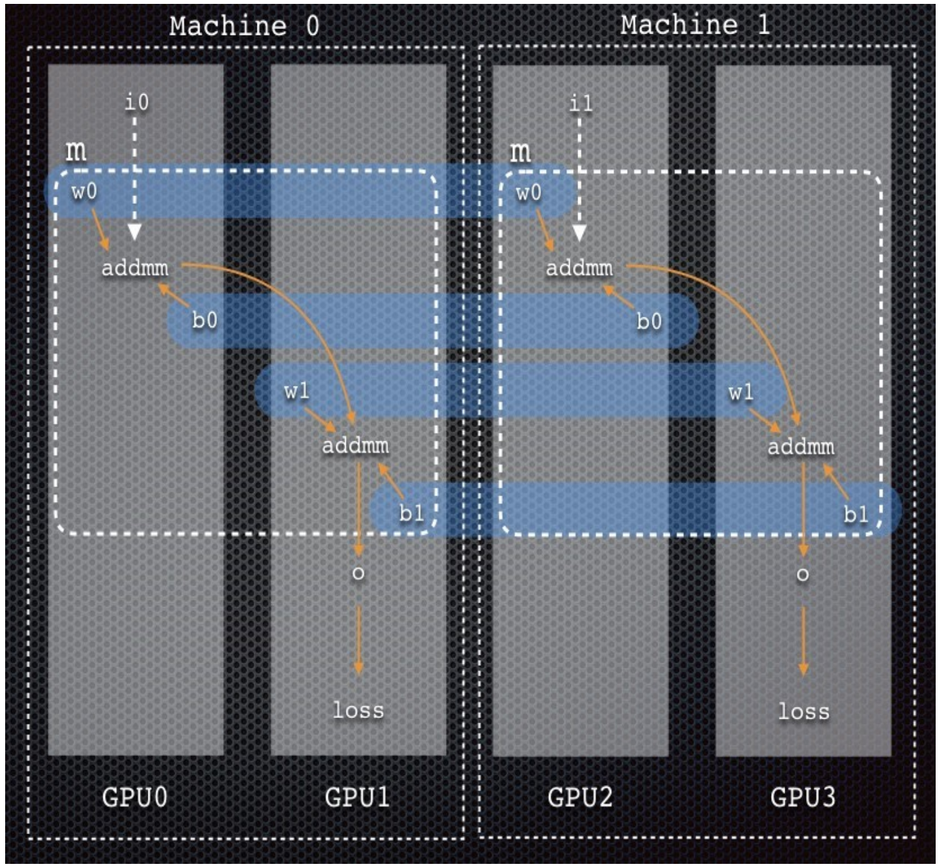
Distributed Data Parallel



Credit: Vincent Quenneville-Bélair, PhD. Facebook AI.

```
def one_machine(machine_rank, world_size,
  backend):  torch.distributed.init_process_group(
    backend, rank=machine_rank, world_size=world_size
  )


  gpus = {
    0: [0, 1],
    1: [2, 3],
  }[machine_rank]  # or one gpu per process to avoid GIL


  model = Net().to(gpus[0])  # default to first gpu on
  machine
  model = torch.nn.parallel.DDP(model, device_ids=gpus)


  # training loop...

for machine_rank in range(world_size):
  torch.multiprocessing.spawn(
    one_machine, args=(world_size, backend),
    nprocs=world_size, join=True # blocking
  )
```

Distributed Data Parallel with Model Parallel




```
def one_machine(machine_rank, world_size, backend):
  torch.distributed.init_process_group(
    backend, rank=machine_rank, world_size=world_size
  )


  gpus = {0: [0, 1],
          1: [2, 3],}[machine_rank]


  model = Net(gpus)
  model = torch.nn.parallel.DDP(model)


  # training loop...

for machine_rank in range(world_size):
  torch.multiprocessing.spawn(
    one_machine, args=(world_size, backend),
    nprocs=world_size, join=True
  )
```

Credit: Vincent Quenneville-Bélair, PhD. Facebook AI.

Thank You