Deep learning

1.6. Tensor internals

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A tensor is a view of a [part of a] **storage**, which is a low-level 1d vector.

```
>>> x = torch.zeros(2, 4)
>>> x.storage()
 0.0
 0.0
 0.0
 0.0
 0.0
 0.0
 0.0
 0.0
[torch.FloatStorage of size 8]
>>> q = x.storage()
>>> q[4] = 1.0
>>> x
tensor([[ 0.,  0.,  0.,  0.],
        [ 1.,  0.,  0.,  0.]])
```

Multiple tensors can share the same storage. It happens when using operations such as `view()`, `expand()` or `transpose()`.

```
>>> y = x.view(2, 2, 2)
>>> y
tensor([[[ 0.,  0.],
         [ 0.,  0.]],

        [[ 1.,  0.],
         [ 0.,  0.]]])
>>> y[1, 1, 0] = 7.0
>>> x
tensor([[ 0.,  0.,  0.,  0.],
        [ 1.,  0.,  7.,  0.]])
>>> y.narrow(0, 1, 1).fill_(3.0)
tensor([[[ 3.,  3.],
         [ 3.,  3.]]])
>>> x
tensor([[ 0.,  0.,  0.,  0.],
        [ 3.,  3.,  3.,  3.]])
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>>> q = torch.arange(0, 20).storage()
>>> x = torch.empty(0).set_(q, storage_offset = 5, size = (3, 2), stride = (4, 1))
>>> x
tensor([[  5.,   6.],
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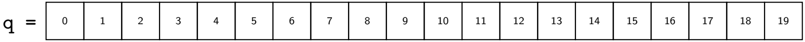

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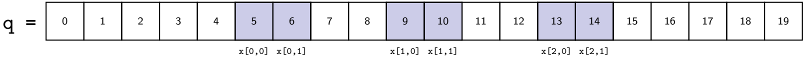

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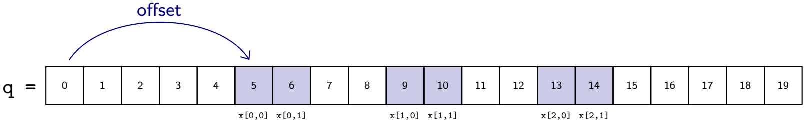

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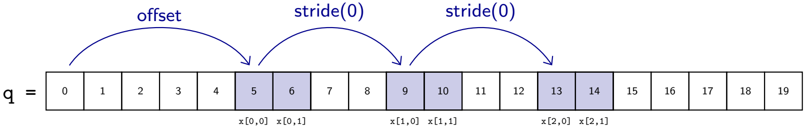

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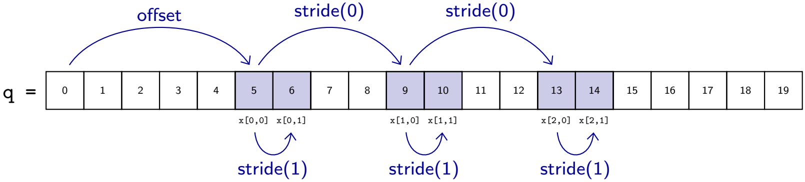

We can explicitly create different “views” of the same storage

```
>>> n = torch.linspace(1, 4, 4)
>>> n
tensor([ 1.,  2.,  3.,  4.])
>>> torch.tensor(0.).set_(n.storage(), 1, (3, 3), (0, 1))
tensor([[ 2.,  3.,  4.],
        [ 2.,  3.,  4.],
        [ 2.,  3.,  4.]])
>>> torch.tensor(0.).set_(n.storage(), 1, (2, 4), (1, 0))
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```

This is in particular how transpositions and broadcasting are implemented.

```
>>> x = torch.empty(100, 100)
>>> x.stride()
(100, 1)
>>> y = x.t()
>>> y.stride()
(1, 100)
```

This organization explains the following (maybe surprising) error

```
>>> x = torch.empty(100, 100)
>>> x.t().view(-1)
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
RuntimeError: invalid argument 2: view size is not compatible with
input tensor's size and stride (at least one dimension spans across
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This can be fixed with `contiguous()`, which returns a contiguous version of the tensor, **making a copy if needed.**

The function `reshape()` combines `view()` and `contiguous()`.

The end