Automatic Gradient Calculation

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Automatic Gradient Calculation

- TensorFlow constructs the forward calculation process, in addition to being able to obtain numerical results
- TensorFlow also automatically builds a computational graph.
- *TensorFlow provides automatic differentiation that can calculate the derivative of the output on network parameters without manual derivation.*
- Consider the following equation

$$y = aw^2 + bw + c$$

The derivative relationship of the output y to the variable w is

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Consider the derivative at $(a, b, c, w) = (1, 2, 3, 4)$

$$\frac{dy}{dw} = 2 \cdot 1 \cdot 4 + 2 = 10.$$

Automatic Gradient Calculation: Tensorflow GradientTape()

```
import tensorflow as tf
# Create 4 tensors
a = tf.constant(1.)
b = tf.constant(2.)
c = tf.constant(3.)
w = tf.constant(4.)

with tf.GradientTape() as tape:# Track derivative
    tape.watch([w]) # Add w to derivative watch list
    # Design the function
    y = a * w**2 + b * w + c
# Auto derivative calculation
[dy_dw] = tape.gradient(y, [w])
print(dy_dw) # print the derivative
```

Output `tf.Tensor(10.0, shape=(), dtype=float32)`