

Алгоритм обратного распространения back propagation

$$f = ((a+e) \cdot (b-d))^2$$

$$\begin{aligned} a &= 23 \\ b &= 2 \\ e &= -5 \\ d &= 7 \end{aligned}$$

$$e = \frac{a+c}{c} = \frac{a+e}{e} = 18 \quad \frac{\partial e}{\partial a} = 1$$

$$g = \frac{b+d}{d} = \frac{b-d}{-d} = -5$$

$$h = \frac{e \cdot g}{g} = \frac{e \cdot g}{e} = -90 \quad \frac{\partial h}{\partial e} = -5 \quad \frac{\partial h}{\partial g} = 18$$

$$f = h^2 = 8100$$

$$\frac{\partial f}{\partial h} = 16200$$

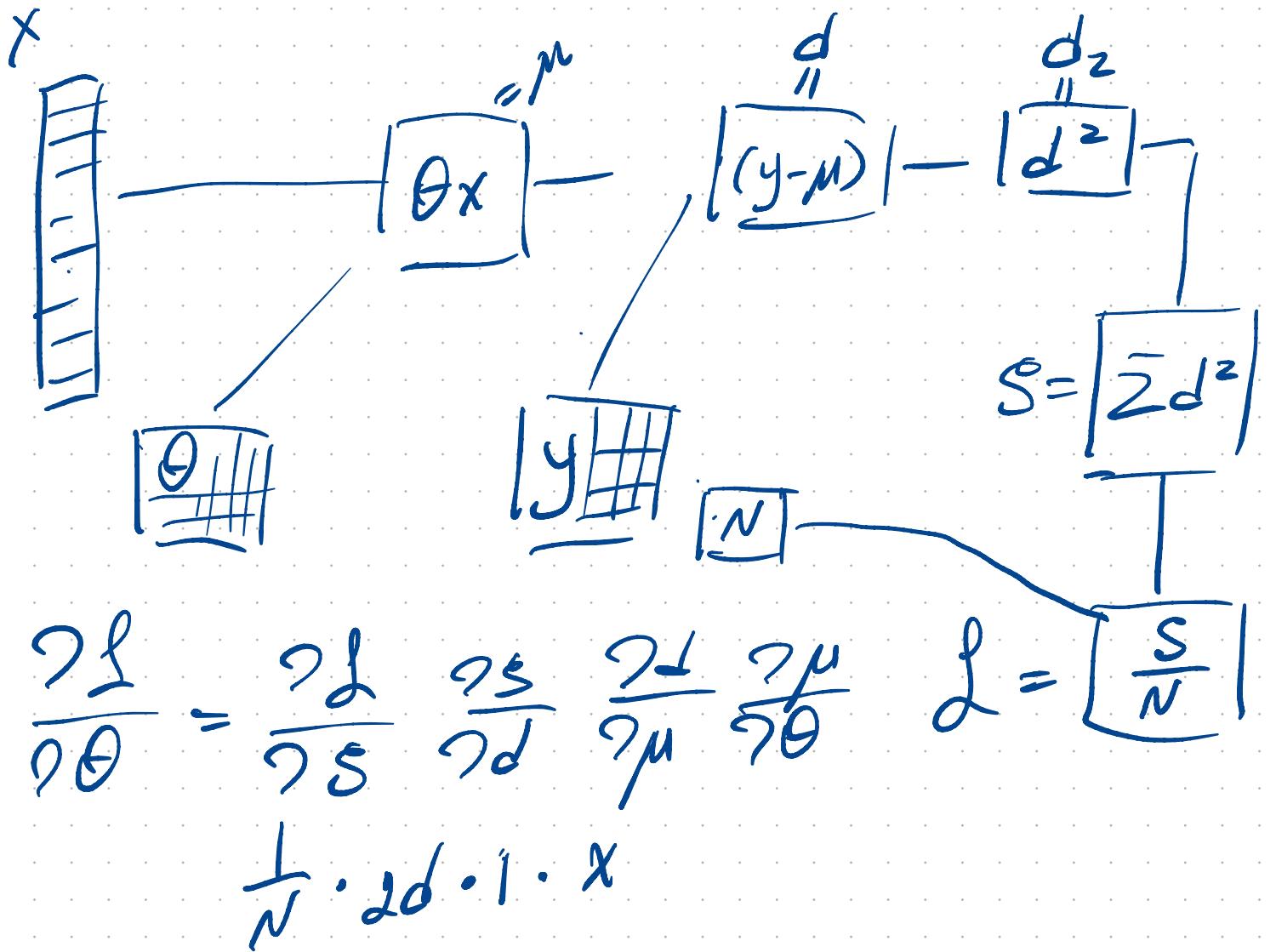
$$\frac{\partial f}{\partial a} = \frac{\partial f}{\partial h} \frac{\partial h}{\partial e} \frac{\partial e}{\partial a} + \frac{\partial f}{\partial h} \frac{\partial h}{\partial g} \frac{\partial g}{\partial a}$$

$$\frac{\partial f}{\partial a} = 16200 \cdot (-5) \cdot 1 = -81000$$

① Если есть график бициклической
сплошной f -ии, то легко можно
построить график бициклической
графической f -ии по любой
переменной — в этом графике

② Полезно комбинировать приемы
должные результаты бициклических

③ а) Помимо коэффициентов $\frac{\partial f}{\partial x_i}$ полезно
использовать бициклические $f(a, b, c, d, \dots)$



$$\frac{\partial L}{\partial \theta} = \frac{\partial L}{\partial S} \frac{\partial S}{\partial d} \frac{\partial d}{\partial \mu} \frac{\partial \mu}{\partial \theta} \quad L = \left| \frac{S}{N} \right|$$

$$\frac{1}{N} \cdot 2d \cdot 1 \cdot x$$

```
class square:  
    def __init__(self):  
        pass
```

```
    def forward(self, x):  
        self.cache = x  
        return x**2
```

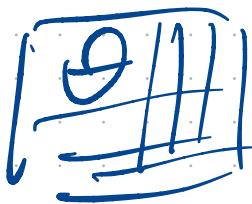
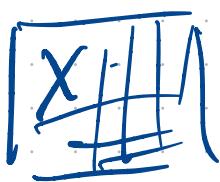
```
    def backward(self):  
        return 2 * self.cache
```

```
class prod:
```

```
    def __init__(self):  
        pass
```

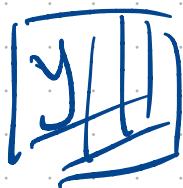
```
    def forward(self, x1, x2):  
        self.cache = (x2, x1)  
        return x1 * x2
```

```
    def backward(self):  
        return self.cache
```



$$\theta x = p$$

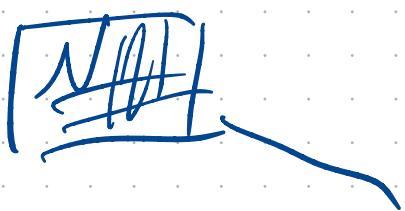
$$\psi(p) = \mu$$



$$(y - \mu) = d$$

$$d^2 = dz$$

$$2dz = s$$



$$\frac{s}{N} = f$$

$$\frac{\partial f}{\partial \theta}$$