Analysis on MoreLoRA

$$W = W_0 + \Delta$$

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1 LoRA

$$\Delta = AB, A \in \mathbf{R}^{m\times r}, rank\Delta \leq r, B \in \mathbf{R}^{r\times n}$$
$$\frac{\partial L}{\partial A} = \frac{\partial L}{\partial W} B^T$$
$$\frac{\partial L}{\partial B} = A^T \frac{\partial L}{\partial W}$$

2 AddLoRA

$$\Delta = AI_{r(1\times n/r)} + I_{r(m/r,1)}B, rank\Delta \leq 2r, A \in \mathbf{R}^{m\times r}, B \in \mathbf{R}^{r\times n}$$
$$\frac{\partial L}{\partial A} = \frac{\partial L}{\partial W} {I_{r(1\times n/r)}}^T$$
$$\frac{\partial L}{\partial B} = {I_{r(m/r\times 1)}}^T \frac{\partial L}{\partial W}$$

3 HadamardLoRA

$$\Delta = A_1B_1 \odot A_2B_2, rank \leq (\frac{r}{2})^2$$
$$A1, A2 \in \mathbf{R}^{m\times r/2}, A2, A2 \in \mathbf{R}^{r/2\times n}$$
$$\frac{\partial L}{\partial A_1} = (\frac{\partial L}{\partial W} \odot (A_2B_2))B_1^T$$
$$\frac{\partial L}{\partial B_1} = A_1^T(\frac{\partial L}{\partial W} \odot (A_2B_2))$$

$$\Delta = (A_1I_{r(1\times n/r)}+I_{r(m/r,1)}B_1)\odot(A_2I_{r(1\times n/r)}+I_{r(m/r,1)}B_2), rank \leq (\frac{2r}{2})^2 = r^2$$
$$A1, A2 \in \mathbf{R}^{m\times r/2}, A2, A2 \in \mathbf{R}^{r/2\times n}$$
$$\frac{\partial L}{\partial A_1} = (\frac{\partial L}{\partial W} \odot (A_2I_{r(1\times n/r)} + I_{r(m/r,1)}B_2)){I_{r(1\times n/r)}}^T$$
$$\frac{\partial L}{\partial B_1} = {I_{r(m/r\times 1)}}^T(\frac{\partial L}{\partial W} \odot (A_2I_{r(1\times n/r)} + I_{r(m/r,1)}B_2))$$