

j` Vhoi iVc`hoZI h` ^` AViVgncV OVAzh` V` AVb` a: Z\_Y`(`  
 `L VghVl J c`kZgh`nd[I ZX] cdad`n` (? ; 7i D98H ; fj Va9dcigWj i`dc

I B: H

- L L C > Y > L "p`LL HQL`L~" >...`> BpL%0, s-s > s-s-n >-H } L`ns-n "pL s-H`H`Y> >H>..L`%0~ , ~ -Y> , AWB' >-H3`¥L/L`%0-> s> , ~ , NV` QY%0~ ) , HL`%0
- L`%0 E "p>" \* >CL` , ~ -Y> 5`>s-s-n , N & 2` L>H%0, B>`>%0, ..p`BN`nL` -n E psl , "pL`"LBp` -s`YL%0B>- } s n>"L`p`%0%0L` E p`sp , "ns->"L`%0, } E L`np`%0B` -j`B`%0> >H>..L`%0p>" >L`%0t`YL`~ > ¥ "s-LH

C di kVi`dc

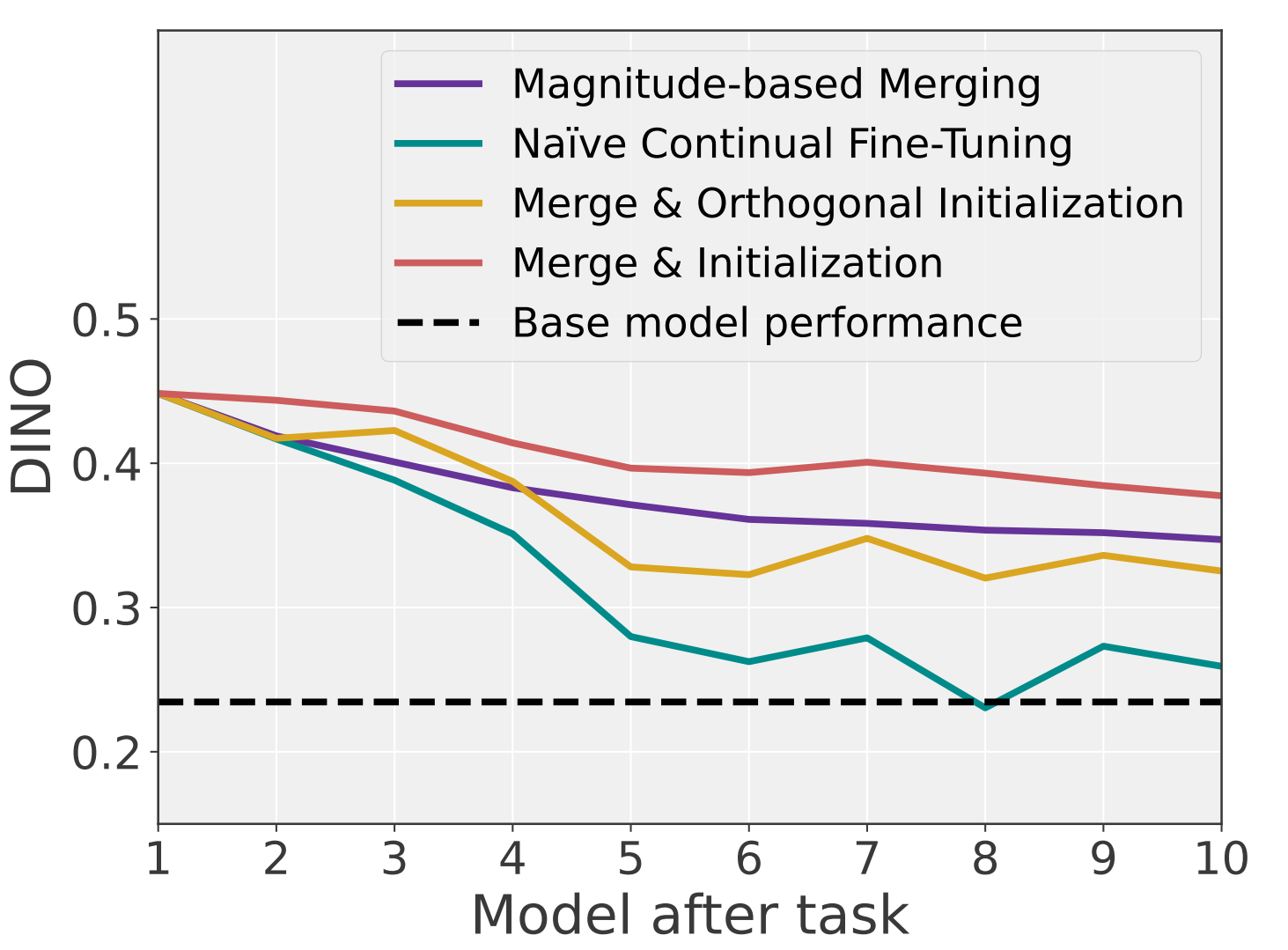
~ , ~ -Y, Y%0..L`%0-> s> , ~ , N> Z`L`L`> CL` ) , HL` , CL`%0CL`> ">%0d>H%0, "pL`B">%0, ..p`BN`nL` -n , N..L`C`S`Y%0`L`-B`HLHy~ , E`LHhL`  
 2L`BL`~" >...`> BpL%0} s n>"L`"p`%0%0L` A¥ } L`ns-n "pL`>H>..L`%0A`L`> ">%0%0AY`" "p`%0%0...>B`B> >%0%0%0%0 s-B`L`%0>A, Y` & 2` E L`np`" } >"B`L`%0`L`L`t`Y>" , "pL`%0L` , N> >H>..L`H`..>"> L`L`%0- 3' ; &  
 : L`... , ..%0 , %0Y`H` "pL`L`QL`B`CL`-L`%0, N } L`ns-n "LBp`-s`YL%0Y`-HL`" "pL`%0B`B`~ -Y> L>-s-n`L`ns`L` E pL`L`"pL` , HL` E`sp`>" } , %0 >%0nL`>H>..L`%0%0 ..>%0HAL`"E`LL`~">%0%0

C Zi] dYH

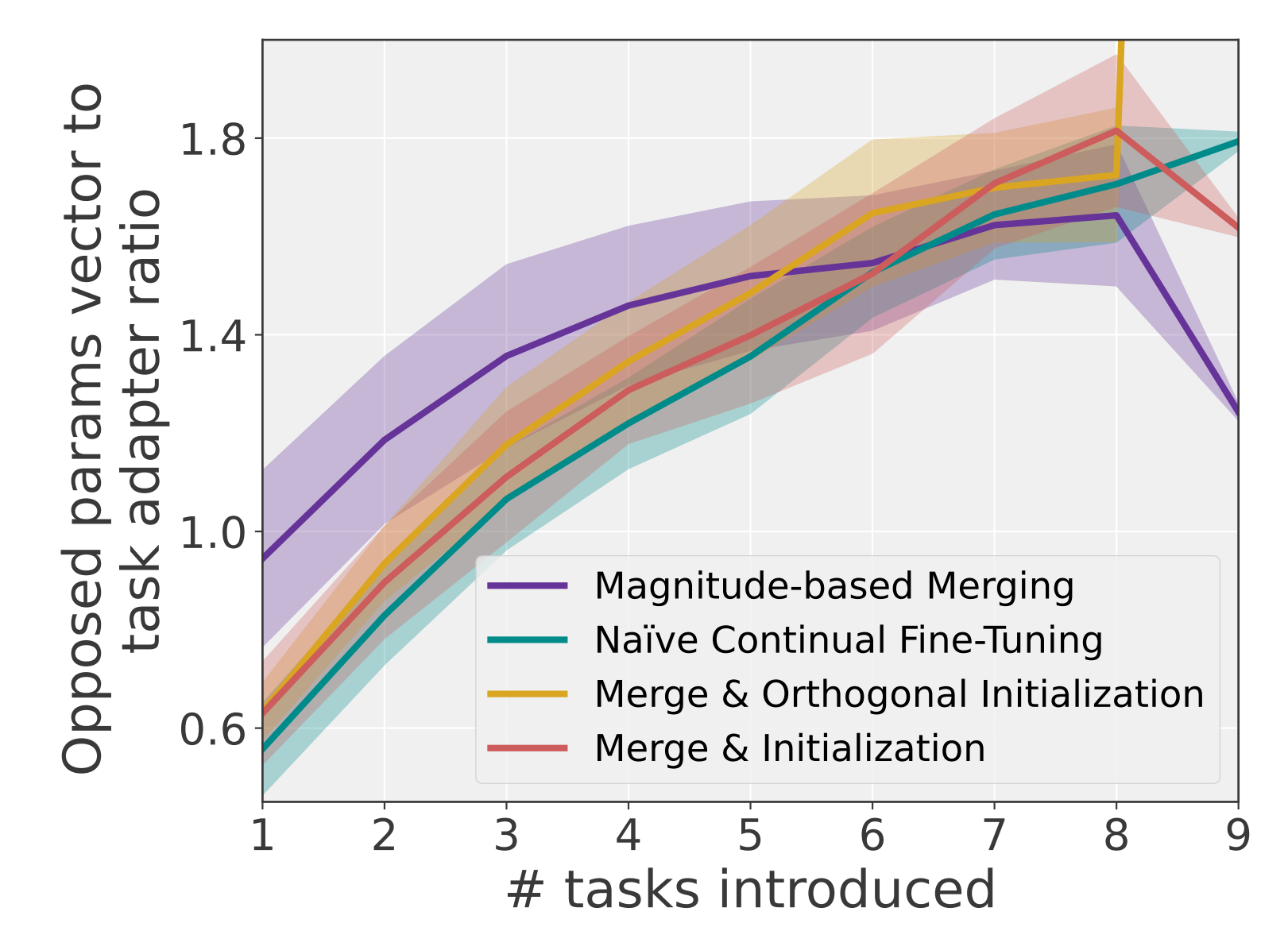
: L L C > Y > L > \* > CL` B` ~ -Y> T`L` "Y`-s-n >...`> Bp` E pL`L` , E` ^>-y` E L`np`%0`L`T`L` "Y`-L`H`N` , } "pL`..L` C`S`Y%0%0%0 E`sp`  
 ) L`nL` "-s > s> , ~ \* LE` ">%0& 2` %0-s > s`LH` s >%0~H>`H` } >-L` A` N(0, I) , B = 0` "pL`L`-H` , N`pL` ">%0` "pL`>H>..L`%0` L`nL`H`S`- , "pL`A>%0 , HL`  
 ) L`nL` , "p, n, -> "-s > s> , ~ : L`S`-s > s`L` A` E L`np`%0%0~ "p, n, -> " , A`t`..t-1` Y`%0n` 3s-n`Y` > 9>Y`L` / LB` } ...%0, ~ 39' : L`HLB` } ...%0`pL`i`"pB`Y`~ >%0  

$$A_{t:t-1}^{(i)} = U V^H$$
 >-H">Y`L`"pL`>%0, E` , NV` s-YLH` , "pL` , E L`%0%0n`Y` > C>Y`L`  
 ) >n-s`Y`HL`A>%0H` %0LB` , ~ , N & 2` E L`np`%0%0 : L`>H>..L`"pL` ) >n` } >` L`p, H >-H`%0LB` E L`np`%0%0 E`sp` "pL` p`npL`%0 } >n-s`Y`HL` E`pL`~ B` } ..>`s-n >`L`>H`Y` } L`nL`H>H>..L`%0E`sp` "pL`B`Y`~L`~ , ~L`

7cVanh`h



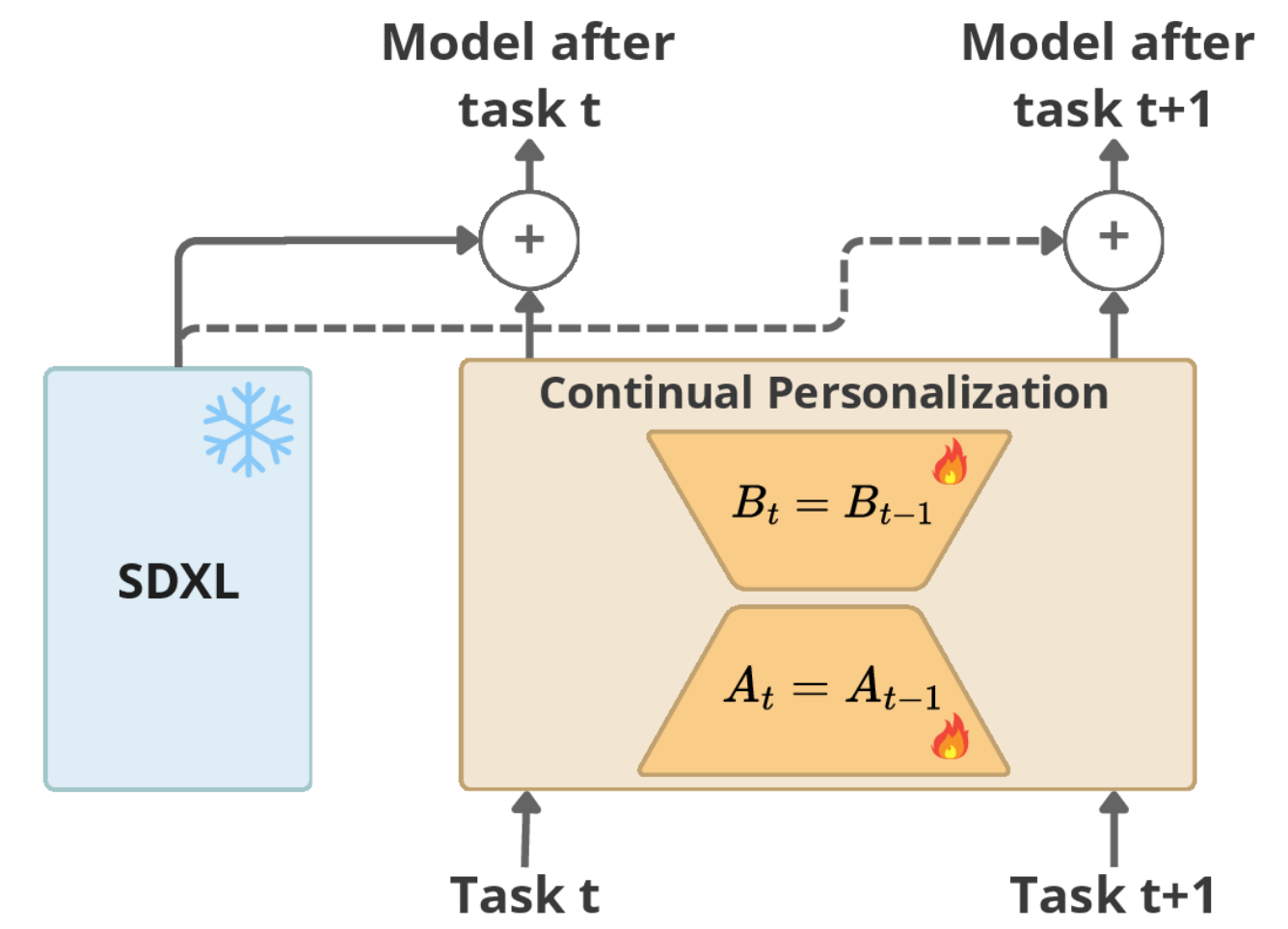
I`sn`Y`L` /`\*\* , %0`L` , ~ "pL`T`%0%0%0, CL`B`~ -Y> T`L` "Y`-s-n` , ~ "pL`-L`" , AWB' ">%0%0



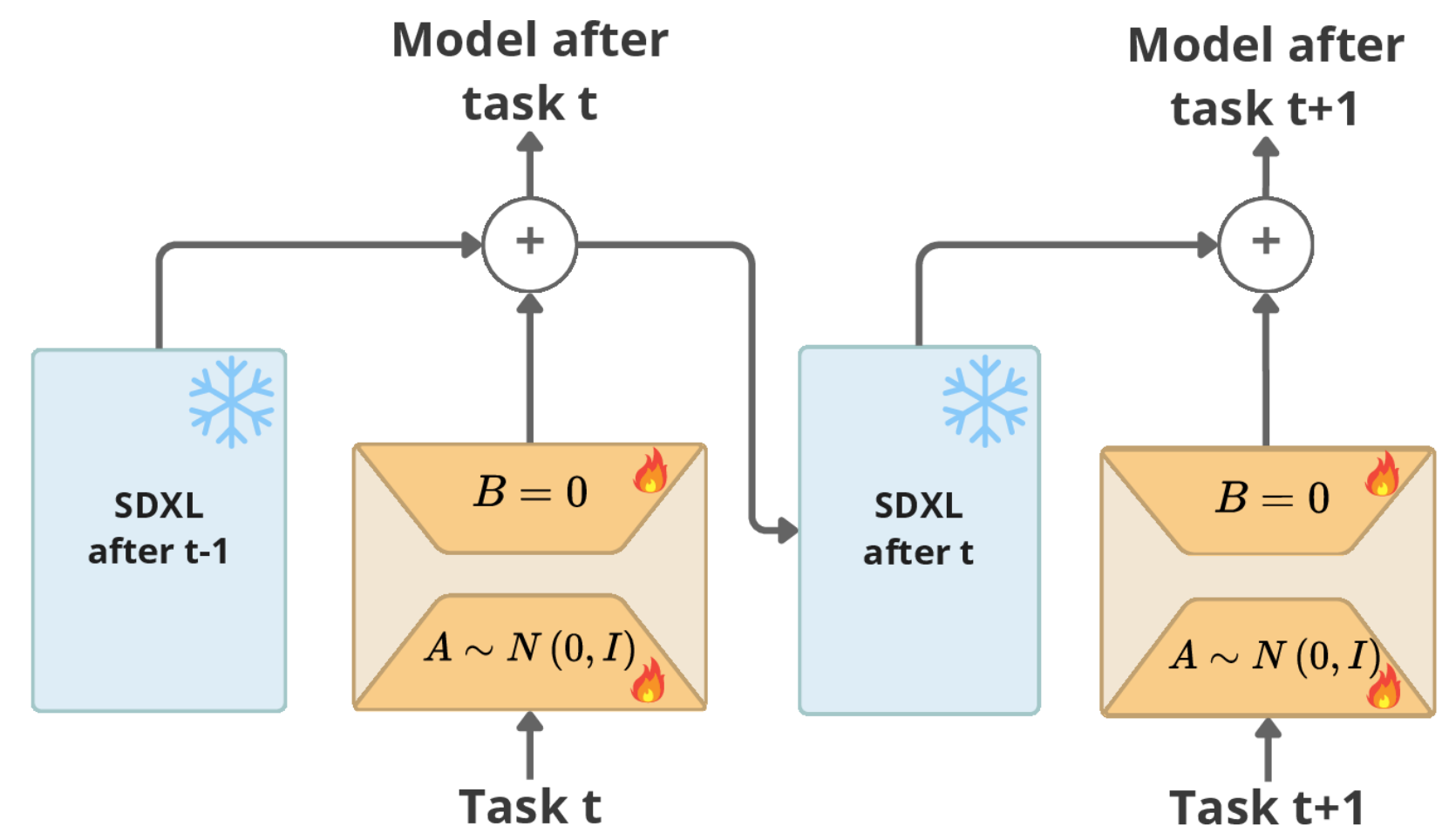
I`sn`Y`L` 5pL`> , ~ N` , ... , %0H`..> } L`L`%0LB` , ~ , } , "pL` ">%0>H>..L`~ , }

9dci `ej Va: ^ j h`dc C dYZaF ZghdcVa0Vi `dc

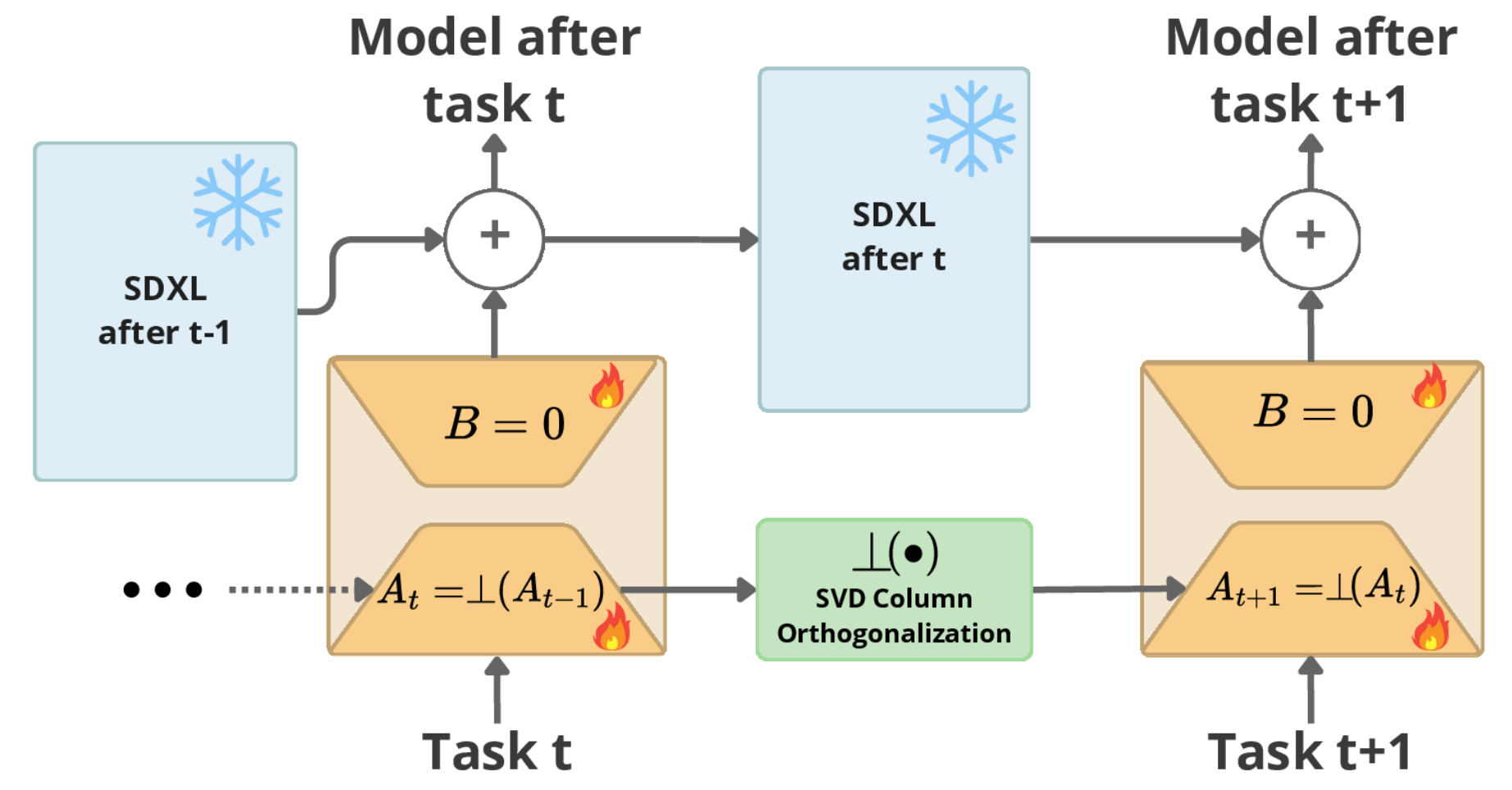
(Baseline) Naive continual fine-tuning



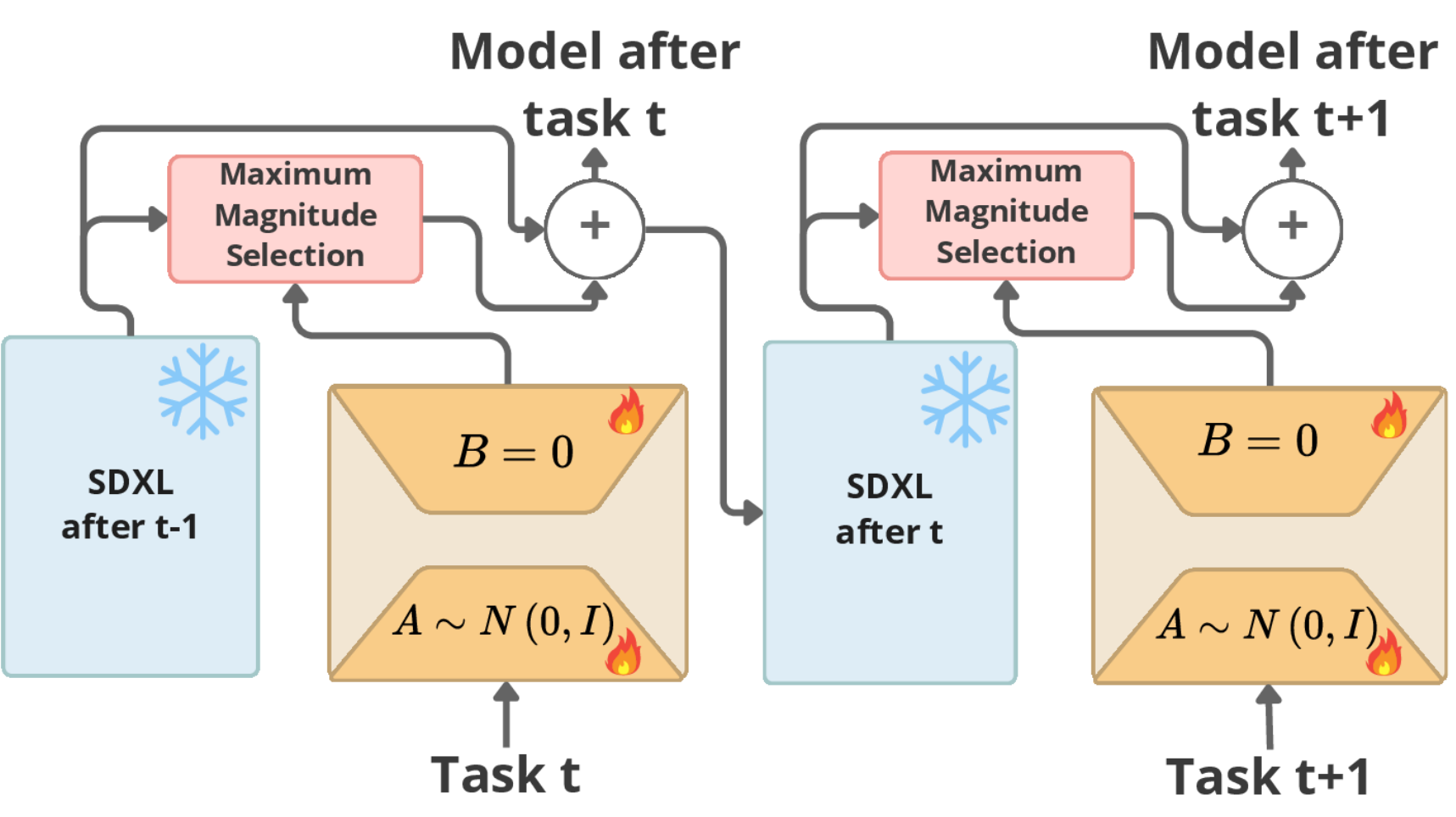
(1) Merge & Initialization



(2) Merge & Orthogonal Initialization



(3) Magnitude-based selection of LoRA weights



mVb eaZh

BYI hCV`Y`W` HUG\_ A U[b]h`XYI` VUG`Y`X`A`Yf[ ]b[` A`Yf[Y]/` b]j]U`j]n]H]c]b` BUq`Y` 7c]b]h]b]i`U` : ]b]Y]H` b]b] A`Yf[Y]/` C]f]h]c[ ]c]b]U` b]j]U`j]n]H]c]b` BYI hGm`Y` HUG\_ A U[b]h`XYI` VUG`Y`X`A`Yf[ ]b[` A`Yf[Y]/` b]j]U`j]n]H]c]b` BUq`Y` 7c]b]h]b]i`U` : ]b]Y]H` b]b] A`Yf[Y]/` C]f]h]c[ ]c]b]U` b]j]U`j]n]H]c]b`

HZjh`ah

	`CL`>nL` 3B` `L` S_T` ( )` `CL`>nL` i , `nL` -n` F_T` ( )`	
`H>..L`T`L` "Y`-s-n` } L`p, H`	`&/'` /`**` ,`	`&/'` /`**` ,`
..>%0} , HL` `L`N`L`-BL`	0.586	0.304
* >CL` , ~ -Y> } s-L` 5Y`-s-n`	0.670 $\pm$ .013	0.402 $\pm$ .029
) L`nL` "-s > s> , ~	0.675 $\pm$ .005	0.457 $\pm$ .011
) L`nL` , "p, n, -> "-s > s> , ~	0.673 $\pm$ .014	0.403 $\pm$ .025
) >n-s`Y`HL`A>%0H` } L`ns-n`	0.643 $\pm$ .002	0.408 $\pm$ .006

5>AL` `CL`>nL` 3B` `L`>-H` `CL`>nL` i , `nL` -n` N` ^` , ~ -Y> , AWB' /L`%0-> s> , ~

	`CL`>nL` 3B` `L` S_T` ( )` `CL`>nL` i , `nL` -n` F_T` ( )`	
`H>..L`T`L` "Y`-s-n` } L`p, H`	`3` /`**` ,`	`3` /`**` ,`
..>%0} , HL` `L`N`L`-BL`	0.088	0.146
* >CL` , ~ -Y> } s-L` 5Y`-s-n`	0.345 $\pm$ .032	0.249 $\pm$ .010
) L`nL` "-s > s> , ~	0.385 $\pm$ .019	0.285 $\pm$ .019
) L`nL` , "p, n, -> "-s > s> , ~	0.349 $\pm$ .014	0.252 $\pm$ .012
) >n-s`Y`HL`A>%0H` } L`ns-n`	0.289 $\pm$ .015	0.240 $\pm$ .009

5>AL` `CL`>nL` 3B` `L`>-H` `CL`>nL` i , `nL` -n` N` ^` , ~ -Y> 3`¥L`/L`%0-> s> , ~

I`V`Z`#`I` Vn`F`d`c`ih

- `H`S`-n` } Y` ..L`>H>..L`%0- > \* >CL` E>¥` L>H%0, "pL` } , HL` E`p`sp`B` -CL`nL`%0 E`>H`%0%0A>%0N` ^` } E`psL`> "pL`L`C>Y`>"L`H` "LBp`-s`YL%0} s n>"L`"p`%0%0L`
- `p`np` L`"L`~" , N`"pL` } Y`> s`-L`N`L`-BL` AL`"E`LL`~ >H>..L`%0` H`Y`-s-n` "s-s-n`%0pL` , "ns-> , N>H>..L`%0`HL`n`>H> , ~
- `...L`%0`"L`H`>...`> BpL`%0`Y`..L`N` } "pL`~>CL`>...`> Bp` s`-B`~ -Y> , AWB'>-H`¥`L`%0L`%0-> s> , ~

7`ndj`a`ZY`i`j`h`\$`\$`

3LL`"pL`N` ..>..L`N`^` } , `L`N`%0-> -n` s`%0p`%0

