**3d dct**；optimization sgd；NLL loss； lr 0.05；cosine lr scheduler；batch size 128；参数分析

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 文件夹 | channel | depth | widen | arch | epoch | ACC top 1 | params;  mult-add |
| rimage01\_3d | 12 | 8 | 4 | 101 | 90 | 78.8  (86.8) | 5.396M  7.70G |
| rimage05\_3d | 3 | 2 | 4 | 50 | 90 | 73.26  (77.7) | 2.945M  961.3M |
| rimage07\_3d | 3 | 8 | 1 | 50 | 90 | 60.44  (55.82) | 0.196M  242.4M |
| rimage08\_3d | 3 | 8 | 2 | 50 | 90 | 69.61  (68.76) | 0.753M  964.0M |
| rimage09\_3d | 3 | 8 | 3 | 50 | 90 | 72.56  (75.42) | 1.669M  2.16G |
| rimage04\_3d | 3 | 8 | 4 | 50 | 90 | 76.15  (81.3) | 2.945M  3.85G |
| rimage06\_3d | 3 | 16 | 4 | 50 | 90 | 74.90  (79.39) | 2.945M  7.69G |
| rimage10\_3d | 6 | 8 | 4 | 50 | 90 | 76.95  (82.43) | 2.945M  3.86Gs |

**rgb；**batchsize=256;lr=0.1



**2d dct**；optimization sgd；CrossEntropyLoss； lr 0.05；cosine lr scheduler；batch size 128；not pretrained；参数分析

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 文件夹 | subset | arch | reduce factor | epoch | stri | lr | ACC top 1 | params;  mult-add |
| rimage02\_2d | 96 | 50 | 1 | 90 | 1 | 0.05 | 81.42  (93.02) | 23.7M  13.6G |
| 31/rimage03\_2d | 96 | 50 | 1 | 90 | 1 | 0.05 | 81.64  (92.85) | 23.7M  13.6G |
| rimage03\_2d | 24 | 50 | 1 | 90 | 1 | 0.05 | 81.44  (93.09) | 23.7M  13.5G |
| rimage04\_2d | 24 | 50 | 1 | 90 | 1 | 0.05 | 81.66  (93.10) | 23.7M  13.5G |
| rimage48\_2d | 24 | 50 | 1 | 90 | 1 | 0.5 | 84.46  (91.96) | 23.7M  13.5G |
| rimage24\_2d | 24 | 50 | 1 | 90 | 2 | 0.05 | 80.66  (92.41) | 23.7M  3.93G |
| rimage46\_2d | 24 | 50 | 1 | 90 | 2 | 0.5 | 83.61  (92.05) | 23.7M  3.93G |
| rimage68\_test | 24 | 50 | 1 | 90 | 2 | 0.5 | 84.19  (91.52) | 23.7M  3.93G |
| rimage51\_2d | 24 | 50 | 1 | 120 | 2 | 0.5 | 84.47  (93.56) | 23.7M  3.93G |
| rimage16\_2d | 24 | 50 | 0.75 | 90 | 1 | 0.05 | 81.83  (90.05) | 13.4M  7.6G |
| rimage77\_2d | 24 | 50 | 0.75 | 90 | 2 | 0.5 | 83.54  (91.06) |  |
| rimage15\_2d | 24 | 50 | 0.5 | 90 | 1 | 0.05 | 80.53  (86.16) | 5.99M  3.4G |
| rimage73\_test | 24 | 50 | 0.5 | 90 | 2 | 0.5 | 82.67  (88.71) | 5.99M  3.4G |
| rimage11\_2d | 6 | 50 | 1 | 80 | 1 | 0.05 | 79..89  (88.64) | 23.7M  13.5G |
| rimage13\_2d | 6 | 50 | 0.75 | 90 | 1 | 0.05 | 79.51  (87.37) | 13.4M  7.6G |
| rimage12\_2d | 6 | 50 | 0.50 | 90 | 1 | 0.05 | 78.62  (83.54) | 5.99M  3.4G |
| rimage27\_2d | 6 | 50 | 0.50 | 90 | 2 | 0.05 | 76.23  (85.98) | 5.99M  979M |
| rimage28\_2d | 6 | 50 | 0.50 | 90 | 2 | 0.1 | 78.81  (87.52) | 5.99M  979M |
| rimage50\_2d | 6 | 50 | 0.50 | 90 | 2 | 0.25 | 80.42  (87.92) | 5.99M  979M |
| rimage49\_2d | 6 | 50 | 0.50 | 90 | 2 | 0.5 | 80.16  (86.90) | 5.99M  979M |
| rimage14\_2d | 6 | 50 | 0.25 | 90 | 1 | 0.05 | 75.27  (75.89) | 1.53M  845.3M |

**Part model 结构一**；optimization sgd；CrossEntropyLoss；cosine lr scheduler；batch size 128；not pretrained；subset low 6; subset high 24; arch 50

一、低频模型保持不动。训练时，所有数据都用来训练高频模型，测试时，只有低频结果置信度不够的输入用到高频模型。

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 文件夹 | low reduce factor | epoch | ACC top 1 | params;  mult-add |
| rimage17\_part | 0.5 | 90 | 78.80  (82.95) | 11.97M  6.76G |
| rimage18\_part | 0.25 | 90 | 75.35  (76.73) | 14.90M  8.45G |

二、低频模型保持不动。训练与测试流程相同，只有低频结果置信度不够的输入用到高频模型。

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 文件夹 | low reduce factor | epoch | ACC top 1 | params;  mult-add |
| rimage19\_part | 0.5 | 90 | 78.65  (84.95) | 11.97M  6.76G |

三、低频模型也参与训练。训练与测试流程相同，所有数据通过低频和高频模型，再经过分类器。low reduce factor 0.5

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 文件夹 | 低频pretrain | stri | epoch | sche | optim | lr | ACC top 1 | params;  mult-add |
| rimage20\_part | rimage12  \_2d | 1 | 90 | cosine | sgd | 0.05 | 80.36  (92.12) | 11.97M  6.76G |
| rimage21\_part | rimage12  \_2d | 1 | 120 | cosine | sgd | 0.05 | 80.56  (93.13) | 11.97M  6.76G |
| rimage22\_part | rimage12  \_2d | 1 | 90 | cosine | sgd | 0.1 | 81.15  (91.60) | 11.97M  6.76G |
| rimage25\_part | rimage12  \_2d | 2 | 90 | cosine | sgd | 0.1 | 67.30  (68.11) | 11.97M  1.96G |
| rimage26\_part | rimage12  \_2d | 2 | 90 | cosine | sgd | 0.05 | 67.39  (70.49) | 11.97M  1.96G |
| rimage29\_part | rimage27  \_2d | 2 | 90 | cosine | sgd | 0.05 | 76.17  (84.69) | 11.97M  1.96G |
| rimage30\_part | rimage28  \_2d | 2 | 90 | cosine | sgd | 0.05 | 78.78  (86.69) | 11.97M  1.96G |
| rimage31\_part | rimage28  \_2d | 2 | 90 | cosine | sgd | 0.05 | 79.04  (86.79) | 11.97M  1.96G |
| rimage33\_part | rimage28  \_2d | 2 | 90 | cosine | sgd | 0.1 | 79.00  (86.29) | 11.97M  1.96G |
| rimage38\_part | rimage28  \_2d | 2 | 90 | cosine | sgd | 0.01 | 78.87  (86.94) | 11.97M  1.96G |
| rimage36\_part | rimage28  \_2d | 2 | 90 | cosine | adam | 0.05 | 76.81  (88.47) | 11.97M  1.96G |
| rimage37\_part | rimage28  \_2d | 2 | 90 | cosine | adam | 0.1 | 76.97  (88.26) | 11.97M  1.96G |
| rimage39\_part | rimage28  \_2d | 2 | 90 | multiStep | adam | 0.1 | 77.28  (87.08) | 11.97M  1.96G |
| rimage40\_part | rimage28  \_2d | 2 | 90 | multiStep | adam | 0.05 | 77.24  (87.82) | 11.97M  1.96G |
| rimage32\_part | rimage28  \_2d | 2 | 90 | multiStep | sgd | 0.05 | 78.86  (86.92) | 11.97M  1.96G |
| rimage34\_part | rimage28  \_2d | 2 | 90 | multiStep | sgd | 0.1 | 78.84  (85.88) | 11.97M  1.96G |
| rimage52\_part | rimage50  \_2d | 2 | 90 | cosine | sgd | 0.5 | 81.62  (89.18) | 11.97M  1.96G |
| rimage55\_part | rimage50  \_2d | 2 | 90 | cosine | sgd | 0.25 | 81.62  (90.19) | 11.97M  1.96G |
| rimage54\_part | rimage50  \_2d | 2 | 90 | cosine | sgd | 0.1 | 81.24  (91.92) | 11.97M  1.96G |
| rimage59\_part | rimage50  \_2d | 2 | 90 | multiStep | sgd | 0.1 | 80.69  (89.59) | 11.97M  1.96G |
| rimage58\_part | rimage28  \_2d | 2 | 90 | cosine | sgd | 0.5 | 81.52  (88.03) | 11.97M  1.96G |
| rimage62\_part | rimage50  \_2d | 2 | 90 | const | sgd | 0.1 | 73.18  (74.19) | 11.97M  1.96G |
| rimage63\_part | rimage50  \_2d | 2 | 90 | cosine  no up | sgd | 0.1 | 81.09  (92.03) | 11.97M  1.96G |
| rimage64\_part | rimage50  \_2d | 2 | 90 | cosine  no up | sgd | 0.5 | 81.15  (86.36) | 11.97M  1.96G |

四、

1、在三rimage22\_part的基础上，保持其他部分不动，所有数据用来训练low\_model\_fc；lr 0.1；no scheduler；epoch 90；

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 文件夹 | low reduce factor | bound | ACC top 1 | | | params;  mult-add | | | |
| only low | normal | both | only low | normal  under B | both | high |
| rimage23\_partfc | 0.5 | 0.9 | 80.24 | 81.20  (92.16) | 81.15 | 5.99M  3.38G | 12.08M  6.76G | 11.97M  6.76G | 5.99M  3.38G |
|  |  | 0.8 |  | 81.22 |  |  |  |  |  |
|  |  | 0.7 |  | 81.06 |  |  |  |  |  |

bound 0.9：67.4%，3.38G\*67.4%+6.76G\*(1-67.4%)=4.48G

bound 0.8：74.1%，3.38G\*74.1%+6.76G\*(1-74.1%)=4.26G

2、stride=2, 在三rimage31\_part的基础上，保持其他部分不动，所有数据用来训练low\_model\_fc；lr 0.1；no scheduler；epoch 90；

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 文件夹 | low reduce factor | bound | ACC top 1 | | | params;  mult-add | | | |
| only low | normal | both | only low | normal  under B | both | high |
| rimage35\_partfc | 0.5 | 0.9 | 78.30 | 79.08  (87.51) | 79.04 |  |  |  |  |
|  |  | 0.8 |  | 79.08 |  |  |  |  |  |
|  |  | 0.7 |  | 79.07 |  |  |  |  |  |

bound 0.9：46.1%

bound 0.8：55.9%

bound 0.7：73.2%

五、

两个loss，一个是只通过低频模型得到的output\_low计算loss，另一个是低频高频都通过得到的output\_all计算loss，两个loss相加后传。测试时是normal模式，部分只低频部分全部。low reduce factor 0.5；stride=2

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 文件夹 | 低频pretrain | stri | epoch | sche | optim | lr | ACC top 1 | params;  mult-add |
| rimage41\_part | rimage28  \_2d | 2 | 90 | cosine | sgd | 0.05 | 79.27 |  |
| rimage42\_part | rimage28  \_2d | 2 | 90 | cosine | sgd | 0.1 | 79.45 |  |
| rimage43\_part | rimage28  \_2d | 2 | 90 | cosine | sgd | 0.2 | 80.29 |  |
| rimage44\_part | rimage28  \_2d | 2 | 90 | cosine | sgd | 0.5 | 81.14 |  |
| rimage47\_part | None | 2 | 90 | cosine | sgd | 0.5 | 75.46 |  |
| rimage45\_part | rimage12  \_2d | 1 | 90 | cosine | sgd | 0.5 |  |  |
| rimage53\_part | rimage50  \_2d | 2 | 90 | cosine | sgd | 0.1 | 80.81 |  |

eval:

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 文件夹 | low reduce factor | bound | above  bound | ACC top 1 | | | params;  mult-add | | | |
|  | only low | normal | both | only low | normal  under B | both | high |
| rimage43\_part | 0.5 | 0.9 | 68.3% | 79.97 | 80.29 | 80.29 | 5.99M  979M | 12.08M  1.96G | 11.97M  1.96G | 5.99M  985M |
|  |  | 0.8 | 75.1% |  | 80.29 |  |  |  |  |  |
|  |  | 0.7 | 80.0% |  | 80.29 |  |  |  |  |  |
|  |  | 0.6 | 85.0% |  | 80.32 |  |  |  |  |  |
|  |  | 0.5 | 89.9% |  | 80.26 |  |  |  |  |  |
| rimage44\_part | 0.5 | 0.9 | 66.6% | 81.01 | 81.14 | 81.14 |  |  |  |  |
|  |  | 0.8 | 73.6% |  | 81.14 |  |  |  |  |  |
|  |  | 0.7 | 79.3% |  | 81.14 |  |  |  |  |  |
|  |  | 0.6 | 84.3% |  | 81.09 |  |  |  |  |  |

bound 0.9：68.3%

bound 0.8：75.1%

bound 0.7：80.0%

bound 0.6：85.0%

**Part model sum 结构二**；optimization sgd；CrossEntropyLoss；cosine lr scheduler；batch size 128；not pretrained；subset low 6; subset high 24; arch 50

低频模型照常，高频模型前传过程中，layer1-4的feature map上叠加低频模型对应部分的feature map（直接相加）。部分数据只通过低频模型的低频分类器（置信概率高），其他数据通过高频模型和高频分类器

一、低频模型也参与训练。训练与测试流程相同，所有数据通过低频和高频模型，再经过高频分类器。low reduce factor 0.5

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 文件夹 | 低频pretrain | stri | epoch | sche | optim | lr | ACC top 1 | params;  mult-add |
| rimage56\_sum | rimage50  \_2d | 2 | 90 | cosine | sgd | 0.5 | 81.63  (88.22) |  |
| rimage57\_sum | rimage50  \_2d | 2 | 90 | cosine | sgd | 0.05 | 80.44  (92.31) |  |

二、同一，只是高频模型的输出与低频模型拼接后再通过分类器

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 文件夹 | 低频pretrain | stri | epoch | sche | optim | lr | ACC top 1 | params;  mult-add |
| rimage60\_sum | rimage50  \_2d | 2 | 90 | cosine | sgd | 0.5 | 81.58  (88.43) |  |
| rimage57\_sum | rimage50  \_2d | 2 | 90 | cosine | sgd | 0.1 | 81.11  (92.41) |  |

**Part model cat 结构二**；

sum的直接相加改成concat

一、低频模型也参与训练。训练与测试流程相同，所有数据通过低频和高频模型，再经过高频分类器。low reduce factor 0.5

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 文件夹 | high  factor | 低频pretrain | cat  位置 | stri | epoch | lr | ACC top 1 | params;  mult-add |
| rimage65\_cat | 0.5 | rimage50  \_2d | [0,1,2  ,3] | 2 | 90 | 0.1 | 80.89  (92.14) |  |
| rimage66\_cat | 0.5 | rimage50  \_2d | [0,1,2  ,3] | 2 | 90 | 0.5 | 81.79  (87.09) |  |
| rimage71\_cat | 0.5 | None | [0,1,2  ,3] | 2 | 90 | 0.5 | 81.10  (89.86) |  |
| rimage86\_cat | 0.5 | None | [[0,0]] | 2 | 90 | 0.5 | 82.75  (88.55) |  |
| rimage82\_cat | 0.5 | None | [0] | 2 | 90 | 0.5 | 82.51  (89.01) |  |
| rimage84\_cat | 0.5 | None | [0,1] | 2 | 90 | 0.5 | 81.79  (88.05) |  |
| rimage85\_cat | 0.5 | None | [0,1,2] | 2 | 90 | 0.5 | 81.58  (89.49) |  |
| rimage83\_cat | 0.5 | rimage50  \_2d | [0] | 2 | 90 | 0.5 | 82.48  (87.58) |  |
| rimage67\_cat | 1 | rimage50  \_2d | [0,1,2  ,3] | 2 | 90 | 0.5 | 81.87  (86.90) |  |
| rimage69\_cat | 1 | None | [0,1,2  ,3] | 2 | 90 | 0.5 | 82.52  (90.95) |  |

二、与一同，只是高频模型的输入从原来的纯高频改成低频叠加高频；optim sgd；scheduler cosine

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 文件夹 | high  factor | low factor | cat  位置 | 低频pretrain | stri | epoch | lr | ACC top 1 | params;  mult-add |
| rimage70\_cat | 1 | 0.5 | [0,1,2  ,3] | rimage50  \_2d | 2 | 90 | 0.5 | 81.62  (88.22) |  |
| rimage72\_cat | 1 | 0.5 | [0,1,2  ,3] | None | 2 | 90 | 0.5 | 83.41  (91.99) |  |
| rimage74\_cat | 0.5 | 0.5 | [0,1,2  ,3] | rimage50  \_2d | 2 | 90 | 0.5 | 81.81  (88.09) |  |
| rimage75\_cat | 0.5 | 0.5 | [0,1,2  ,3] | None | 2 | 90 | 0.5 | 82.06  (89.97) |  |
| rimage78\_cat | 0.5 | 0.5 | [3] | None | 2 | 90 | 0.5 | 80.84  (86.89) |  |
| rimage87\_cat | 0.5 | 0.5 | [[0,0]] | None | 2 | 90 | 0.5 | 82.46  (88.48) |  |
| rimage79\_cat | 0.5 | 0.5 | [0] | None | 2 | 90 | 0.5 | 82.77  (88.83) |  |
| rimage80\_cat | 0.5 | 0.5 | [0,1] | None | 2 | 90 | 0.5 | 82.61  (88.94) |  |
| rimage81\_cat | 0.5 | 0.5 | [0,1,2] | None | 2 | 90 | 0.5 | 81.86  (90.11) |  |
| rimage76\_cat | 0.75 | 0.25 | [0,1,2  ,3] | None | 2 | 90 | 0.5 | 80.73  (90.75) |  |

**Part model cat input conv 结构三**

与上一部分的一同，只是在resnet前面加一层卷积（conv2d，batchnorm，relu），卷积之后进行concat，resnet内部不进行concat

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 文件夹 | high  factor | low factor | 低频pretrain | stri | epoch | lr | ACC top 1 | params;  mult-add |
| rimage88\_cat | 0.5 | 0.5 | None | 2 | 90 | 0.5 | 82.87  (88.00) |  |
| rimage89\_cat | 0.5 | 0.5 | None | 1 | 90 | 0.5 | 83.32  (88.81) |  |

eval：

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 文件夹 | base | bound | above  bound | ACC top 1 | | | params;  mult-add | | | |
|  | only low | normal | both | only low | normal  under B | both | high |
| rimage90\_  catlow | rimage88  \_cat | 0.9 | 64.0% | 80.52 | 83.17 | 82.87 | 5.99M  0.99G | 11.88M  1.35G | 11.88M  2.00G |  |
|  |  | 0.85 | 68.0% |  | 83.22 |  |  | 11.88M  1.31G |  |  |
|  |  | 0.8 | 71.5% |  | 83.10 |  |  | 11.88M  1.28G |  |  |

0.9：64.0%\*0.99G+(1-64.0%)\*2.00G=1.35G

0.85：68.0%\*0.99G+(1-68.0%)\*2.00G=1.31G

0.8：71.5%\*0.99G+(1-71.5%)\*2.00G=1.28G

**idea**

低频分量和高频分量分开进行计算还有一个好处：防止频率混叠

如果计算时间的瓶颈在于通信，那我可以先传低频分量，再传高频分量。如果计算时间的瓶颈在于gpu计算，那我可以将低频和高频的计算并行起来

低频model不再detach，而是和高频model一起训练，训好之后再固定低频moel，训练低频model的分类器