

1 Introduction

Using our DenseNet-BC we have approximately $634k$ 32FP-ops and $626k$ FP32-params. This gives us a score of approximately (rounding up) 0.078 in total, where for the ops, we obtain 0.06 as our score, and for the parameters, we obtain 0.018 as our score.

To test a pre-trained network and check the score, just run `profile.py`. To train a network, just run `train.py` and then re-run `profile.py`.

We describe our methods and computations in the following:

2 Data Augmentation

We first use standard Data augmentation such as flip and random crop. In addition, we propose to add other different data augmentations. We use CutMix with $\alpha = 1$ for all training dataset, and we drop 64 pixels randomly for each input training image.

3 Architecture

We use a DenseNet-BC architecture with $K = 8$, depth $D = 196$ and reduction $R = 0.5$.

4 Computing the Number of Parameters

To get the number of parameters of the DenseNet-BC architecture, we compute the number of parameters of each layer (or each Bottleneck layer that contains 2 Batch norm layers, 2 Convolutional layers and 2 Relu), as described in Table ??

5 Computing the Number of Operations

to get the number of operations required to process one input through the DenseNet-BC network, we compute the number of operations of each layer (or each Bottleneck layer that contains 2 Batch norm layers, 2 Convolutional layers and 2 Relu), as described in Table ??

Layer	Number of parameters
Convolution	$F_{in}F_{out}S_c^2$
Batch norm	$4F_{in}$
$Bottleneck_i$	$4[F_{in} + K(4 + F_{in} + i + K(1 + i))]$
Linear	$F_{in}F_{out}$
Transition	$F_{in}(4 + RF_{in})$

Table 1: The number of parameters for each layer. Note that F_{in} represents the number of input feature maps, F_{out} represents the number of output feature maps, S_c^2 represents the kernel size of a convolutional operation, i represents the depth of the bottleneck inside a block that contains $\frac{D-4}{6}$ bottleneck layers.

6 Training procedure

We train the network with the data augmentation described on Section ?? for 200 epochs, using a batch size of 32 and a softmax temperature of 6. Our learning rate starts at 0.1 and is divided by 10 at epochs 100 and 150. We then fine-tune the network by training it for an extra 5 epochs without data-augmentation.

Layer	Number of operations
Convolution	$[\frac{F_{in}F_{out}S_c^2}{2} + (F_{in}S_c^2 - 1)F_{out}]P$
Batch norm	$3F_{in}P$
Relu	$F_{in}P$
Average pooling	$S_p^2PF_{in}$
Linear	$1.5F_{in}F_{out}$
Transition	$4F_{in}P + [\frac{F_{in}F_{out}S_c^2}{2} + (F_{in}S_c^2 - 1)F_{out}]P + S_p^2PF_{out}$
$Bottleneck_i$	Batch norm1 + Relu1 + Batch norm2 + Relu2 + Conv1 + Conv2 Batch norm1 = $3P(F_{in} + iK)$ Relu1 = $P(F_{in} + iK)$ Batch norm2 = $12P_{in}K$ Relu2 = $4P_{in}K$ Conv1 = $P[\frac{(F_{in}+iK)4K}{2} + (F_{in} + iK - 1)4K]$ Conv2 = $[\frac{36K^2}{2} + (36K - 1)K]P$

Table 2: The number of operations for each layer. Note that F_{in} represents the number of input feature maps, F_{out} represents the number of output feature maps, S_c^2 represents the kernel size of a convolutional operation, S_p^2 represents the kernel size of an average pooling operation, i represents the depth of the bottleneck inside a block that contains $\frac{D-4}{6}$ bottleneck layers, P represents the number of pixels of an input feature map.

Conv2d: S_c=3, F_in=3, F_out=16, P=1024, params=216, operations=647168
Batch norm: F_in=16 P=1024, params=16, operations=49152
ReLU: F_in=16 P=1024, params=0, operations=16384
Conv2d: S_c=1, F_in=16, F_out=32, P=1024, params=256, operations=753664
Batch norm: F_in=32 P=1024, params=32, operations=98304
ReLU: F_in=32 P=1024, params=0, operations=32768
Conv2d: S_c=3, F_in=32, F_out=8, P=1024, params=1152, operations=3530752
Batch norm: F_in=24 P=1024, params=24, operations=73728
ReLU: F_in=24 P=1024, params=0, operations=24576
Conv2d: S_c=1, F_in=24, F_out=32, P=1024, params=384, operations=1146880
Batch norm: F_in=32 P=1024, params=32, operations=98304
ReLU: F_in=32 P=1024, params=0, operations=32768
Conv2d: S_c=3, F_in=32, F_out=8, P=1024, params=1152, operations=3530752
Batch norm: F_in=32 P=1024, params=32, operations=98304
ReLU: F_in=32 P=1024, params=0, operations=32768
Conv2d: S_c=1, F_in=32, F_out=32, P=1024, params=512, operations=1540096
Batch norm: F_in=32 P=1024, params=32, operations=98304
ReLU: F_in=32 P=1024, params=0, operations=32768
Conv2d: S_c=3, F_in=32, F_out=8, P=1024, params=1152, operations=3530752
Batch norm: F_in=40 P=1024, params=40, operations=122880
ReLU: F_in=40 P=1024, params=0, operations=40960
Conv2d: S_c=1, F_in=40, F_out=32, P=1024, params=640, operations=1933312
Batch norm: F_in=32 P=1024, params=32, operations=98304
ReLU: F_in=32 P=1024, params=0, operations=32768

Conv2d: S_c=3, F_in=32, F_out=8, P=1024, params=1152, operations=3530752
 Batch norm: F_in=48 P=1024, params=48, operations=147456
 ReLU: F_in=48 P=1024, params=0, operations=49152
 Conv2d: S_c=1, F_in=48, F_out=32, P=1024, params=768, operations=2326528
 Batch norm: F_in=32 P=1024, params=32, operations=98304
 ReLU: F_in=32 P=1024, params=0, operations=32768
 Conv2d: S_c=3, F_in=32, F_out=8, P=1024, params=1152, operations=3530752
 Batch norm: F_in=56 P=1024, params=56, operations=172032
 ReLU: F_in=56 P=1024, params=0, operations=57344
 Conv2d: S_c=1, F_in=56, F_out=32, P=1024, params=896, operations=2719744
 Batch norm: F_in=32 P=1024, params=32, operations=98304
 ReLU: F_in=32 P=1024, params=0, operations=32768
 Conv2d: S_c=3, F_in=32, F_out=8, P=1024, params=1152, operations=3530752
 Batch norm: F_in=64 P=1024, params=64, operations=196608
 ReLU: F_in=64 P=1024, params=0, operations=65536
 Conv2d: S_c=1, F_in=64, F_out=32, P=1024, params=1024, operations=3112960
 Batch norm: F_in=32 P=1024, params=32, operations=98304
 ReLU: F_in=32 P=1024, params=0, operations=32768
 Conv2d: S_c=3, F_in=32, F_out=8, P=1024, params=1152, operations=3530752
 Batch norm: F_in=72 P=1024, params=72, operations=221184
 ReLU: F_in=72 P=1024, params=0, operations=73728
 Conv2d: S_c=1, F_in=72, F_out=32, P=1024, params=1152, operations=3506176
 Batch norm: F_in=32 P=1024, params=32, operations=98304
 ReLU: F_in=32 P=1024, params=0, operations=32768
 Conv2d: S_c=3, F_in=32, F_out=8, P=1024, params=1152, operations=3530752
 Batch norm: F_in=80 P=1024, params=80, operations=245760
 ReLU: F_in=80 P=1024, params=0, operations=81920
 Conv2d: S_c=1, F_in=80, F_out=32, P=1024, params=1280, operations=3899392
 Batch norm: F_in=32 P=1024, params=32, operations=98304
 ReLU: F_in=32 P=1024, params=0, operations=32768
 Conv2d: S_c=3, F_in=32, F_out=8, P=1024, params=1152, operations=3530752
 Batch norm: F_in=88 P=1024, params=88, operations=270336
 ReLU: F_in=88 P=1024, params=0, operations=90112
 Conv2d: S_c=1, F_in=88, F_out=32, P=1024, params=1408, operations=4292608
 Batch norm: F_in=32 P=1024, params=32, operations=98304
 ReLU: F_in=32 P=1024, params=0, operations=32768
 Conv2d: S_c=3, F_in=32, F_out=8, P=1024, params=1152, operations=3530752
 Batch norm: F_in=96 P=1024, params=96, operations=294912
 ReLU: F_in=96 P=1024, params=0, operations=98304
 Conv2d: S_c=1, F_in=96, F_out=32, P=1024, params=1536, operations=4685824
 Batch norm: F_in=32 P=1024, params=32, operations=98304
 ReLU: F_in=32 P=1024, params=0, operations=32768
 Conv2d: S_c=3, F_in=32, F_out=8, P=1024, params=1152, operations=3530752
 Batch norm: F_in=104 P=1024, params=104, operations=319488
 ReLU: F_in=104 P=1024, params=0, operations=106496
 Conv2d: S_c=1, F_in=104, F_out=32, P=1024, params=1664, operations=5079040
 Batch norm: F_in=32 P=1024, params=32, operations=98304
 ReLU: F_in=32 P=1024, params=0, operations=32768
 Conv2d: S_c=3, F_in=32, F_out=8, P=1024, params=1152, operations=3530752
 Batch norm: F_in=112 P=1024, params=112, operations=344064

ReLU: F_in=112 P=1024, params=0, operations=114688
 Conv2d: S_c=1, F_in=112, F_out=32, P=1024, params=1792, operations=5472256
 Batch norm: F_in=32 P=1024, params=32, operations=98304
 ReLU: F_in=32 P=1024, params=0, operations=32768
 Conv2d: S_c=3, F_in=32, F_out=8, P=1024, params=1152, operations=3530752
 Batch norm: F_in=120 P=1024, params=120, operations=368640
 ReLU: F_in=120 P=1024, params=0, operations=122880
 Conv2d: S_c=1, F_in=120, F_out=32, P=1024, params=1920, operations=5865472
 Batch norm: F_in=32 P=1024, params=32, operations=98304
 ReLU: F_in=32 P=1024, params=0, operations=32768
 Conv2d: S_c=3, F_in=32, F_out=8, P=1024, params=1152, operations=3530752
 Batch norm: F_in=128 P=1024, params=128, operations=393216
 ReLU: F_in=128 P=1024, params=0, operations=131072
 Conv2d: S_c=1, F_in=128, F_out=32, P=1024, params=2048, operations=6258688
 Batch norm: F_in=32 P=1024, params=32, operations=98304
 ReLU: F_in=32 P=1024, params=0, operations=32768
 Conv2d: S_c=3, F_in=32, F_out=8, P=1024, params=1152, operations=3530752
 Batch norm: F_in=136 P=1024, params=136, operations=417792
 ReLU: F_in=136 P=1024, params=0, operations=139264
 Conv2d: S_c=1, F_in=136, F_out=32, P=1024, params=2176, operations=6651904
 Batch norm: F_in=32 P=1024, params=32, operations=98304
 ReLU: F_in=32 P=1024, params=0, operations=32768
 Conv2d: S_c=3, F_in=32, F_out=8, P=1024, params=1152, operations=3530752
 Batch norm: F_in=144 P=1024, params=144, operations=442368
 ReLU: F_in=144 P=1024, params=0, operations=147456
 Conv2d: S_c=1, F_in=144, F_out=32, P=1024, params=2304, operations=7045120
 Batch norm: F_in=32 P=1024, params=32, operations=98304
 ReLU: F_in=32 P=1024, params=0, operations=32768
 Conv2d: S_c=3, F_in=32, F_out=8, P=1024, params=1152, operations=3530752
 Batch norm: F_in=152 P=1024, params=152, operations=466944
 ReLU: F_in=152 P=1024, params=0, operations=155648
 Conv2d: S_c=1, F_in=152, F_out=32, P=1024, params=2432, operations=7438336
 Batch norm: F_in=32 P=1024, params=32, operations=98304
 ReLU: F_in=32 P=1024, params=0, operations=32768
 Conv2d: S_c=3, F_in=32, F_out=8, P=1024, params=1152, operations=3530752
 Batch norm: F_in=160 P=1024, params=160, operations=491520
 ReLU: F_in=160 P=1024, params=0, operations=163840
 Conv2d: S_c=1, F_in=160, F_out=32, P=1024, params=2560, operations=7831552
 Batch norm: F_in=32 P=1024, params=32, operations=98304
 ReLU: F_in=32 P=1024, params=0, operations=32768
 Conv2d: S_c=3, F_in=32, F_out=8, P=1024, params=1152, operations=3530752
 Batch norm: F_in=168 P=1024, params=168, operations=516096
 ReLU: F_in=168 P=1024, params=0, operations=172032
 Conv2d: S_c=1, F_in=168, F_out=32, P=1024, params=2688, operations=8224768
 Batch norm: F_in=32 P=1024, params=32, operations=98304
 ReLU: F_in=32 P=1024, params=0, operations=32768
 Conv2d: S_c=3, F_in=32, F_out=8, P=1024, params=1152, operations=3530752
 Batch norm: F_in=176 P=1024, params=176, operations=540672
 ReLU: F_in=176 P=1024, params=0, operations=180224
 Conv2d: S_c=1, F_in=176, F_out=32, P=1024, params=2816, operations=8617984

Batch norm: F_in=32 P=1024, params=32, operations=98304
 ReLU: F_in=32 P=1024, params=0, operations=32768
 Conv2d: S_c=3, F_in=32, F_out=8, P=1024, params=1152, operations=3530752
 Batch norm: F_in=184 P=1024, params=184, operations=565248
 ReLU: F_in=184 P=1024, params=0, operations=188416
 Conv2d: S_c=1, F_in=184, F_out=32, P=1024, params=2944, operations=9011200
 Batch norm: F_in=32 P=1024, params=32, operations=98304
 ReLU: F_in=32 P=1024, params=0, operations=32768
 Conv2d: S_c=3, F_in=32, F_out=8, P=1024, params=1152, operations=3530752
 Batch norm: F_in=192 P=1024, params=192, operations=589824
 ReLU: F_in=192 P=1024, params=0, operations=196608
 Conv2d: S_c=1, F_in=192, F_out=32, P=1024, params=3072, operations=9404416
 Batch norm: F_in=32 P=1024, params=32, operations=98304
 ReLU: F_in=32 P=1024, params=0, operations=32768
 Conv2d: S_c=3, F_in=32, F_out=8, P=1024, params=1152, operations=3530752
 Batch norm: F_in=200 P=1024, params=200, operations=614400
 ReLU: F_in=200 P=1024, params=0, operations=204800
 Conv2d: S_c=1, F_in=200, F_out=32, P=1024, params=3200, operations=9797632
 Batch norm: F_in=32 P=1024, params=32, operations=98304
 ReLU: F_in=32 P=1024, params=0, operations=32768
 Conv2d: S_c=3, F_in=32, F_out=8, P=1024, params=1152, operations=3530752
 Batch norm: F_in=208 P=1024, params=208, operations=638976
 ReLU: F_in=208 P=1024, params=0, operations=212992
 Conv2d: S_c=1, F_in=208, F_out=32, P=1024, params=3328, operations=10190848
 Batch norm: F_in=32 P=1024, params=32, operations=98304
 ReLU: F_in=32 P=1024, params=0, operations=32768
 Conv2d: S_c=3, F_in=32, F_out=8, P=1024, params=1152, operations=3530752
 Batch norm: F_in=216 P=1024, params=216, operations=663552
 ReLU: F_in=216 P=1024, params=0, operations=221184
 Conv2d: S_c=1, F_in=216, F_out=32, P=1024, params=3456, operations=10584064
 Batch norm: F_in=32 P=1024, params=32, operations=98304
 ReLU: F_in=32 P=1024, params=0, operations=32768
 Conv2d: S_c=3, F_in=32, F_out=8, P=1024, params=1152, operations=3530752
 Batch norm: F_in=224 P=1024, params=224, operations=688128
 ReLU: F_in=224 P=1024, params=0, operations=229376
 Conv2d: S_c=1, F_in=224, F_out=32, P=1024, params=3584, operations=10977280
 Batch norm: F_in=32 P=1024, params=32, operations=98304
 ReLU: F_in=32 P=1024, params=0, operations=32768
 Conv2d: S_c=3, F_in=32, F_out=8, P=1024, params=1152, operations=3530752
 Batch norm: F_in=232 P=1024, params=232, operations=712704
 ReLU: F_in=232 P=1024, params=0, operations=237568
 Conv2d: S_c=1, F_in=232, F_out=32, P=1024, params=3712, operations=11370496
 Batch norm: F_in=32 P=1024, params=32, operations=98304
 ReLU: F_in=32 P=1024, params=0, operations=32768
 Conv2d: S_c=3, F_in=32, F_out=8, P=1024, params=1152, operations=3530752
 Batch norm: F_in=240 P=1024, params=240, operations=737280
 ReLU: F_in=240 P=1024, params=0, operations=245760
 Conv2d: S_c=1, F_in=240, F_out=32, P=1024, params=3840, operations=11763712
 Batch norm: F_in=32 P=1024, params=32, operations=98304
 ReLU: F_in=32 P=1024, params=0, operations=32768

Conv2d: S_c=3, F_in=32, F_out=8, P=1024, params=1152, operations=3530752
 Batch norm: F_in=248 P=1024, params=248, operations=761856
 ReLU: F_in=248 P=1024, params=0, operations=253952
 Conv2d: S_c=1, F_in=248, F_out=32, P=1024, params=3968, operations=12156928
 Batch norm: F_in=32 P=1024, params=32, operations=98304
 ReLU: F_in=32 P=1024, params=0, operations=32768
 Conv2d: S_c=3, F_in=32, F_out=8, P=1024, params=1152, operations=3530752
 Batch norm: F_in=256 P=1024, params=256, operations=786432
 ReLU: F_in=256 P=1024, params=0, operations=262144
 Conv2d: S_c=1, F_in=256, F_out=32, P=1024, params=4096, operations=12550144
 Batch norm: F_in=32 P=1024, params=32, operations=98304
 ReLU: F_in=32 P=1024, params=0, operations=32768
 Conv2d: S_c=3, F_in=32, F_out=8, P=1024, params=1152, operations=3530752
 Batch norm: F_in=264 P=1024, params=264, operations=811008
 ReLU: F_in=264 P=1024, params=0, operations=270336
 Conv2d: S_c=1, F_in=264, F_out=32, P=1024, params=4224, operations=12943360
 Batch norm: F_in=32 P=1024, params=32, operations=98304
 ReLU: F_in=32 P=1024, params=0, operations=32768
 Conv2d: S_c=3, F_in=32, F_out=8, P=1024, params=1152, operations=3530752
 Batch norm: F_in=272 P=1024, params=272, operations=835584
 ReLU: F_in=272 P=1024, params=0, operations=278528
 Conv2d: S_c=1, F_in=272, F_out=136, P=1024, params=18496, operations=56680448
 AvgPool: S=2, F_in=136, P=1024, params=0, operations=69632
 Batch norm: F_in=136 P=256, params=136, operations=104448
 ReLU: F_in=136 P=256, params=0, operations=34816
 Conv2d: S_c=1, F_in=136, F_out=32, P=256, params=2176, operations=1662976
 Batch norm: F_in=32 P=256, params=32, operations=24576
 ReLU: F_in=32 P=256, params=0, operations=8192
 Conv2d: S_c=3, F_in=32, F_out=8, P=256, params=1152, operations=882688
 Batch norm: F_in=144 P=256, params=144, operations=110592
 ReLU: F_in=144 P=256, params=0, operations=36864
 Conv2d: S_c=1, F_in=144, F_out=32, P=256, params=2304, operations=1761280
 Batch norm: F_in=32 P=256, params=32, operations=24576
 ReLU: F_in=32 P=256, params=0, operations=8192
 Conv2d: S_c=3, F_in=32, F_out=8, P=256, params=1152, operations=882688
 Batch norm: F_in=152 P=256, params=152, operations=116736
 ReLU: F_in=152 P=256, params=0, operations=38912
 Conv2d: S_c=1, F_in=152, F_out=32, P=256, params=2432, operations=1859584
 Batch norm: F_in=32 P=256, params=32, operations=24576
 ReLU: F_in=32 P=256, params=0, operations=8192
 Conv2d: S_c=3, F_in=32, F_out=8, P=256, params=1152, operations=882688
 Batch norm: F_in=160 P=256, params=160, operations=122880
 ReLU: F_in=160 P=256, params=0, operations=40960
 Conv2d: S_c=1, F_in=160, F_out=32, P=256, params=2560, operations=1957888
 Batch norm: F_in=32 P=256, params=32, operations=24576
 ReLU: F_in=32 P=256, params=0, operations=8192
 Conv2d: S_c=3, F_in=32, F_out=8, P=256, params=1152, operations=882688
 Batch norm: F_in=168 P=256, params=168, operations=129024
 ReLU: F_in=168 P=256, params=0, operations=43008
 Conv2d: S_c=1, F_in=168, F_out=32, P=256, params=2688, operations=2056192

Batch norm: F_in=32 P=256, params=32, operations=24576
 ReLU: F_in=32 P=256, params=0, operations=8192
 Conv2d: S_c=3, F_in=32, F_out=8, P=256, params=1152, operations=882688
 Batch norm: F_in=176 P=256, params=176, operations=135168
 ReLU: F_in=176 P=256, params=0, operations=45056
 Conv2d: S_c=1, F_in=176, F_out=32, P=256, params=2816, operations=2154496
 Batch norm: F_in=32 P=256, params=32, operations=24576
 ReLU: F_in=32 P=256, params=0, operations=8192
 Conv2d: S_c=3, F_in=32, F_out=8, P=256, params=1152, operations=882688
 Batch norm: F_in=184 P=256, params=184, operations=141312
 ReLU: F_in=184 P=256, params=0, operations=47104
 Conv2d: S_c=1, F_in=184, F_out=32, P=256, params=2944, operations=2252800
 Batch norm: F_in=32 P=256, params=32, operations=24576
 ReLU: F_in=32 P=256, params=0, operations=8192
 Conv2d: S_c=3, F_in=32, F_out=8, P=256, params=1152, operations=882688
 Batch norm: F_in=192 P=256, params=192, operations=147456
 ReLU: F_in=192 P=256, params=0, operations=49152
 Conv2d: S_c=1, F_in=192, F_out=32, P=256, params=3072, operations=2351104
 Batch norm: F_in=32 P=256, params=32, operations=24576
 ReLU: F_in=32 P=256, params=0, operations=8192
 Conv2d: S_c=3, F_in=32, F_out=8, P=256, params=1152, operations=882688
 Batch norm: F_in=200 P=256, params=200, operations=153600
 ReLU: F_in=200 P=256, params=0, operations=51200
 Conv2d: S_c=1, F_in=200, F_out=32, P=256, params=3200, operations=2449408
 Batch norm: F_in=32 P=256, params=32, operations=24576
 ReLU: F_in=32 P=256, params=0, operations=8192
 Conv2d: S_c=3, F_in=32, F_out=8, P=256, params=1152, operations=882688
 Batch norm: F_in=208 P=256, params=208, operations=159744
 ReLU: F_in=208 P=256, params=0, operations=53248
 Conv2d: S_c=1, F_in=208, F_out=32, P=256, params=3328, operations=2547712
 Batch norm: F_in=32 P=256, params=32, operations=24576
 ReLU: F_in=32 P=256, params=0, operations=8192
 Conv2d: S_c=3, F_in=32, F_out=8, P=256, params=1152, operations=882688
 Batch norm: F_in=216 P=256, params=216, operations=165888
 ReLU: F_in=216 P=256, params=0, operations=55296
 Conv2d: S_c=1, F_in=216, F_out=32, P=256, params=3456, operations=2646016
 Batch norm: F_in=32 P=256, params=32, operations=24576
 ReLU: F_in=32 P=256, params=0, operations=8192
 Conv2d: S_c=3, F_in=32, F_out=8, P=256, params=1152, operations=882688
 Batch norm: F_in=224 P=256, params=224, operations=172032
 ReLU: F_in=224 P=256, params=0, operations=57344
 Conv2d: S_c=1, F_in=224, F_out=32, P=256, params=3584, operations=2744320
 Batch norm: F_in=32 P=256, params=32, operations=24576
 ReLU: F_in=32 P=256, params=0, operations=8192
 Conv2d: S_c=3, F_in=32, F_out=8, P=256, params=1152, operations=882688
 Batch norm: F_in=232 P=256, params=232, operations=178176
 ReLU: F_in=232 P=256, params=0, operations=59392
 Conv2d: S_c=1, F_in=232, F_out=32, P=256, params=3712, operations=2842624
 Batch norm: F_in=32 P=256, params=32, operations=24576
 ReLU: F_in=32 P=256, params=0, operations=8192

Conv2d: S_c=3, F_in=32, F_out=8, P=256, params=1152, operations=882688
 Batch norm: F_in=240 P=256, params=240, operations=184320
 ReLU: F_in=240 P=256, params=0, operations=61440
 Conv2d: S_c=1, F_in=240, F_out=32, P=256, params=3840, operations=2940928
 Batch norm: F_in=32 P=256, params=32, operations=24576
 ReLU: F_in=32 P=256, params=0, operations=8192
 Conv2d: S_c=3, F_in=32, F_out=8, P=256, params=1152, operations=882688
 Batch norm: F_in=248 P=256, params=248, operations=190464
 ReLU: F_in=248 P=256, params=0, operations=63488
 Conv2d: S_c=1, F_in=248, F_out=32, P=256, params=3968, operations=3039232
 Batch norm: F_in=32 P=256, params=32, operations=24576
 ReLU: F_in=32 P=256, params=0, operations=8192
 Conv2d: S_c=3, F_in=32, F_out=8, P=256, params=1152, operations=882688
 Batch norm: F_in=256 P=256, params=256, operations=196608
 ReLU: F_in=256 P=256, params=0, operations=65536
 Conv2d: S_c=1, F_in=256, F_out=32, P=256, params=4096, operations=3137536
 Batch norm: F_in=32 P=256, params=32, operations=24576
 ReLU: F_in=32 P=256, params=0, operations=8192
 Conv2d: S_c=3, F_in=32, F_out=8, P=256, params=1152, operations=882688
 Batch norm: F_in=264 P=256, params=264, operations=202752
 ReLU: F_in=264 P=256, params=0, operations=67584
 Conv2d: S_c=1, F_in=264, F_out=32, P=256, params=4224, operations=3235840
 Batch norm: F_in=32 P=256, params=32, operations=24576
 ReLU: F_in=32 P=256, params=0, operations=8192
 Conv2d: S_c=3, F_in=32, F_out=8, P=256, params=1152, operations=882688
 Batch norm: F_in=272 P=256, params=272, operations=208896
 ReLU: F_in=272 P=256, params=0, operations=69632
 Conv2d: S_c=1, F_in=272, F_out=32, P=256, params=4352, operations=3334144
 Batch norm: F_in=32 P=256, params=32, operations=24576
 ReLU: F_in=32 P=256, params=0, operations=8192
 Conv2d: S_c=3, F_in=32, F_out=8, P=256, params=1152, operations=882688
 Batch norm: F_in=280 P=256, params=280, operations=215040
 ReLU: F_in=280 P=256, params=0, operations=71680
 Conv2d: S_c=1, F_in=280, F_out=32, P=256, params=4480, operations=3432448
 Batch norm: F_in=32 P=256, params=32, operations=24576
 ReLU: F_in=32 P=256, params=0, operations=8192
 Conv2d: S_c=3, F_in=32, F_out=8, P=256, params=1152, operations=882688
 Batch norm: F_in=288 P=256, params=288, operations=221184
 ReLU: F_in=288 P=256, params=0, operations=73728
 Conv2d: S_c=1, F_in=288, F_out=32, P=256, params=4608, operations=3530752
 Batch norm: F_in=32 P=256, params=32, operations=24576
 ReLU: F_in=32 P=256, params=0, operations=8192
 Conv2d: S_c=3, F_in=32, F_out=8, P=256, params=1152, operations=882688
 Batch norm: F_in=296 P=256, params=296, operations=227328
 ReLU: F_in=296 P=256, params=0, operations=75776
 Conv2d: S_c=1, F_in=296, F_out=32, P=256, params=4736, operations=3629056
 Batch norm: F_in=32 P=256, params=32, operations=24576
 ReLU: F_in=32 P=256, params=0, operations=8192
 Conv2d: S_c=3, F_in=32, F_out=8, P=256, params=1152, operations=882688
 Batch norm: F_in=304 P=256, params=304, operations=233472

ReLU: F_in=304 P=256, params=0, operations=77824
 Conv2d: S_c=1, F_in=304, F_out=32, P=256, params=4864, operations=3727360
 Batch norm: F_in=32 P=256, params=32, operations=24576
 ReLU: F_in=32 P=256, params=0, operations=8192
 Conv2d: S_c=3, F_in=32, F_out=8, P=256, params=1152, operations=882688
 Batch norm: F_in=312 P=256, params=312, operations=239616
 ReLU: F_in=312 P=256, params=0, operations=79872
 Conv2d: S_c=1, F_in=312, F_out=32, P=256, params=4992, operations=3825664
 Batch norm: F_in=32 P=256, params=32, operations=24576
 ReLU: F_in=32 P=256, params=0, operations=8192
 Conv2d: S_c=3, F_in=32, F_out=8, P=256, params=1152, operations=882688
 Batch norm: F_in=320 P=256, params=320, operations=245760
 ReLU: F_in=320 P=256, params=0, operations=81920
 Conv2d: S_c=1, F_in=320, F_out=32, P=256, params=5120, operations=3923968
 Batch norm: F_in=32 P=256, params=32, operations=24576
 ReLU: F_in=32 P=256, params=0, operations=8192
 Conv2d: S_c=3, F_in=32, F_out=8, P=256, params=1152, operations=882688
 Batch norm: F_in=328 P=256, params=328, operations=251904
 ReLU: F_in=328 P=256, params=0, operations=83968
 Conv2d: S_c=1, F_in=328, F_out=32, P=256, params=5248, operations=4022272
 Batch norm: F_in=32 P=256, params=32, operations=24576
 ReLU: F_in=32 P=256, params=0, operations=8192
 Conv2d: S_c=3, F_in=32, F_out=8, P=256, params=1152, operations=882688
 Batch norm: F_in=336 P=256, params=336, operations=258048
 ReLU: F_in=336 P=256, params=0, operations=86016
 Conv2d: S_c=1, F_in=336, F_out=32, P=256, params=5376, operations=4120576
 Batch norm: F_in=32 P=256, params=32, operations=24576
 ReLU: F_in=32 P=256, params=0, operations=8192
 Conv2d: S_c=3, F_in=32, F_out=8, P=256, params=1152, operations=882688
 Batch norm: F_in=344 P=256, params=344, operations=264192
 ReLU: F_in=344 P=256, params=0, operations=88064
 Conv2d: S_c=1, F_in=344, F_out=32, P=256, params=5504, operations=4218880
 Batch norm: F_in=32 P=256, params=32, operations=24576
 ReLU: F_in=32 P=256, params=0, operations=8192
 Conv2d: S_c=3, F_in=32, F_out=8, P=256, params=1152, operations=882688
 Batch norm: F_in=352 P=256, params=352, operations=270336
 ReLU: F_in=352 P=256, params=0, operations=90112
 Conv2d: S_c=1, F_in=352, F_out=32, P=256, params=5632, operations=4317184
 Batch norm: F_in=32 P=256, params=32, operations=24576
 ReLU: F_in=32 P=256, params=0, operations=8192
 Conv2d: S_c=3, F_in=32, F_out=8, P=256, params=1152, operations=882688
 Batch norm: F_in=360 P=256, params=360, operations=276480
 ReLU: F_in=360 P=256, params=0, operations=92160
 Conv2d: S_c=1, F_in=360, F_out=32, P=256, params=5760, operations=4415488
 Batch norm: F_in=32 P=256, params=32, operations=24576
 ReLU: F_in=32 P=256, params=0, operations=8192
 Conv2d: S_c=3, F_in=32, F_out=8, P=256, params=1152, operations=882688
 Batch norm: F_in=368 P=256, params=368, operations=282624
 ReLU: F_in=368 P=256, params=0, operations=94208
 Conv2d: S_c=1, F_in=368, F_out=32, P=256, params=5888, operations=4513792

Batch norm: F_in=32 P=256, params=32, operations=24576
 ReLU: F_in=32 P=256, params=0, operations=8192
 Conv2d: S_c=3, F_in=32, F_out=8, P=256, params=1152, operations=882688
 Batch norm: F_in=376 P=256, params=376, operations=288768
 ReLU: F_in=376 P=256, params=0, operations=96256
 Conv2d: S_c=1, F_in=376, F_out=32, P=256, params=6016, operations=4612096
 Batch norm: F_in=32 P=256, params=32, operations=24576
 ReLU: F_in=32 P=256, params=0, operations=8192
 Conv2d: S_c=3, F_in=32, F_out=8, P=256, params=1152, operations=882688
 Batch norm: F_in=384 P=256, params=384, operations=294912
 ReLU: F_in=384 P=256, params=0, operations=98304
 Conv2d: S_c=1, F_in=384, F_out=32, P=256, params=6144, operations=4710400
 Batch norm: F_in=32 P=256, params=32, operations=24576
 ReLU: F_in=32 P=256, params=0, operations=8192
 Conv2d: S_c=3, F_in=32, F_out=8, P=256, params=1152, operations=882688
 Batch norm: F_in=392 P=256, params=392, operations=301056
 ReLU: F_in=392 P=256, params=0, operations=100352
 Conv2d: S_c=1, F_in=392, F_out=196, P=256, params=38416, operations=29453312
 AvgPool: S=2, F_in=196, P=256, params=0, operations=25088
 Batch norm: F_in=196 P=64, params=196, operations=37632
 ReLU: F_in=196 P=64, params=0, operations=12544
 Conv2d: S_c=1, F_in=196, F_out=32, P=64, params=3136, operations=600064
 Batch norm: F_in=32 P=64, params=32, operations=6144
 ReLU: F_in=32 P=64, params=0, operations=2048
 Conv2d: S_c=3, F_in=32, F_out=8, P=64, params=1152, operations=220672
 Batch norm: F_in=204 P=64, params=204, operations=39168
 ReLU: F_in=204 P=64, params=0, operations=13056
 Conv2d: S_c=1, F_in=204, F_out=32, P=64, params=3264, operations=624640
 Batch norm: F_in=32 P=64, params=32, operations=6144
 ReLU: F_in=32 P=64, params=0, operations=2048
 Conv2d: S_c=3, F_in=32, F_out=8, P=64, params=1152, operations=220672
 Batch norm: F_in=212 P=64, params=212, operations=40704
 ReLU: F_in=212 P=64, params=0, operations=13568
 Conv2d: S_c=1, F_in=212, F_out=32, P=64, params=3392, operations=649216
 Batch norm: F_in=32 P=64, params=32, operations=6144
 ReLU: F_in=32 P=64, params=0, operations=2048
 Conv2d: S_c=3, F_in=32, F_out=8, P=64, params=1152, operations=220672
 Batch norm: F_in=220 P=64, params=220, operations=42240
 ReLU: F_in=220 P=64, params=0, operations=14080
 Conv2d: S_c=1, F_in=220, F_out=32, P=64, params=3520, operations=673792
 Batch norm: F_in=32 P=64, params=32, operations=6144
 ReLU: F_in=32 P=64, params=0, operations=2048
 Conv2d: S_c=3, F_in=32, F_out=8, P=64, params=1152, operations=220672
 Batch norm: F_in=228 P=64, params=228, operations=43776
 ReLU: F_in=228 P=64, params=0, operations=14592
 Conv2d: S_c=1, F_in=228, F_out=32, P=64, params=3648, operations=698368
 Batch norm: F_in=32 P=64, params=32, operations=6144
 ReLU: F_in=32 P=64, params=0, operations=2048
 Conv2d: S_c=3, F_in=32, F_out=8, P=64, params=1152, operations=220672
 Batch norm: F_in=236 P=64, params=236, operations=45312

ReLU: F_in=236 P=64, params=0, operations=15104
Conv2d: S_c=1, F_in=236, F_out=32, P=64, params=3776, operations=722944
Batch norm: F_in=32 P=64, params=32, operations=6144
ReLU: F_in=32 P=64, params=0, operations=2048
Conv2d: S_c=3, F_in=32, F_out=8, P=64, params=1152, operations=220672
Batch norm: F_in=244 P=64, params=244, operations=46848
ReLU: F_in=244 P=64, params=0, operations=15616
Conv2d: S_c=1, F_in=244, F_out=32, P=64, params=3904, operations=747520
Batch norm: F_in=32 P=64, params=32, operations=6144
ReLU: F_in=32 P=64, params=0, operations=2048
Conv2d: S_c=3, F_in=32, F_out=8, P=64, params=1152, operations=220672
Batch norm: F_in=252 P=64, params=252, operations=48384
ReLU: F_in=252 P=64, params=0, operations=16128
Conv2d: S_c=1, F_in=252, F_out=32, P=64, params=4032, operations=772096
Batch norm: F_in=32 P=64, params=32, operations=6144
ReLU: F_in=32 P=64, params=0, operations=2048
Conv2d: S_c=3, F_in=32, F_out=8, P=64, params=1152, operations=220672
Batch norm: F_in=260 P=64, params=260, operations=49920
ReLU: F_in=260 P=64, params=0, operations=16640
Conv2d: S_c=1, F_in=260, F_out=32, P=64, params=4160, operations=796672
Batch norm: F_in=32 P=64, params=32, operations=6144
ReLU: F_in=32 P=64, params=0, operations=2048
Conv2d: S_c=3, F_in=32, F_out=8, P=64, params=1152, operations=220672
Batch norm: F_in=268 P=64, params=268, operations=51456
ReLU: F_in=268 P=64, params=0, operations=17152
Conv2d: S_c=1, F_in=268, F_out=32, P=64, params=4288, operations=821248
Batch norm: F_in=32 P=64, params=32, operations=6144
ReLU: F_in=32 P=64, params=0, operations=2048
Conv2d: S_c=3, F_in=32, F_out=8, P=64, params=1152, operations=220672
Batch norm: F_in=276 P=64, params=276, operations=52992
ReLU: F_in=276 P=64, params=0, operations=17664
Conv2d: S_c=1, F_in=276, F_out=32, P=64, params=4416, operations=845824
Batch norm: F_in=32 P=64, params=32, operations=6144
ReLU: F_in=32 P=64, params=0, operations=2048
Conv2d: S_c=3, F_in=32, F_out=8, P=64, params=1152, operations=220672
Batch norm: F_in=284 P=64, params=284, operations=54528
ReLU: F_in=284 P=64, params=0, operations=18176
Conv2d: S_c=1, F_in=284, F_out=32, P=64, params=4544, operations=870400
Batch norm: F_in=32 P=64, params=32, operations=6144
ReLU: F_in=32 P=64, params=0, operations=2048
Conv2d: S_c=3, F_in=32, F_out=8, P=64, params=1152, operations=220672
Batch norm: F_in=292 P=64, params=292, operations=56064
ReLU: F_in=292 P=64, params=0, operations=18688
Conv2d: S_c=1, F_in=292, F_out=32, P=64, params=4672, operations=894976
Batch norm: F_in=32 P=64, params=32, operations=6144
ReLU: F_in=32 P=64, params=0, operations=2048
Conv2d: S_c=3, F_in=32, F_out=8, P=64, params=1152, operations=220672
Batch norm: F_in=300 P=64, params=300, operations=57600
ReLU: F_in=300 P=64, params=0, operations=19200
Conv2d: S_c=1, F_in=300, F_out=32, P=64, params=4800, operations=919552

Batch norm: F_in=32 P=64, params=32, operations=6144
 ReLU: F_in=32 P=64, params=0, operations=2048
 Conv2d: S_c=3, F_in=32, F_out=8, P=64, params=1152, operations=220672
 Batch norm: F_in=308 P=64, params=308, operations=59136
 ReLU: F_in=308 P=64, params=0, operations=19712
 Conv2d: S_c=1, F_in=308, F_out=32, P=64, params=4928, operations=944128
 Batch norm: F_in=32 P=64, params=32, operations=6144
 ReLU: F_in=32 P=64, params=0, operations=2048
 Conv2d: S_c=3, F_in=32, F_out=8, P=64, params=1152, operations=220672
 Batch norm: F_in=316 P=64, params=316, operations=60672
 ReLU: F_in=316 P=64, params=0, operations=20224
 Conv2d: S_c=1, F_in=316, F_out=32, P=64, params=5056, operations=968704
 Batch norm: F_in=32 P=64, params=32, operations=6144
 ReLU: F_in=32 P=64, params=0, operations=2048
 Conv2d: S_c=3, F_in=32, F_out=8, P=64, params=1152, operations=220672
 Batch norm: F_in=324 P=64, params=324, operations=62208
 ReLU: F_in=324 P=64, params=0, operations=20736
 Conv2d: S_c=1, F_in=324, F_out=32, P=64, params=5184, operations=993280
 Batch norm: F_in=32 P=64, params=32, operations=6144
 ReLU: F_in=32 P=64, params=0, operations=2048
 Conv2d: S_c=3, F_in=32, F_out=8, P=64, params=1152, operations=220672
 Batch norm: F_in=332 P=64, params=332, operations=63744
 ReLU: F_in=332 P=64, params=0, operations=21248
 Conv2d: S_c=1, F_in=332, F_out=32, P=64, params=5312, operations=1017856
 Batch norm: F_in=32 P=64, params=32, operations=6144
 ReLU: F_in=32 P=64, params=0, operations=2048
 Conv2d: S_c=3, F_in=32, F_out=8, P=64, params=1152, operations=220672
 Batch norm: F_in=340 P=64, params=340, operations=65280
 ReLU: F_in=340 P=64, params=0, operations=21760
 Conv2d: S_c=1, F_in=340, F_out=32, P=64, params=5440, operations=1042432
 Batch norm: F_in=32 P=64, params=32, operations=6144
 ReLU: F_in=32 P=64, params=0, operations=2048
 Conv2d: S_c=3, F_in=32, F_out=8, P=64, params=1152, operations=220672
 Batch norm: F_in=348 P=64, params=348, operations=66816
 ReLU: F_in=348 P=64, params=0, operations=22272
 Conv2d: S_c=1, F_in=348, F_out=32, P=64, params=5568, operations=1067008
 Batch norm: F_in=32 P=64, params=32, operations=6144
 ReLU: F_in=32 P=64, params=0, operations=2048
 Conv2d: S_c=3, F_in=32, F_out=8, P=64, params=1152, operations=220672
 Batch norm: F_in=356 P=64, params=356, operations=68352
 ReLU: F_in=356 P=64, params=0, operations=22784
 Conv2d: S_c=1, F_in=356, F_out=32, P=64, params=5696, operations=1091584
 Batch norm: F_in=32 P=64, params=32, operations=6144
 ReLU: F_in=32 P=64, params=0, operations=2048
 Conv2d: S_c=3, F_in=32, F_out=8, P=64, params=1152, operations=220672
 Batch norm: F_in=364 P=64, params=364, operations=69888
 ReLU: F_in=364 P=64, params=0, operations=23296
 Conv2d: S_c=1, F_in=364, F_out=32, P=64, params=5824, operations=1116160
 Batch norm: F_in=32 P=64, params=32, operations=6144
 ReLU: F_in=32 P=64, params=0, operations=2048

Conv2d: S_c=3, F_in=32, F_out=8, P=64, params=1152, operations=220672
 Batch norm: F_in=372 P=64, params=372, operations=71424
 ReLU: F_in=372 P=64, params=0, operations=23808
 Conv2d: S_c=1, F_in=372, F_out=32, P=64, params=5952, operations=1140736
 Batch norm: F_in=32 P=64, params=32, operations=6144
 ReLU: F_in=32 P=64, params=0, operations=2048
 Conv2d: S_c=3, F_in=32, F_out=8, P=64, params=1152, operations=220672
 Batch norm: F_in=380 P=64, params=380, operations=72960
 ReLU: F_in=380 P=64, params=0, operations=24320
 Conv2d: S_c=1, F_in=380, F_out=32, P=64, params=6080, operations=1165312
 Batch norm: F_in=32 P=64, params=32, operations=6144
 ReLU: F_in=32 P=64, params=0, operations=2048
 Conv2d: S_c=3, F_in=32, F_out=8, P=64, params=1152, operations=220672
 Batch norm: F_in=388 P=64, params=388, operations=74496
 ReLU: F_in=388 P=64, params=0, operations=24832
 Conv2d: S_c=1, F_in=388, F_out=32, P=64, params=6208, operations=1189888
 Batch norm: F_in=32 P=64, params=32, operations=6144
 ReLU: F_in=32 P=64, params=0, operations=2048
 Conv2d: S_c=3, F_in=32, F_out=8, P=64, params=1152, operations=220672
 Batch norm: F_in=396 P=64, params=396, operations=76032
 ReLU: F_in=396 P=64, params=0, operations=25344
 Conv2d: S_c=1, F_in=396, F_out=32, P=64, params=6336, operations=1214464
 Batch norm: F_in=32 P=64, params=32, operations=6144
 ReLU: F_in=32 P=64, params=0, operations=2048
 Conv2d: S_c=3, F_in=32, F_out=8, P=64, params=1152, operations=220672
 Batch norm: F_in=404 P=64, params=404, operations=77568
 ReLU: F_in=404 P=64, params=0, operations=25856
 Conv2d: S_c=1, F_in=404, F_out=32, P=64, params=6464, operations=1239040
 Batch norm: F_in=32 P=64, params=32, operations=6144
 ReLU: F_in=32 P=64, params=0, operations=2048
 Conv2d: S_c=3, F_in=32, F_out=8, P=64, params=1152, operations=220672
 Batch norm: F_in=412 P=64, params=412, operations=79104
 ReLU: F_in=412 P=64, params=0, operations=26368
 Conv2d: S_c=1, F_in=412, F_out=32, P=64, params=6592, operations=1263616
 Batch norm: F_in=32 P=64, params=32, operations=6144
 ReLU: F_in=32 P=64, params=0, operations=2048
 Conv2d: S_c=3, F_in=32, F_out=8, P=64, params=1152, operations=220672
 Batch norm: F_in=420 P=64, params=420, operations=80640
 ReLU: F_in=420 P=64, params=0, operations=26880
 Conv2d: S_c=1, F_in=420, F_out=32, P=64, params=6720, operations=1288192
 Batch norm: F_in=32 P=64, params=32, operations=6144
 ReLU: F_in=32 P=64, params=0, operations=2048
 Conv2d: S_c=3, F_in=32, F_out=8, P=64, params=1152, operations=220672
 Batch norm: F_in=428 P=64, params=428, operations=82176
 ReLU: F_in=428 P=64, params=0, operations=27392
 Conv2d: S_c=1, F_in=428, F_out=32, P=64, params=6848, operations=1312768
 Batch norm: F_in=32 P=64, params=32, operations=6144
 ReLU: F_in=32 P=64, params=0, operations=2048
 Conv2d: S_c=3, F_in=32, F_out=8, P=64, params=1152, operations=220672
 Batch norm: F_in=436 P=64, params=436, operations=83712

ReLU: F_in=436 P=64, params=0, operations=27904
Conv2d: S_c=1, F_in=436, F_out=32, P=64, params=6976, operations=1337344
Batch norm: F_in=32 P=64, params=32, operations=6144
ReLU: F_in=32 P=64, params=0, operations=2048
Conv2d: S_c=3, F_in=32, F_out=8, P=64, params=1152, operations=220672
Batch norm: F_in=444 P=64, params=444, operations=85248
ReLU: F_in=444 P=64, params=0, operations=28416
Conv2d: S_c=1, F_in=444, F_out=32, P=64, params=7104, operations=1361920
Batch norm: F_in=32 P=64, params=32, operations=6144
ReLU: F_in=32 P=64, params=0, operations=2048
Conv2d: S_c=3, F_in=32, F_out=8, P=64, params=1152, operations=220672
Batch norm: F_in=452 P=64, params=452, operations=86784
ReLU: F_in=452 P=64, params=0, operations=28928
Conv2d: S_c=1, F_in=452, F_out=226, P=64, params=51076, operations=9792128
AvgPool: S=2, F_in=226, P=64, params=0, operations=7232
Batch norm: F_in=226 P=16, params=226, operations=10848
ReLU: F_in=226 P=16, params=0, operations=3616
AvgPool: S=4, F_in=226, P=16, params=0, operations=904
Linear: F_in=226, F_out=100, params=11350, operations=33800