Fast campus Copyright FASTCAMPUS Corp.All Rights Reserved

Part 4
SOTA model

Ch2. CoAtNet

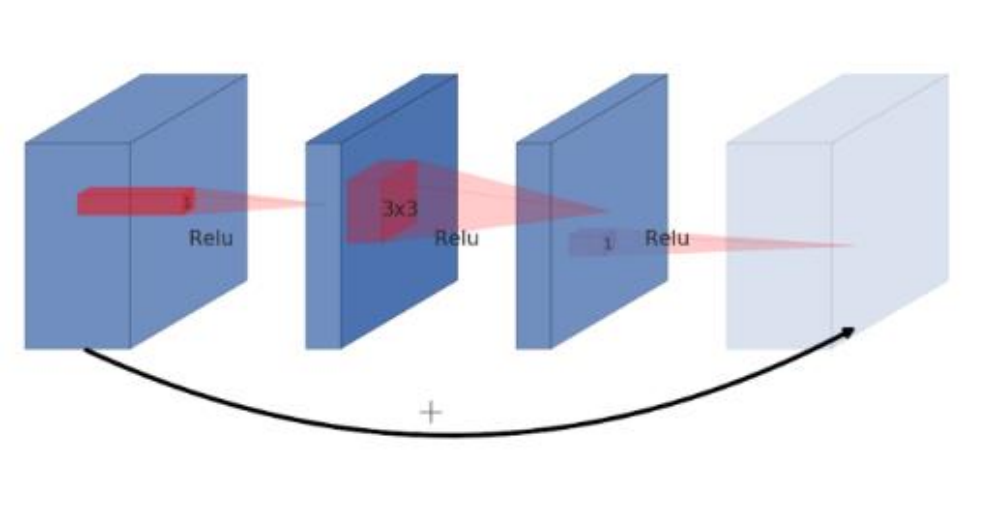
CoAtNet: Marrying Convolution and Attention for All Data Sizes

Fast campus Copyright FASTCAMPUS Corp.All Rights Reserved

MB Convolution Block

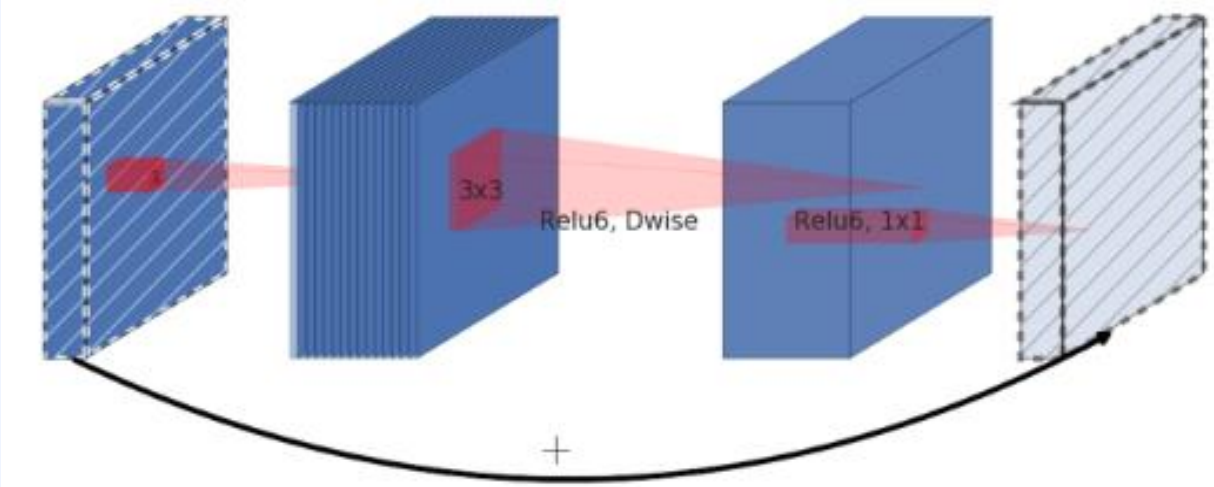
- Depthwise convolution을 사용하는 개선된 inverted residual bottleneck

일반 block



- wide - narrow - wide 한 형태

MB block

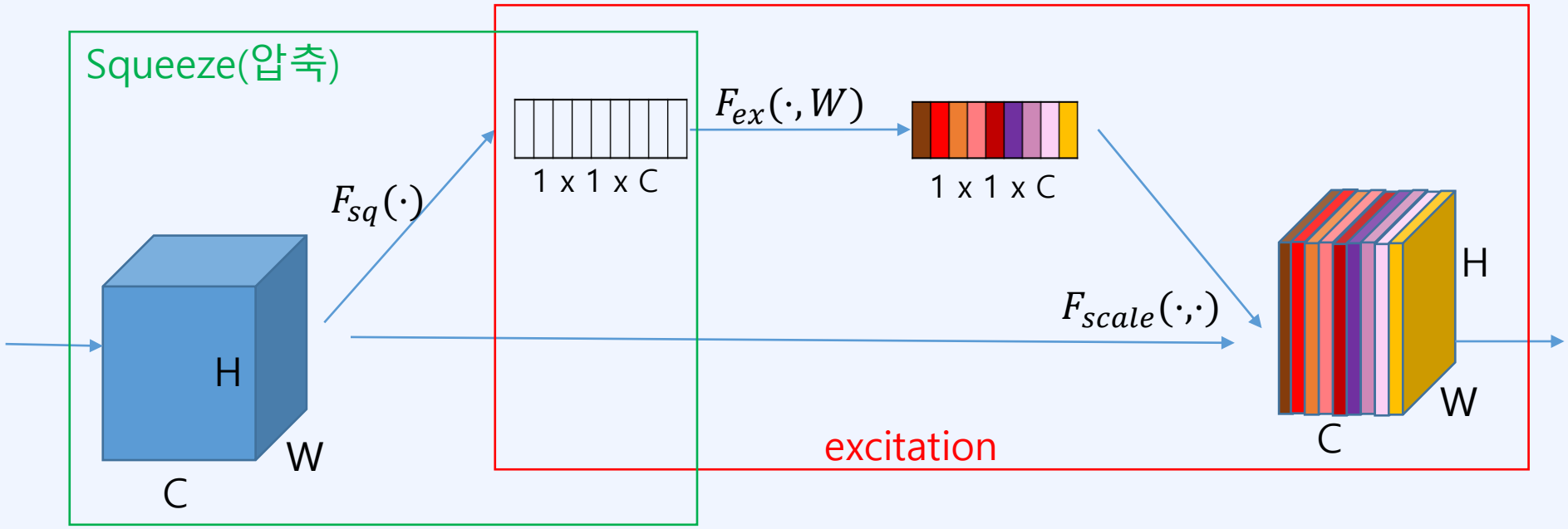


- narrow - wide - narrow한 형태

Fast campus Copyright FASTCAMPUS Corp.All Rights Reserved

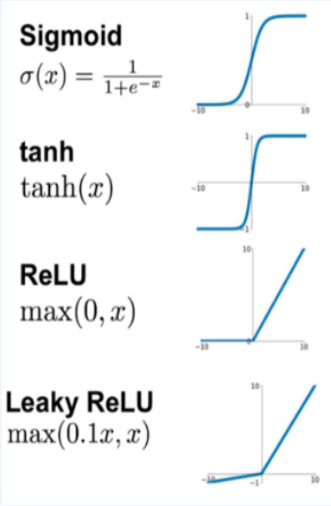
SENet

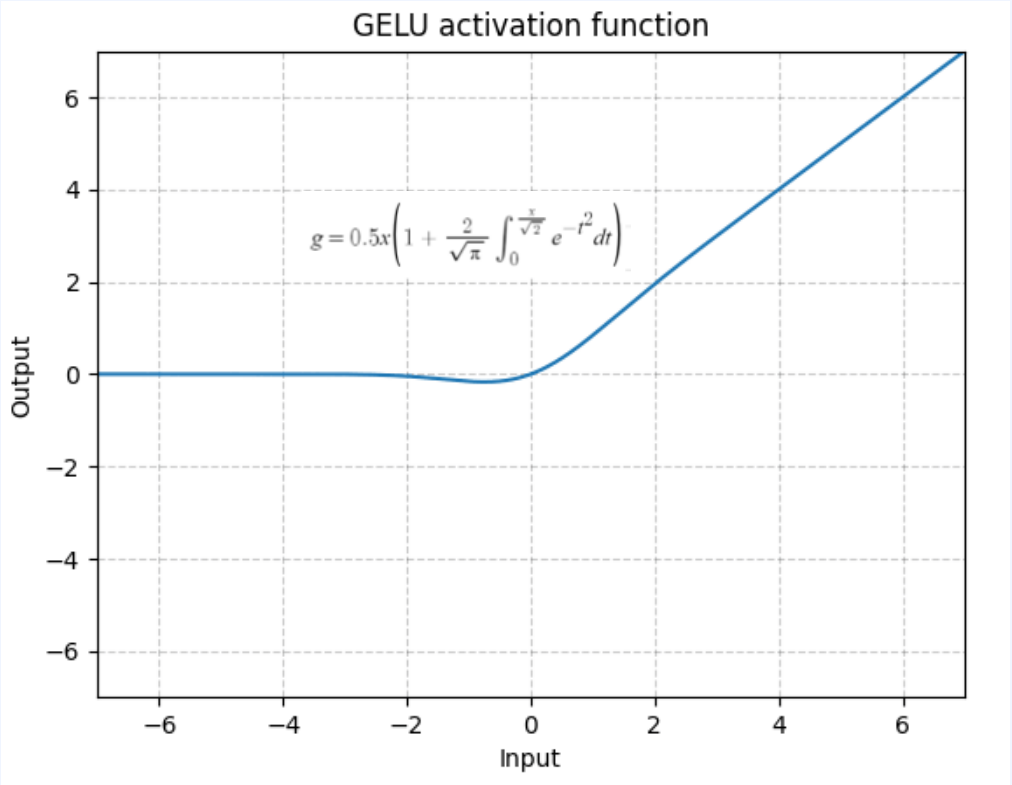
- Sequeeze-and-excitation network
- 모델 성능 향상을 위해 기존의 네트워크에 붙여 사용
  - ResNet에서 테스트 시, 0.6% 정확도 향상



Fast campus Copyright FASTCAMPUS Corp.All Rights Reserved

GeLU(Gaussian Error Linear units)





Fast campus Copyright FASTCAMPUS Corp.All Rights Reserved

2D Relative Attention

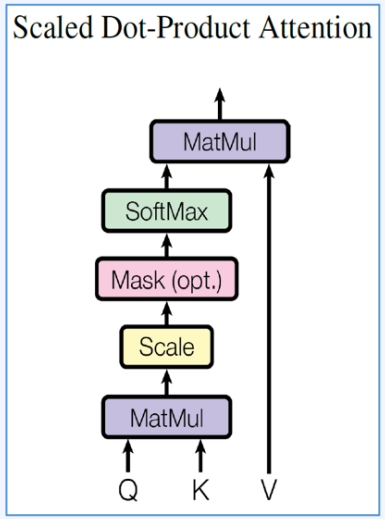
C_{head}

Q : query

K : Key

V : Value

$$softmax\left(\frac{QK^T}{\sqrt{C_{head}}} + relative\ position\ bias\right)V$$



[Vaswani, A.(NIPS'17)]

Fast campus Copyright FASTCAMPUS Corp.All Rights Reserved

Relative position bias

- Relative coordinates

Ex) Feature map size = 3

x axis

1	2	3
4	5	6
7	8	9

Δx

	1	2	3	4	5	6	7	8	9
1	0	0	0	-1	-1	-1	-2	-2	-2
2	0	0	0	-1	-1	-1	-2	-2	-2
3	0	0	0	-1	-1	-1	-2	-2	-2
4	1	1	1	0	0	0	-1	-1	-1
5	1	1	1	0	0	0	-1	-1	-1
6	1	1	1	0	0	0	-1	-1	-1
7	2	2	2	1	1	1	0	0	0
8	2	2	2	1	1	1	0	0	0
9	2	2	2	1	1	1	0	0	0

y axis

1	2	3
4	5	6
7	8	9

Δy

	1	2	3	4	5	6	7	8	9
1	0	-1	-2	0	-1	-2	0	-1	-2
2	1	0	-1	1	0	-1	1	0	-1
3	2	1	0	2	1	0	2	1	0
4	0	-1	-2	0	-1	-2	0	-1	-2
5	1	0	-1	1	0	-1	1	0	-1
6	2	1	0	2	1	0	2	1	0
7	0	-1	-2	0	-1	-2	0	-1	-2
8	1	0	-1	1	0	-1	1	0	-1
9	2	1	0	2	1	0	2	1	0

Fast campus Copyright FASTCAMPUS Corp.All Rights Reserved

Relative position bias

- Relative Position index

Δx

	1	2	3	4	5	6	7	8	9
1	**2**	**2**	**2**	**1**	**1**	**1**	**0**	**0**	**0**
2	2	2	2	1	1	1	0	0	0
3	2	2	2	1	1	1	0	0	0
4	3	3	3	2	2	2	1	1	1
5	3	3	3	2	2	2	1	1	1
6	3	3	3	2	2	2	1	1	1
7	4	4	4	3	3	3	2	2	2
8	4	4	4	3	3	3	2	2	2
9	4	4	4	3	3	3	2	2	2

Δy

	1	2	3	4	5	6	7	8	9
1	**2**	**1**	**0**	**2**	**1**	**0**	**2**	**1**	**0**
2	3	2	1	3	2	1	3	2	1
3	4	3	2	4	3	2	4	3	2
4	2	1	0	2	1	0	2	1	0
5	3	2	1	3	2	1	3	2	1
6	4	3	2	4	3	2	4	3	2
7	2	1	0	2	1	0	2	1	0
8	3	2	1	3	2	1	3	2	1
9	4	3	2	4	3	2	4	3	2

Fast campus Copyright FASTCAMPUS Corp.All Rights Reserved

Relative position bias

- Relative Position index

$$\Delta x = \Delta x * (2 * input_{width} - 1)$$

	1	2	3	4	5	6	7	8	9
1	**10**	**10**	**10**	**5**	**5**	**5**	**0**	**0**	**0**
2	10	10	10	5	5	5	0	0	0
3	10	10	10	5	5	5	0	0	0
4	15	15	15	10	10	10	5	5	5
5	15	15	15	10	10	10	5	5	5
6	15	15	15	10	10	10	5	5	5
7	20	20	20	15	15	15	10	10	10
8	20	20	20	15	15	15	10	10	10
9	20	20	20	15	15	15	10	10	10

Relative Position matrix = $\Delta x + \Delta y$

	1	2	3	4	5	6	7	8	9
1	**12**	**11**	**10**	**7**	**6**	**5**	**2**	**1**	**0**
2	13	12	11	8	7	6	3	2	1
3	14	13	12	9	8	7	4	3	2
4	17	16	15	12	11	10	7	6	5
5	18	17	16	13	12	11	8	7	6
6	19	18	17	14	13	12	9	8	7
7	22	21	20	17	16	13	12	11	10
8	23	22	21	18	17	16	13	12	11
9	24	23	22	19	18	17	14	13	12

Fast campus Copyright FASTCAMPUS Corp.All Rights Reserved

Relative position bias

Input size(MxM) = 3x3

Relative Position index

	1	2	3	4	5	6	7	8	9
1	12	11	10	7	6	5	2	1	0
2	13	12	11	8	7	6	3	2	1
3	14	13	12	9	8	7	4	3	2
4	17	16	15	12	11	10	7	6	5
5	18	17	16	13	12	11	8	7	6
6	19	18	17	14	13	12	9	8	7
7	22	21	20	17	16	13	12	11	10
8	23	22	21	18	17	16	13	12	11
9	24	23	22	19	18	17	14	13	12

Relative coordinates Range:
[-M+1,M-1]
x축,y축 범위[-2, 2]

5

5 $\hat{B} \in R^{(2M-1)\times(2M-1)}$

Relative position index range:
[0, (2M-1)x(2M-1)-1]
3x3인 경우 범위, [0, 24]

9

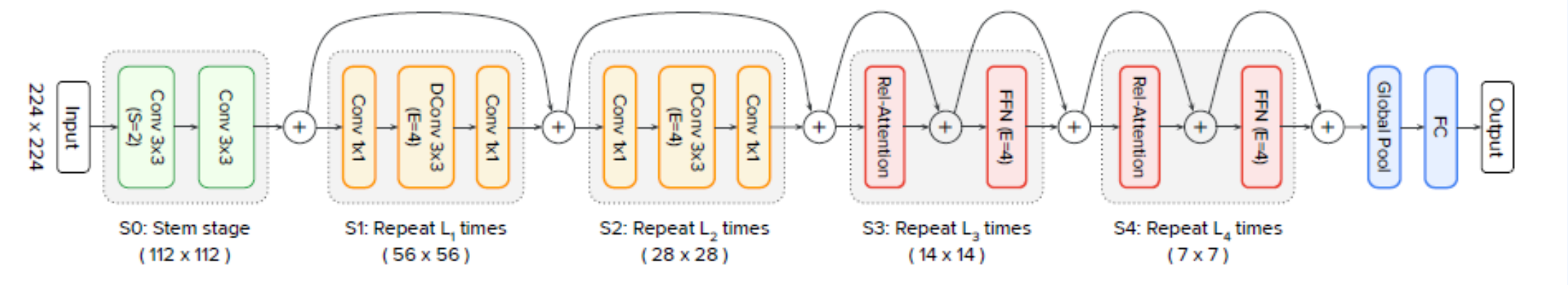
9 $B \in R^{M^2\times M^2}$

Fast campus Copyright FASTCAMPUS Corp.All Rights Reserved

CoAtNet Architecture

Fast campus Copyright FASTCAMPUS Corp.All Rights Reserved

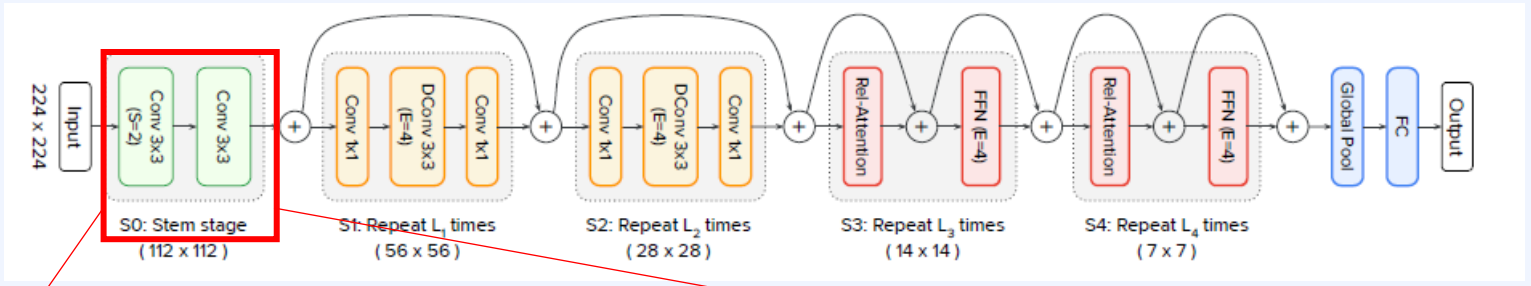
CoAtNet Architecture

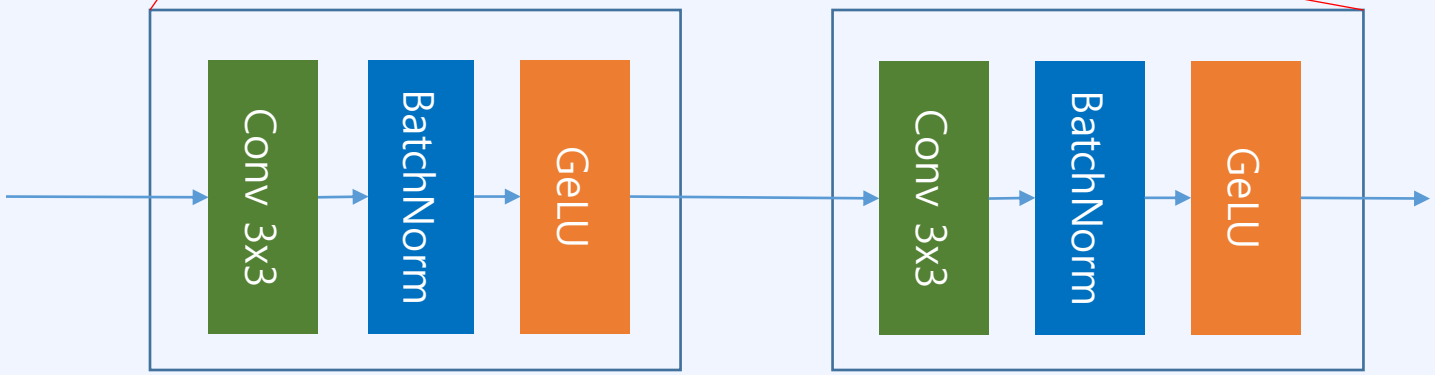


Fast campus Copyright FASTCAMPUS Corp.All Rights Reserved

Stage 0

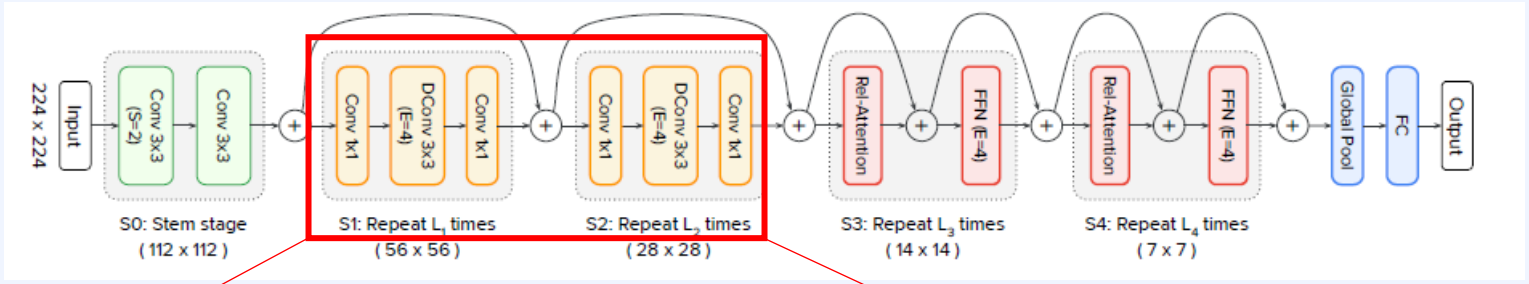
- 2 Layer Convolution stem

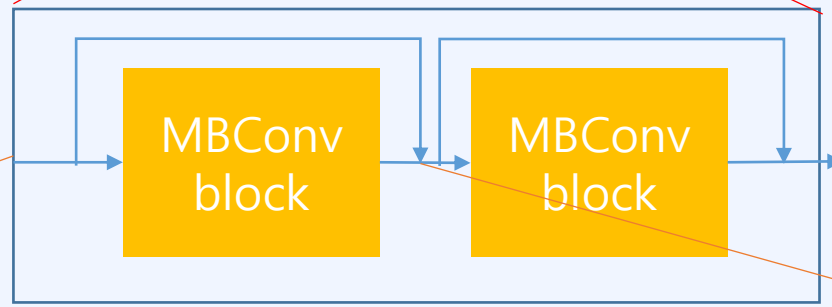




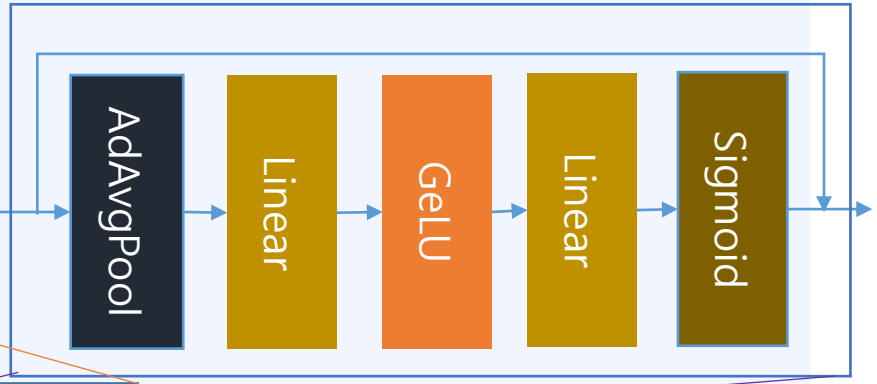
Fast campus Copyright FASTCAMPUS Corp.All Rights Reserved

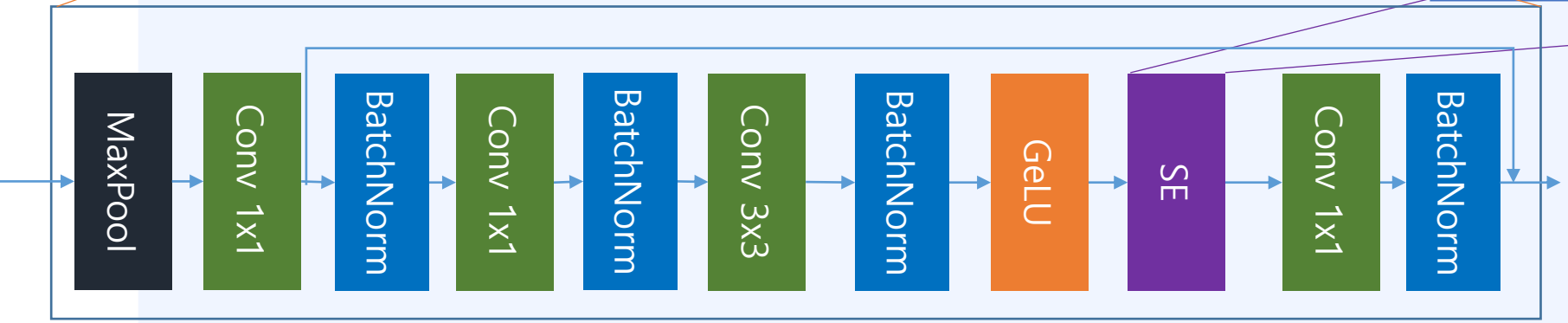
Stage1,2





SENet

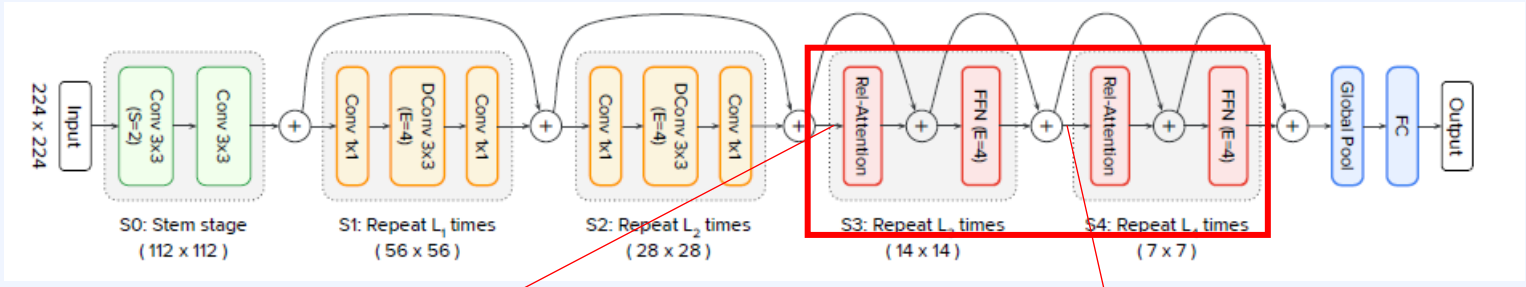


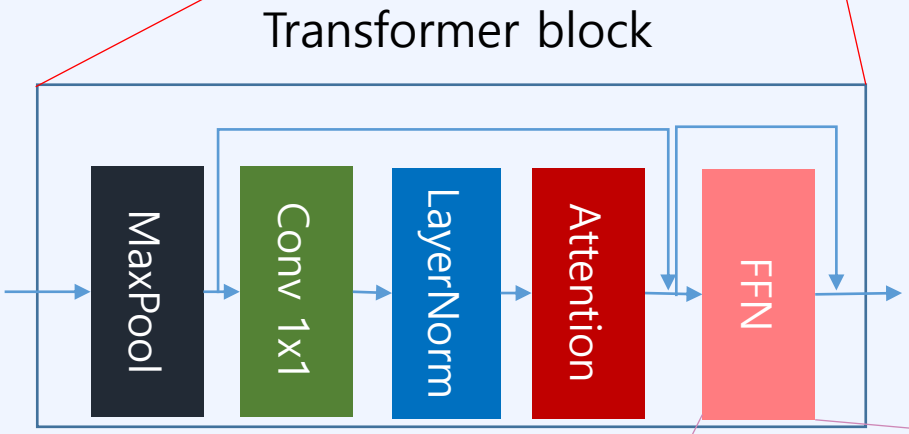


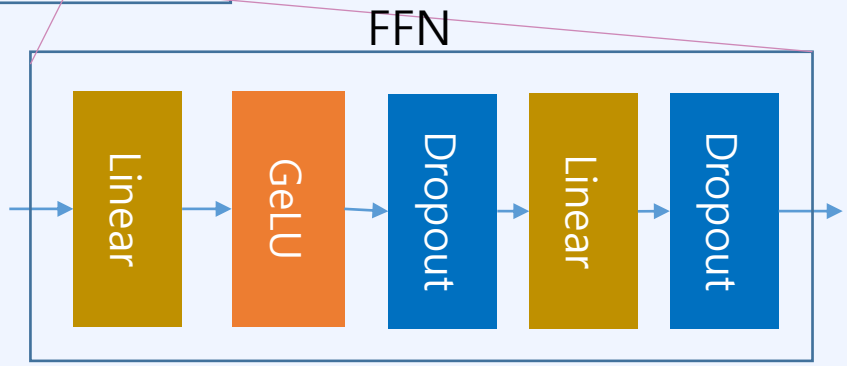
MBConv block

Fast campus Copyright FASTCAMPUS Corp.All Rights Reserved

Stage 3,4







Fast campus Copyright FASTCAMPUS Corp.All Rights Reserved

Summary