

ICT이노베이션스퀘어 AI복합교육 고급 언어과정

자연어처리를 위한 CNN (Convolution Neural Network)

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Conv2D



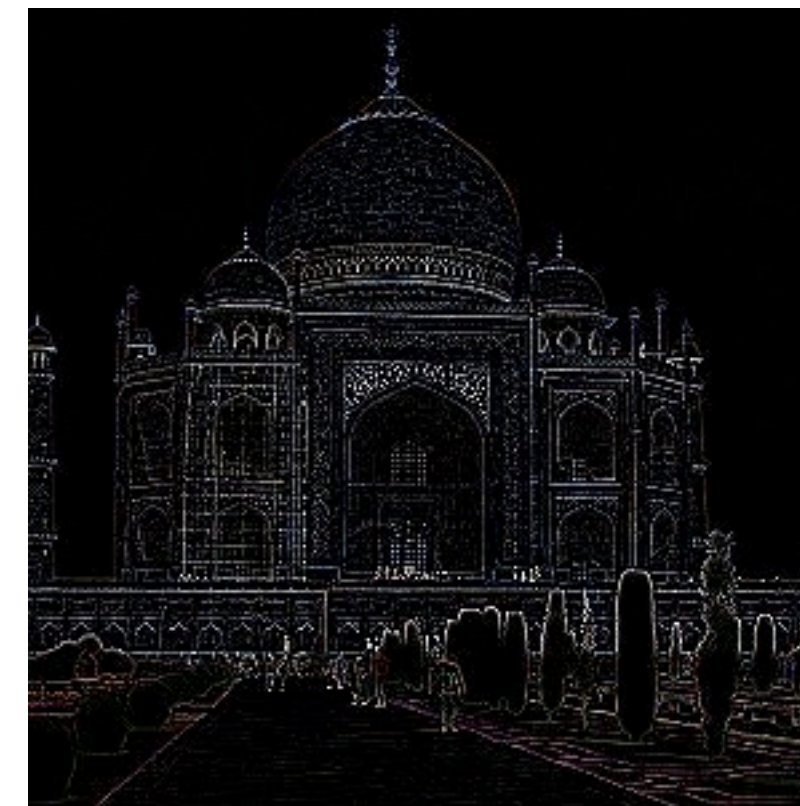
Sharpen

0	0	0	0	0
0	0	-1	0	0
0	-1	5	-1	0
0	0	-1	0	0
0	0	0	0	0



Blur

0	0	0	0	0
0	1	1	1	0
0	1	1	1	0
0	1	1	1	0
0	0	0	0	0



Edge Detect

	0	1	0	
	1	-4	1	
	0	1	0	



Emboss

	-2	-1	0	
	-1	1	1	
	0	1	2	

Convolution Filter를 이용하여 이미지의 특징을 다양하게 추출 가능

Conv2D (Convolution Layer)

1	0	1	2	0
0	1	1	0	1
1	0	2	1	1
1	2	1	0	0
1	1	0	2	2

Image

1	0	1
0	1	0
1	0	1

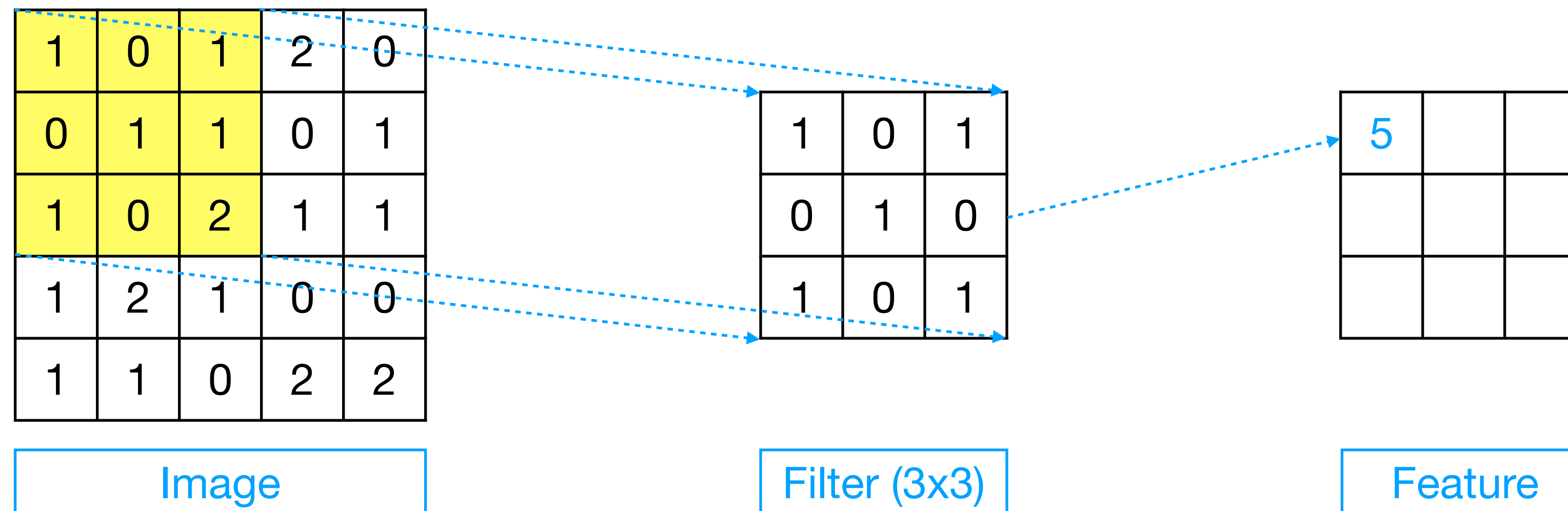
Filter (3x3)

	?	

Feature

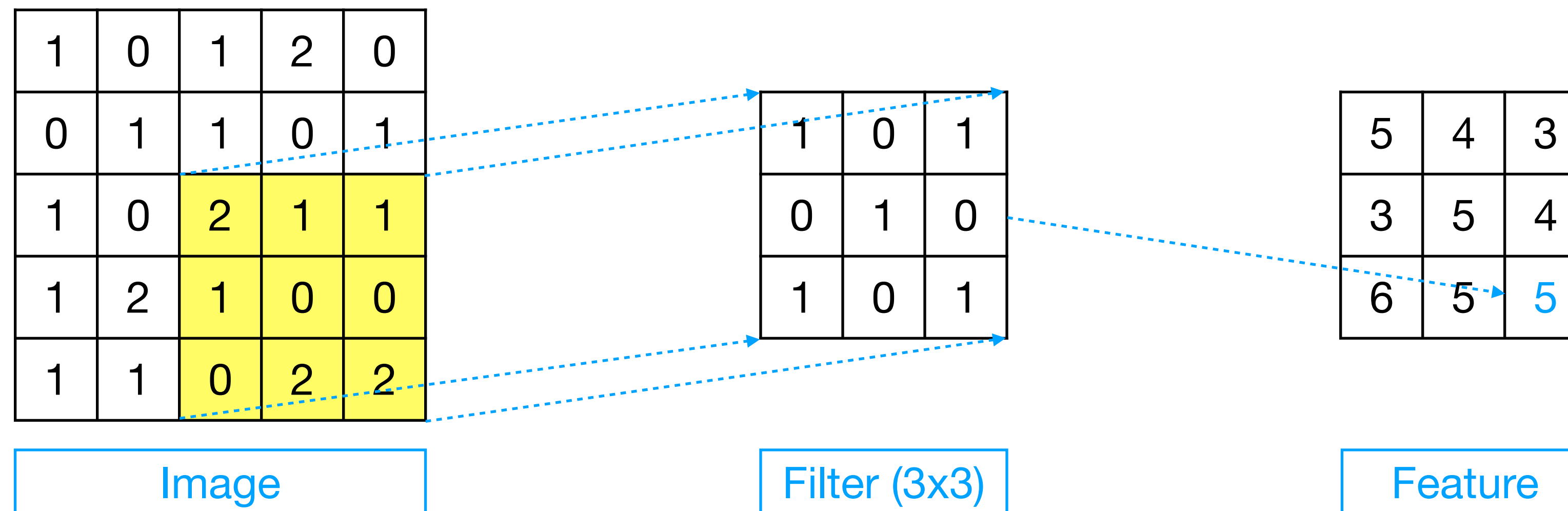
Conv2D (Convolution Layer)

$$\begin{aligned} &(1 \times 1) + (0 \times 0) + (1 \times 1) \\ &+ (0 \times 0) + (1 \times 1) + (1 \times 0) \\ &+ (1 \times 1) + (0 \times 0) + (2 \times 1) \\ &= 5 \end{aligned}$$



Conv2D (Convolution Layer)

$$\begin{aligned} &(2 \times 1) + (1 \times 0) + (1 \times 1) \\ &+ (1 \times 0) + (0 \times 1) + (0 \times 0) \\ &+ (0 \times 1) + (2 \times 0) + (2 \times 1) \\ &= 5 \end{aligned}$$



Conv2D (Convolution Layer)

1	0	1	2	0
0	1	1	0	1
1	0	2	1	1
1	2	1	0	0
1	1	0	2	2

Image

			1	1	1
		0	1	1	0
1	0	1			
0	1	0			
1	0	1			

Filter (3x3)

Filter 개수 3

			2	2	6
		4	2	5	6
5	4	3			
3	5	4			
6	5	5			

Feature

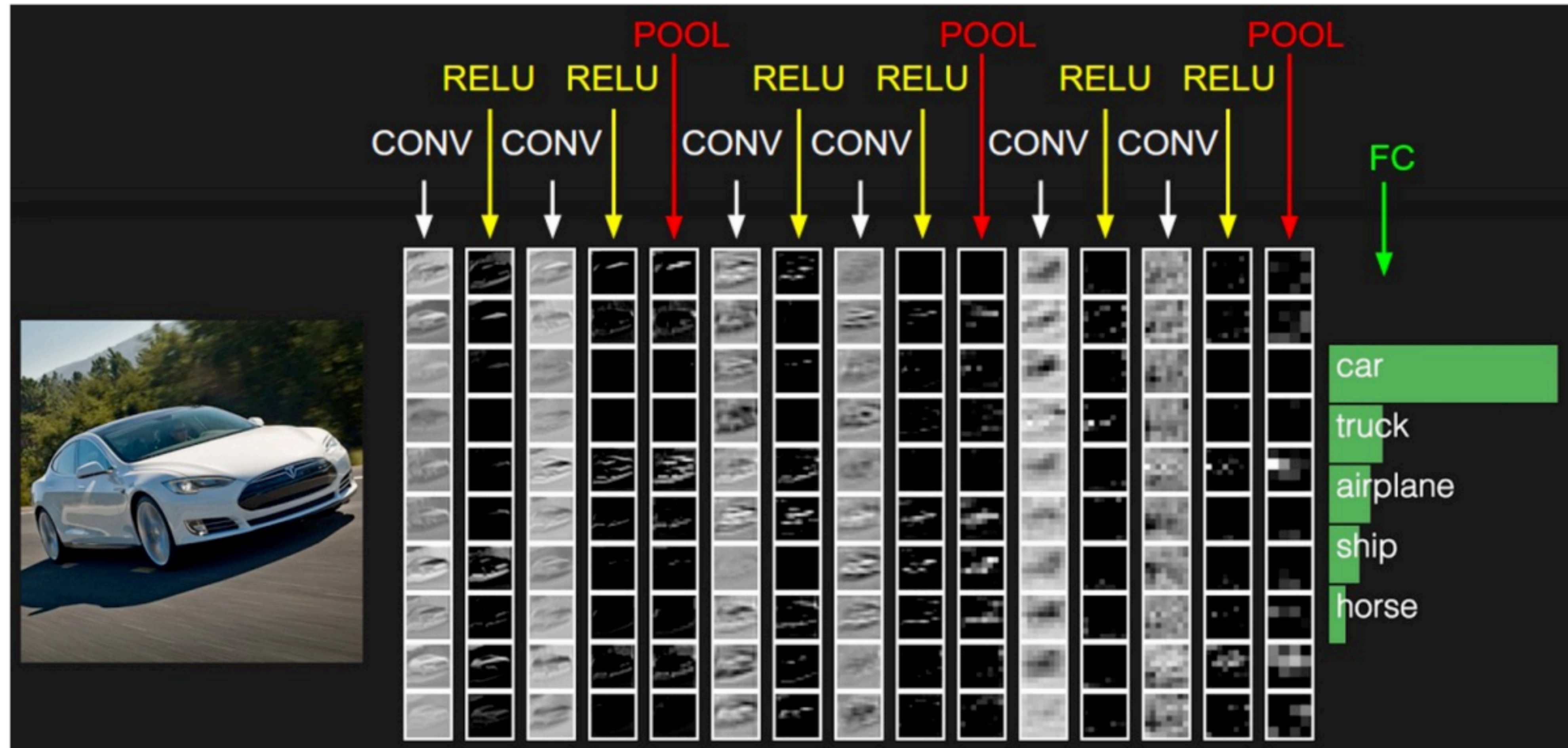
Conv2D (Max Pooling)

1	1	2	5
7	6	3	2
3	4	1	0
1	2	2	6

Filter (2x2)
Stride 2

7	5
4	6

Conv2D (Inference)



Conv1D (Convolution Layer)

이순신은	0.2	0.1	-0.3	0.4
16세기	0.5	0.2	-0.3	-0.1
무신으로	-0.1	-0.3	-0.2	0.4
임진왜란	0.3	-0.3	0.1	0.1
당시	0.2	-0.3	0.4	0.2
조선	0.1	0.2	-0.1	-0.1
수군을	-0.4	-0.4	0.2	0.3

Word Embedding

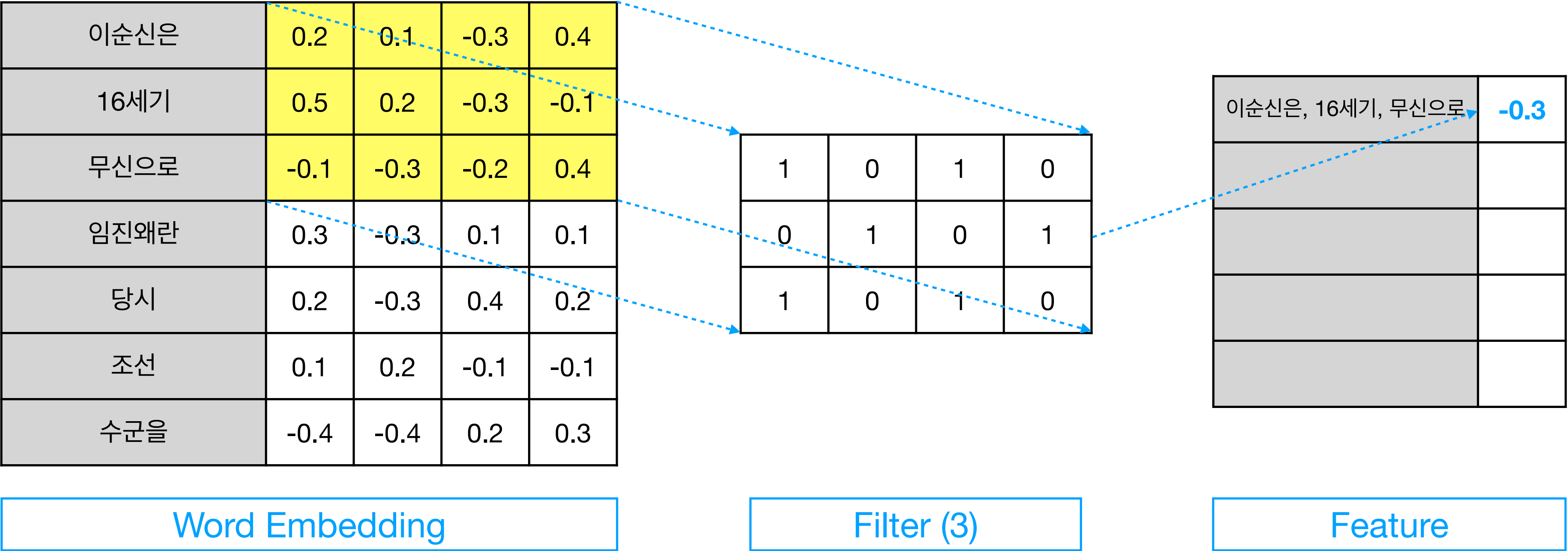
1	0	1	0
0	1	0	1
1	0	1	0

Filter (3)

Feature

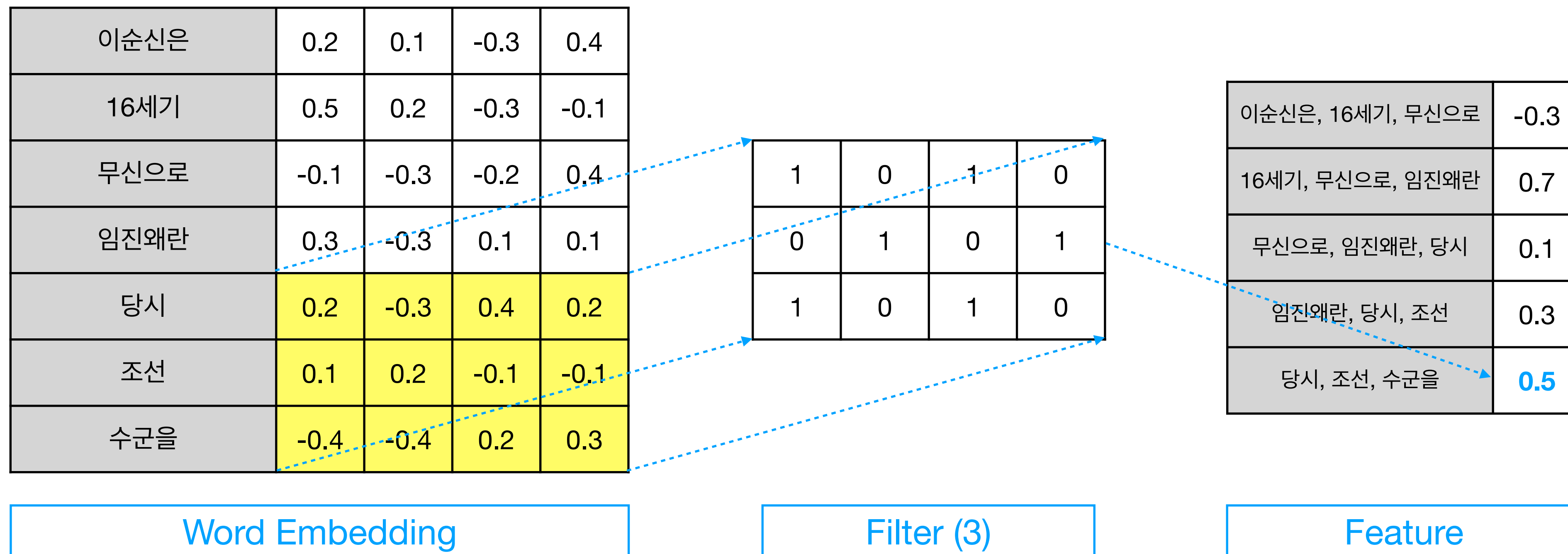
Conv1D (Convolution Layer)

$$\begin{aligned} & (0.2 \times 1) + (0.1 \times 0) + (-0.3 \times 1) + (0.4 \times 0) \\ & + (0.5 \times 0) + (0.2 \times 1) + (-0.3 \times 0) + (-0.1 \times 1) \\ & + (-0.1 \times 1) + (-0.3 \times 0) + (-0.2 \times 1) + (0.4 \times 0) \\ & = -0.3 \end{aligned}$$



Conv1D (Convolution Layer)

$$\begin{aligned}
 & (0.2 \times 1) + (-0.3 \times 0) + (0.4 \times 1) + (0.2 \times 0) \\
 & + (0.1 \times 0) + (0.2 \times 1) + (-0.1 \times 1) + (-0.1 \times 0) \\
 & + (-0.4 \times 1) + (-0.4 \times 0) + (0.2 \times 1) + (0.3 \times 0) \\
 & = 0.5
 \end{aligned}$$



Conv1D (Convolution Layer)

이순신은	0.2	0.1	-0.3	0.4
16세기	0.5	0.2	-0.3	-0.1
무신으로	-0.1	-0.3	-0.2	0.4
임진왜란	0.3	-0.3	0.1	0.1
당시	0.2	-0.3	0.4	0.2
조선	0.1	0.2	-0.1	-0.1
수군을	-0.4	-0.4	0.2	0.3

Word Embedding

		1	0	1	0	
	1	0	1	0		
1	0	1	0			
0	1	0	1			
1	0	1	0			

Filter (3)

Filter 개수 3

이순신은, 16세기, 무신으로	-0.3	1.6	-1.0
16세기, 무신으로, 임진왜란	0.7	-0.1	0.8
무신으로, 임진왜란, 당시	0.1	0.3	0.3
임진왜란, 당시, 조선	0.3	0.1	1.2
당시, 조선, 수군을	0.5	0.6	0.9

Feature

Conv1D (Max Pooling)

이순신은	0.2	0.1	-0.3	0.4
16세기	0.5	0.2	-0.3	-0.1
무신으로	-0.1	-0.3	-0.2	0.4
임진왜란	0.3	-0.3	0.1	0.1
당시	0.2	-0.3	0.4	0.2
조선	0.1	0.2	-0.1	-0.1
수군을	-0.4	-0.4	0.2	0.3

Word Embedding

	1	0	1	0
3	1	2	-3	
-1	2	1	-3	
1	1	-1	1	

Filter (3)

Filter 개수 3

이순신은, 16세기, 무신으로	-0.3	1.6	-1.0
16세기, 무신으로, 임진왜란	0.7	-0.1	0.8
무신으로, 임진왜란, 당시	0.1	0.3	0.3
임진왜란, 당시, 조선	0.3	0.1	1.2
당시, 조선, 수군을	0.5	0.6	0.9
Max Pooling	0.7	1.6	1.2

Feature max pooling

Conv1D (Avg Pooling)

이순신은	0.2	0.1	-0.3	0.4
16세기	0.5	0.2	-0.3	-0.1
무신으로	-0.1	-0.3	-0.2	0.4
임진왜란	0.3	-0.3	0.1	0.1
당시	0.2	-0.3	0.4	0.2
조선	0.1	0.2	-0.1	-0.1
수군을	-0.4	-0.4	0.2	0.3

Word Embedding

	1	0	1	0
3	1	2	-3	
-1	2	1	-3	
1	1	-1	1	

Filter (3)

Filter 개수 3

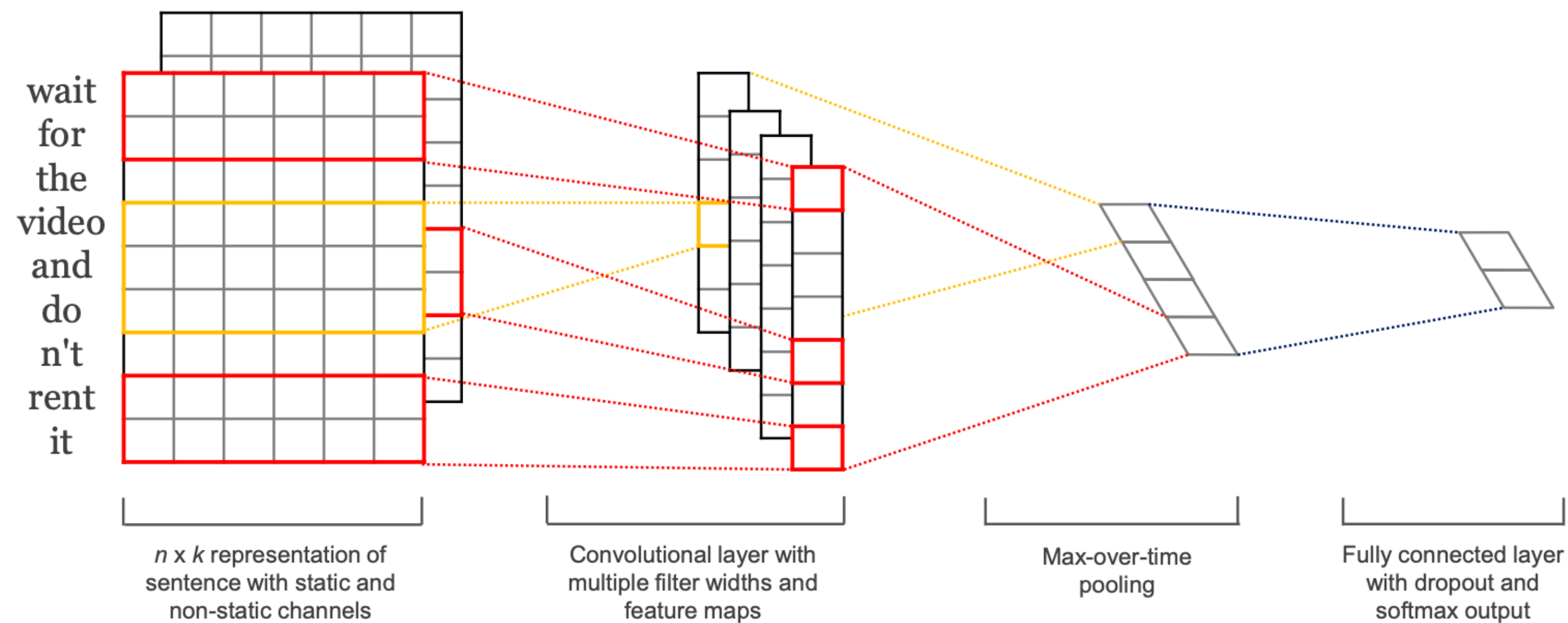
이순신은, 16세기, 무신으로	-0.3	1.6	-1.0
16세기, 무신으로, 임진왜란	0.7	-0.1	0.8
무신으로, 임진왜란, 당시	0.1	0.3	0.3
임진왜란, 당시, 조선	0.3	0.1	1.2
당시, 조선, 수군을	0.5	0.6	0.9
Max Pooling	-1.0	0.5	-0.6

Feature avg pooling

Conv1D

Convolutional Neural Networks for Sentence Classification

- Yoon kim (2014)
- CNN을 이용한 classification 모델
- 간단한 모델이면서도 좋은 성능을 냄

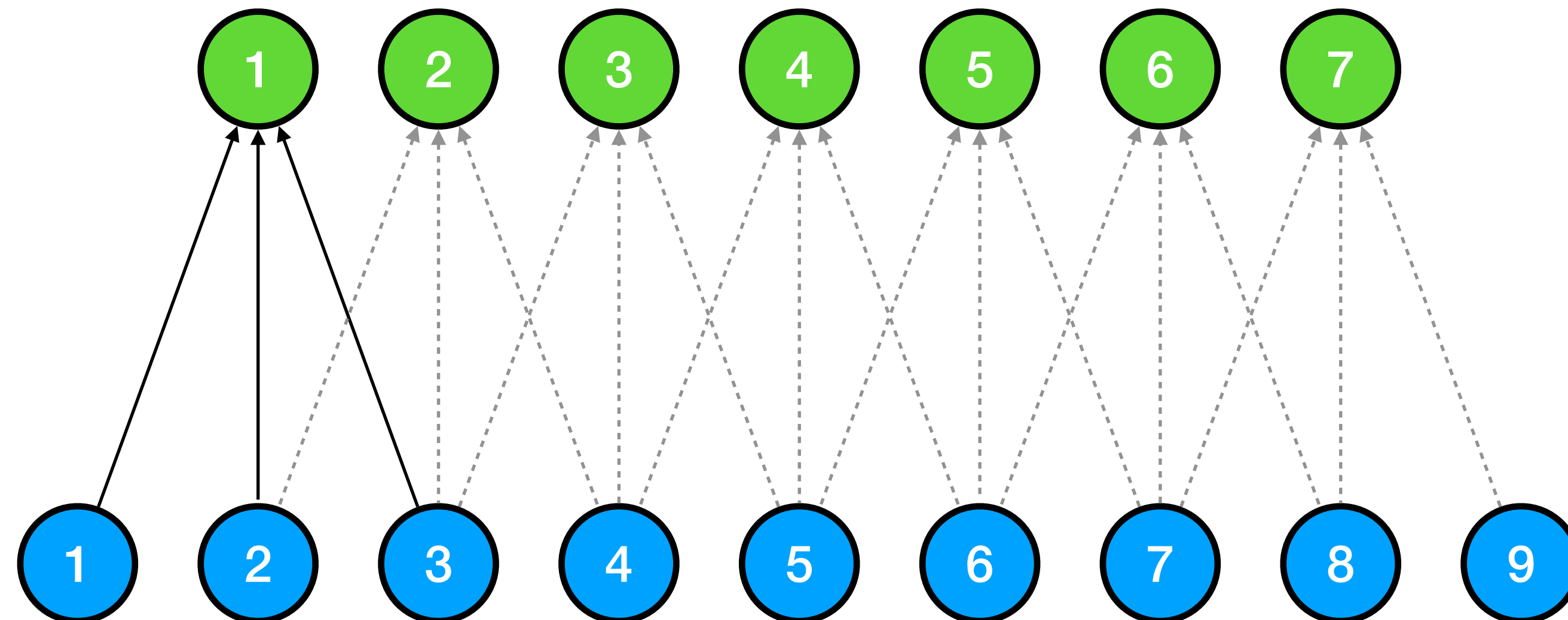


Conv1D (padding)

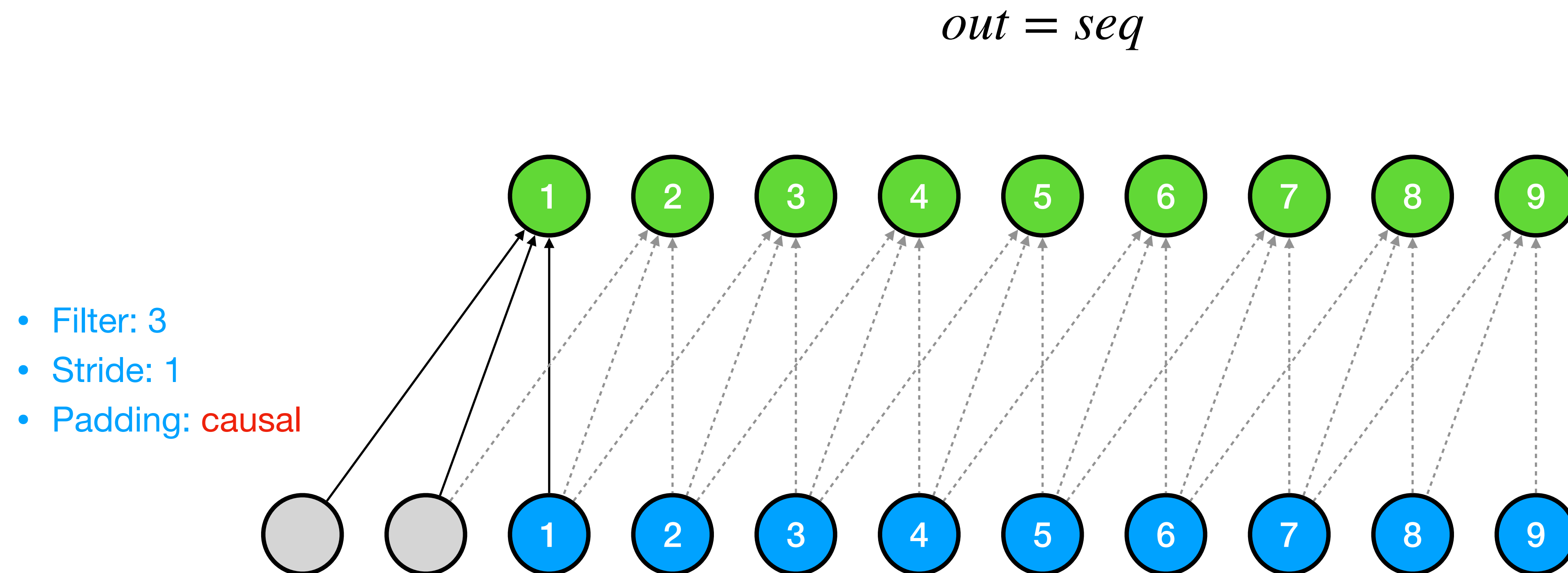
$$\text{window} = \text{filter}$$

$$\text{out} = \text{seq} - \text{window} + 1$$

- Filter: 3
- Stride: 1
- Padding: **valid**



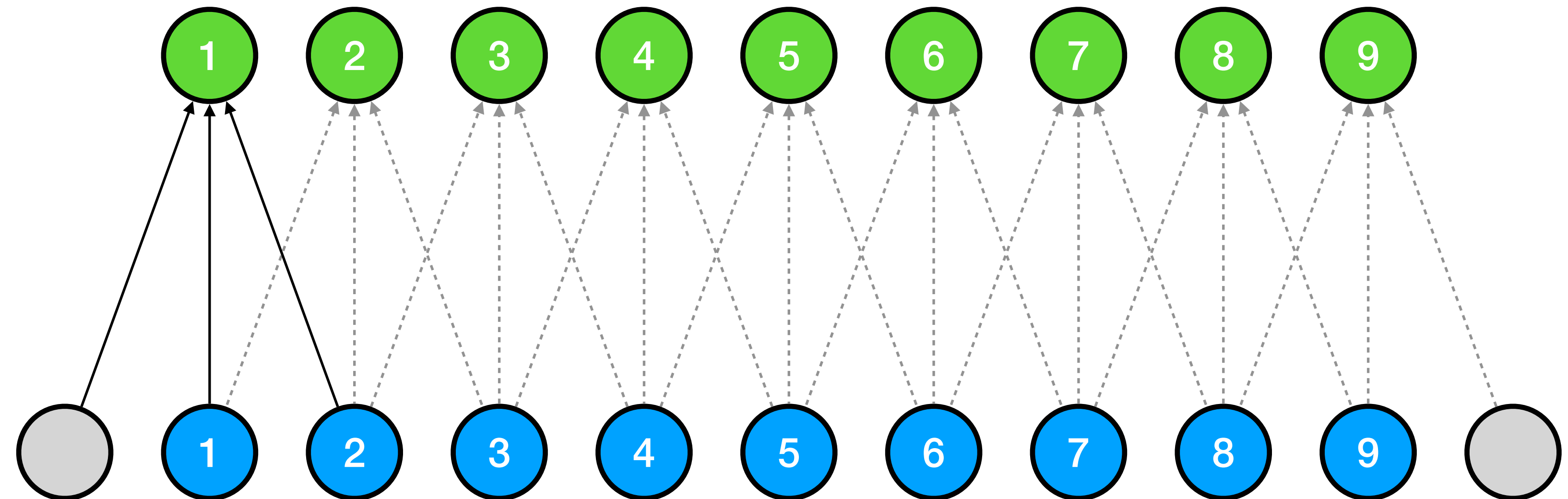
Conv1D (padding)



Conv1D (padding)

$out = seq$

- Filter: 3
- Stride: 1
- Padding: same

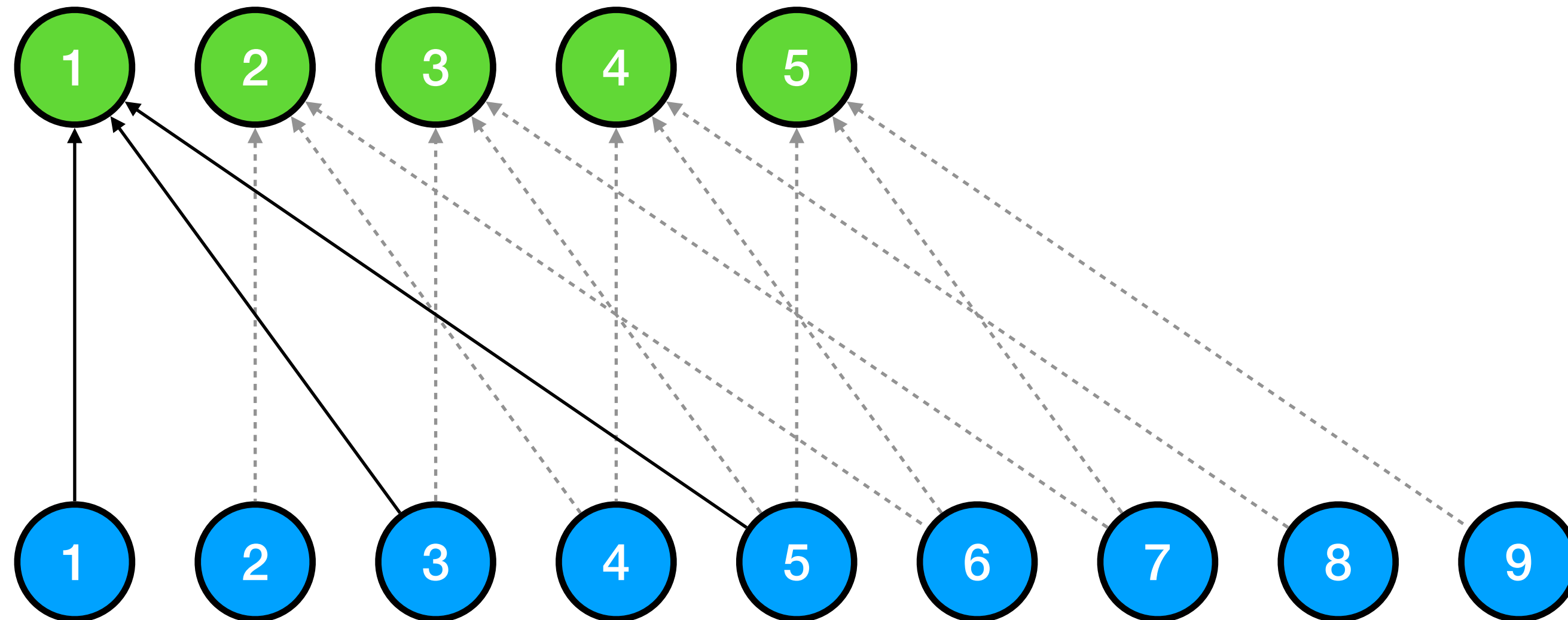


Conv1D (padding)

$$window = filter + (filter - 1) \times (dilation - 1)$$

$$out = seq - window + 1$$

- Filter: 3
- Stride: 1
- Padding: valid
- Dilation: 2



감사합니다.