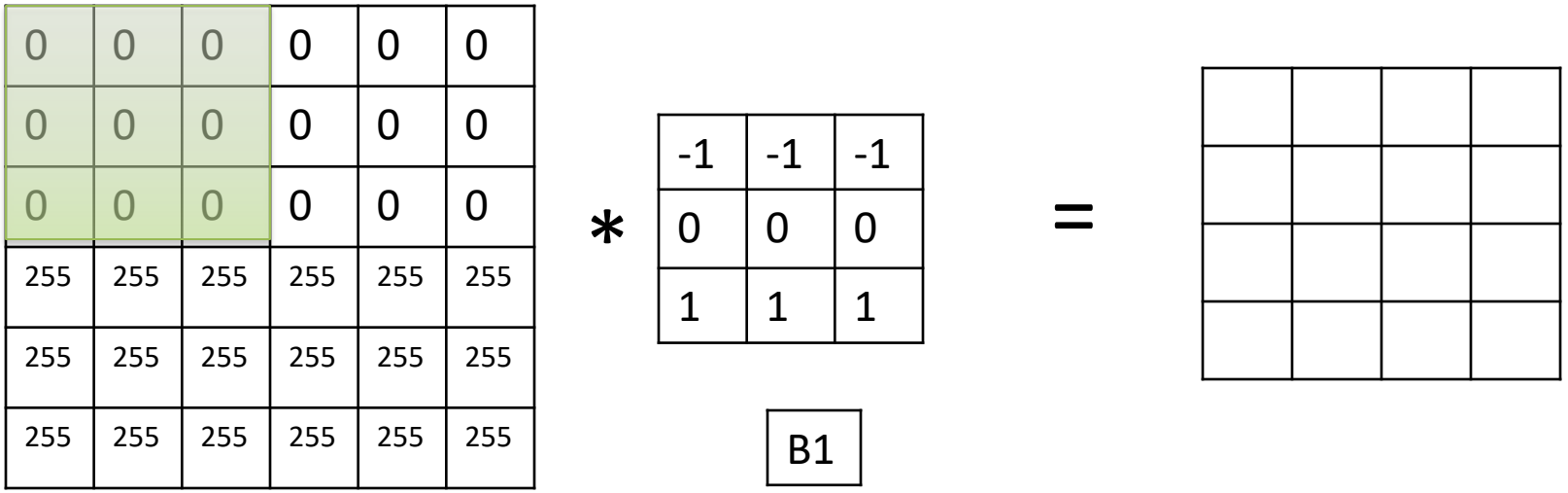
CNN weights & Baises

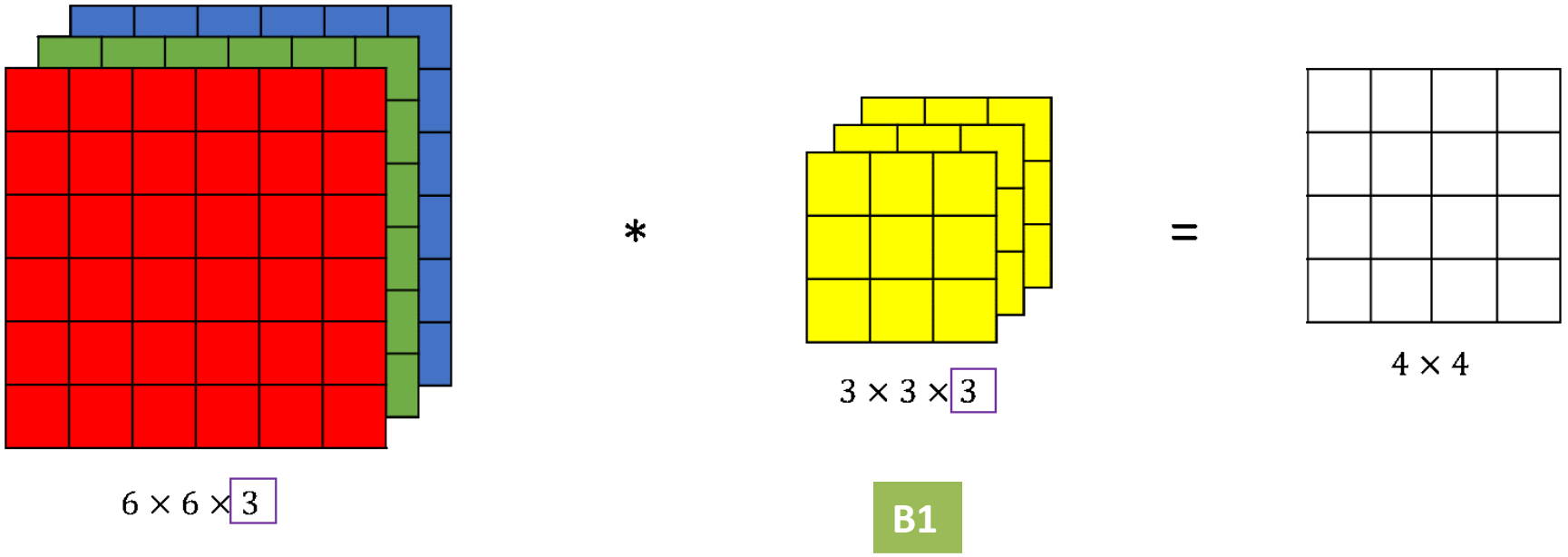
MUKESH KUMAR



3X3 filter will have 9 weights and 1 bias

```
Weights: [w1, w2, w3,
          w4, w5, w6,
          w7, w8, w9]
Bias: b1
```

$$y = \left(\sum_{i=0}^{2} \sum_{j=0}^{2} w_{ij} \cdot x_{ij} \right) + b$$



- 3X3X3 filter will have 27 weights and 1 bias

- For Red channel:

$$W_{\text{Red}} = \begin{bmatrix} w_{r00} & w_{r01} & w_{r02} \\ w_{r10} & w_{r11} & w_{r12} \\ w_{r20} & w_{r21} & w_{r22} \end{bmatrix}$$

- For Blue channel:

$$W_{\text{Blue}} = \begin{bmatrix} w_{b00} & w_{b01} & w_{b02} \\ w_{b10} & w_{b11} & w_{b12} \\ w_{b20} & w_{b21} & w_{b22} \end{bmatrix}$$

- For Green channel:

$$W_{\text{Green}} = \begin{bmatrix} w_{g00} & w_{g01} & w_{g02} \\ w_{g10} & w_{g11} & w_{g12} \\ w_{g20} & w_{g21} & w_{g22} \end{bmatrix}$$

The convolution result for the filter at one position is calculated as:

$$\text{Output} = \left(\sum_{i=0}^{2} \sum_{j=0}^{2} w_{r_{ij}} \cdot i_{r_{ij}} + \sum_{i=0}^{2} \sum_{j=0}^{2} w_{g_{ij}} \cdot i_{g_{ij}} + \sum_{i=0}^{2} \sum_{j=0}^{2} w_{b_{ij}} \cdot i_{b_{ij}} \right) + b$$

- Dropout
- Batch normalization
- Pooling output size calculations
- Non-trainable parameters