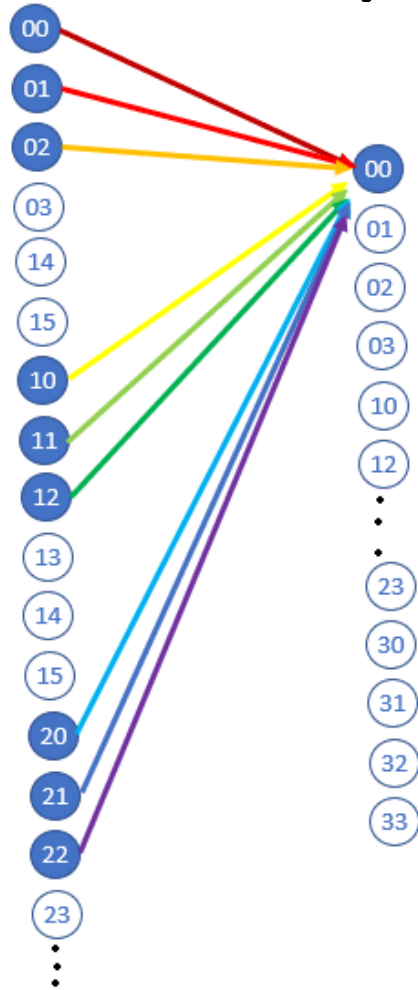
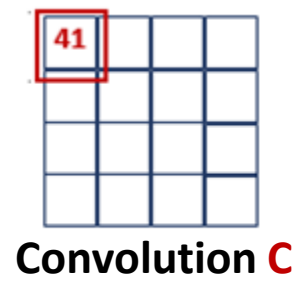


CNN – Sparsely Connected Network



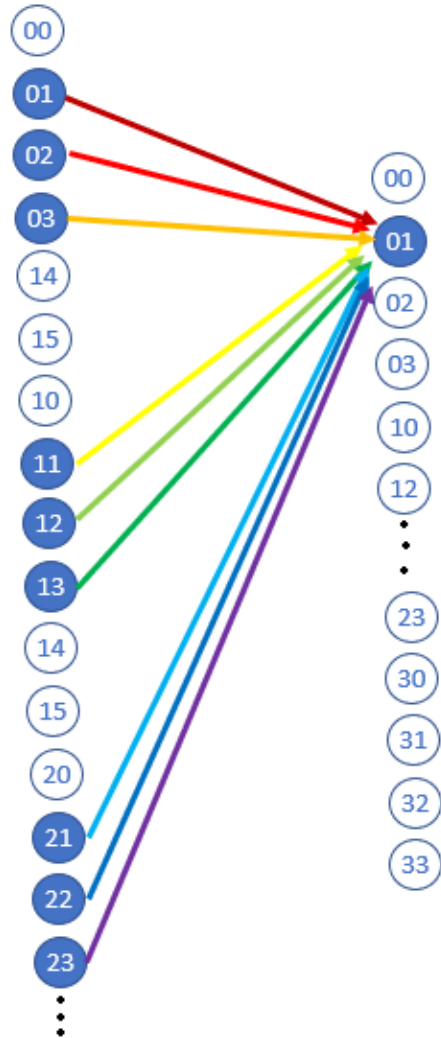
5	6	7	5	6	7
6	7	8	6	7	8
7	8	9	7	8	9
5	6	7	5	6	7
6	7	8	6	7	8
7	8	9	7	8	9

Input Matrix A



$$\begin{aligned}
 C_{00} &= A_{00}F_{00} + A_{01}F_{01} + A_{02}F_{02} + A_{10}F_{10} + A_{11}F_{11} + A_{12}F_{12} + A_{20}F_{20} \\
 &\quad + A_{21}F_{21} + A_{22}F_{22}
 \end{aligned}$$

CNN – Sparsely Connected Network



5	6	7	5	6	7
6	7	8	6	7	8
7	8	9	7	8	9
5	6	7	5	6	7
6	7	8	6	7	8
7	8	9	7	8	9

Input Matrix **A**



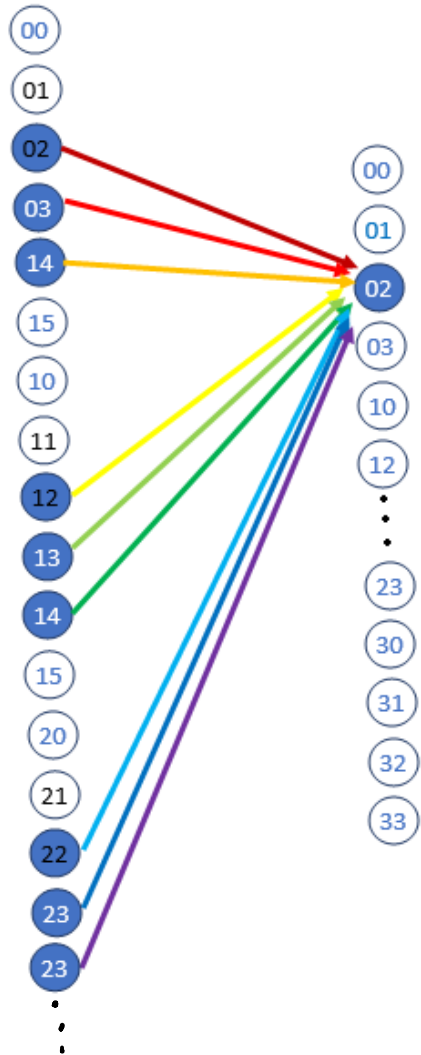
Filter **F**

41	44		

Convolution **C**

$$\begin{aligned}
 C_{01} &= A_{01}F_{00} + A_{02}F_{01} + A_{03}F_{02} + A_{11}F_{10} + A_{12}F_{11} + A_{13}F_{12} \\
 &+ A_{21}F_{20} + A_{22}F_{21} + A_{23}F_{22}
 \end{aligned}$$

CNN – Sparsely Connected Network

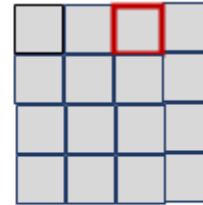


5	6	7	5	6	7
6	7	8	6	7	8
7	8	9	7	8	9
5	6	7	5	6	7
6	7	8	6	7	8
7	8	9	7	8	9

Input Matrix **A**



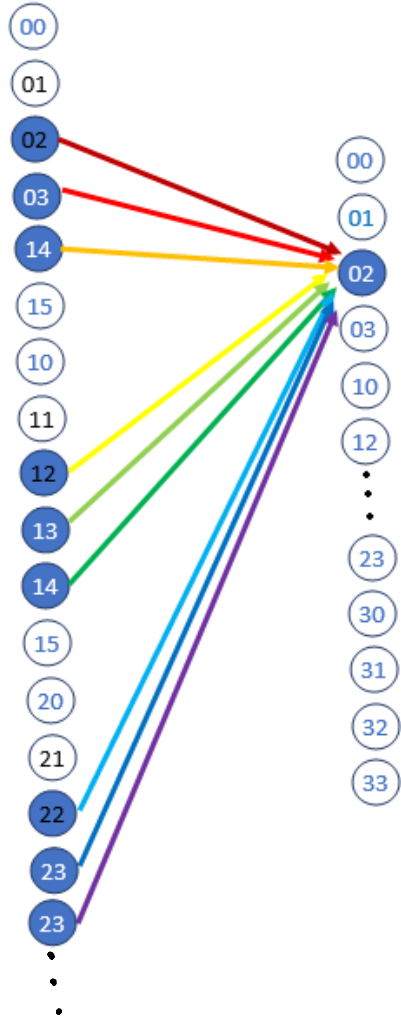
Filter **F**



Convolution **C**

$$\begin{aligned}
 C_{02} &= A_{02}F_{00} + A_{03}F_{01} + A_{04}F_{02} + A_{12}F_{10} + A_{13}F_{11} + A_{14}F_{12} \\
 &+ A_{22}F_{20} + A_{23}F_{21} + A_{24}F_{22}
 \end{aligned}$$

CNN – Sparsely Connected Network

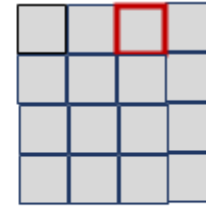


5	6	7	5	6	7
6	7	8	6	7	8
7	8	9	7	8	9
5	6	7	5	6	7
6	7	8	6	7	8
7	8	9	7	8	9

Input Matrix **A**



Filter **F**



Convolution **C**

So, CNN is a sparsely connected MLP

Parameters – Filters Define the Parameters

5	6	7	5	6	7
6	7	8	6	7	8
7	8	9	7	8	9
5	6	7	5	6	7
6	7	8	6	7	8
7	8	9	7	8	9



41		

$$C_{00} = A_{00}F_{00} + A_{01}F_{01} + A_{02}F_{02} + A_{10}F_{10} + A_{11}F_{11} + A_{12}F_{12} + A_{20}F_{20} + A_{21}F_{21} + A_{22}F_{22}$$

5	6	7	5	6	7
6	7	8	6	7	8
7	8	9	7	8	9
5	6	7	5	6	7
6	7	8	6	7	8
7	8	9	7	8	9



41	44	

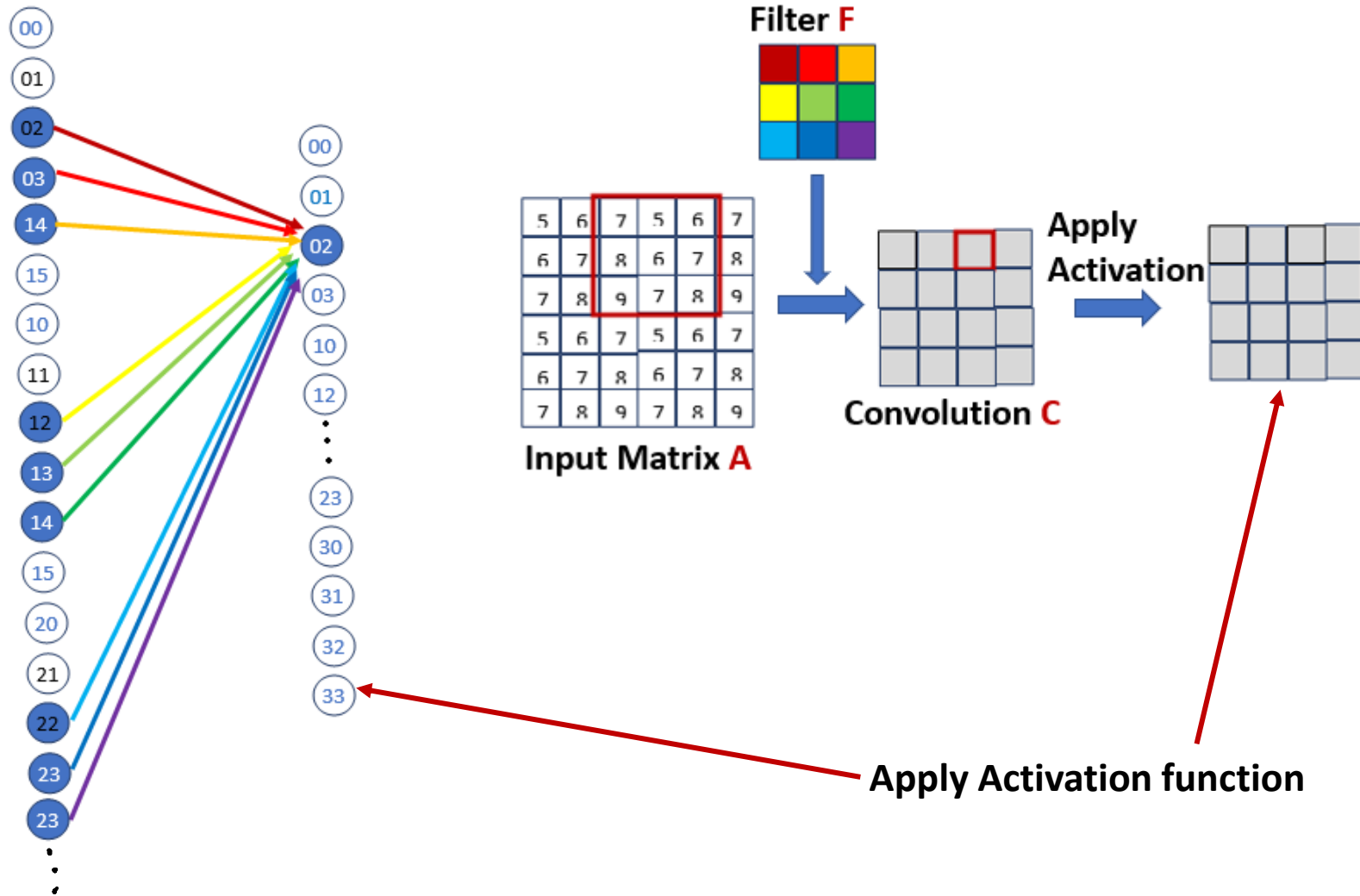
$$C_{01} = A_{01}F_{00} + A_{02}F_{01} + A_{03}F_{02} + A_{11}F_{10} + A_{12}F_{11} + A_{13}F_{12} + A_{21}F_{20} + A_{22}F_{21} + A_{23}F_{22}$$

5	6	7	5	6	7
6	7	8	6	7	8
7	8	9	7	8	9
5	6	7	5	6	7
6	7	8	6	7	8
7	8	9	7	8	9

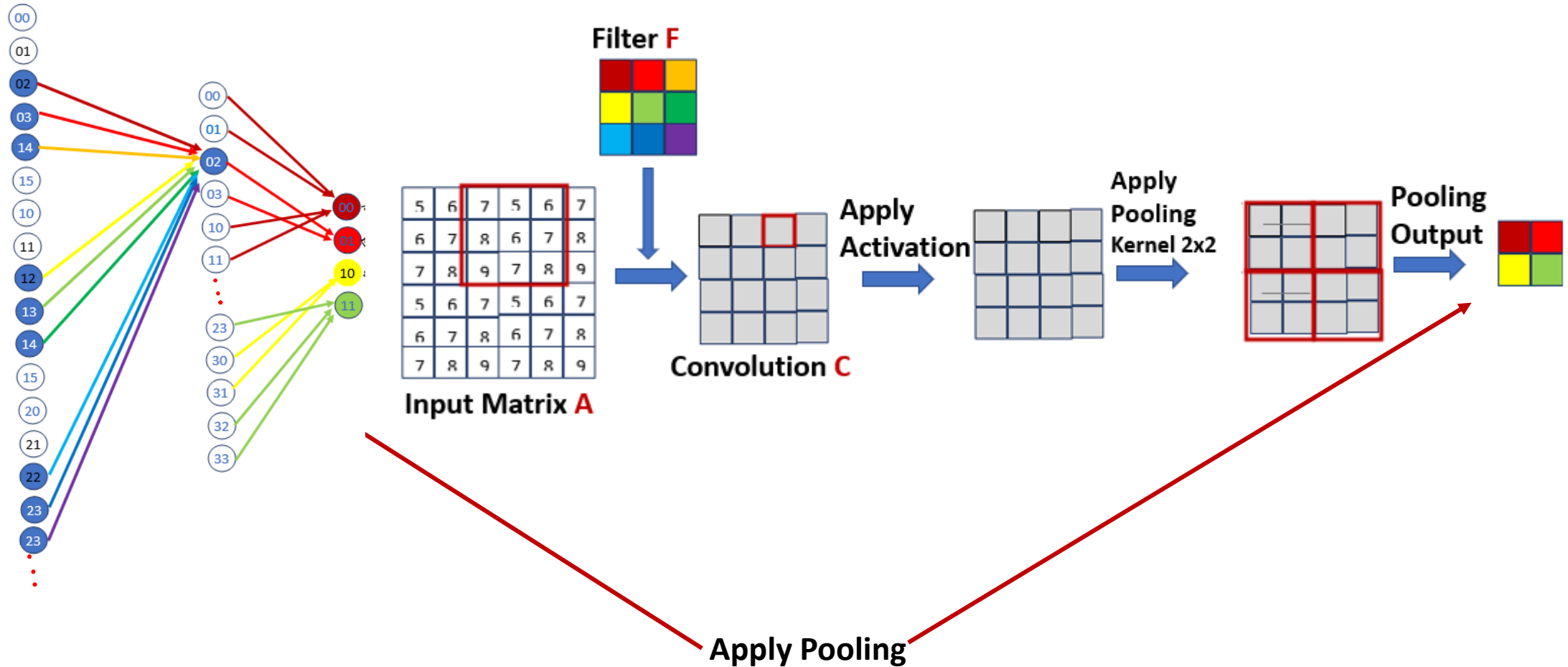


$$C_{02} = A_{02}F_{00} + A_{03}F_{01} + A_{04}F_{02} + A_{12}F_{10} + A_{13}F_{11} + A_{14}F_{12} + A_{22}F_{20} + A_{23}F_{21} + A_{24}F_{22}$$

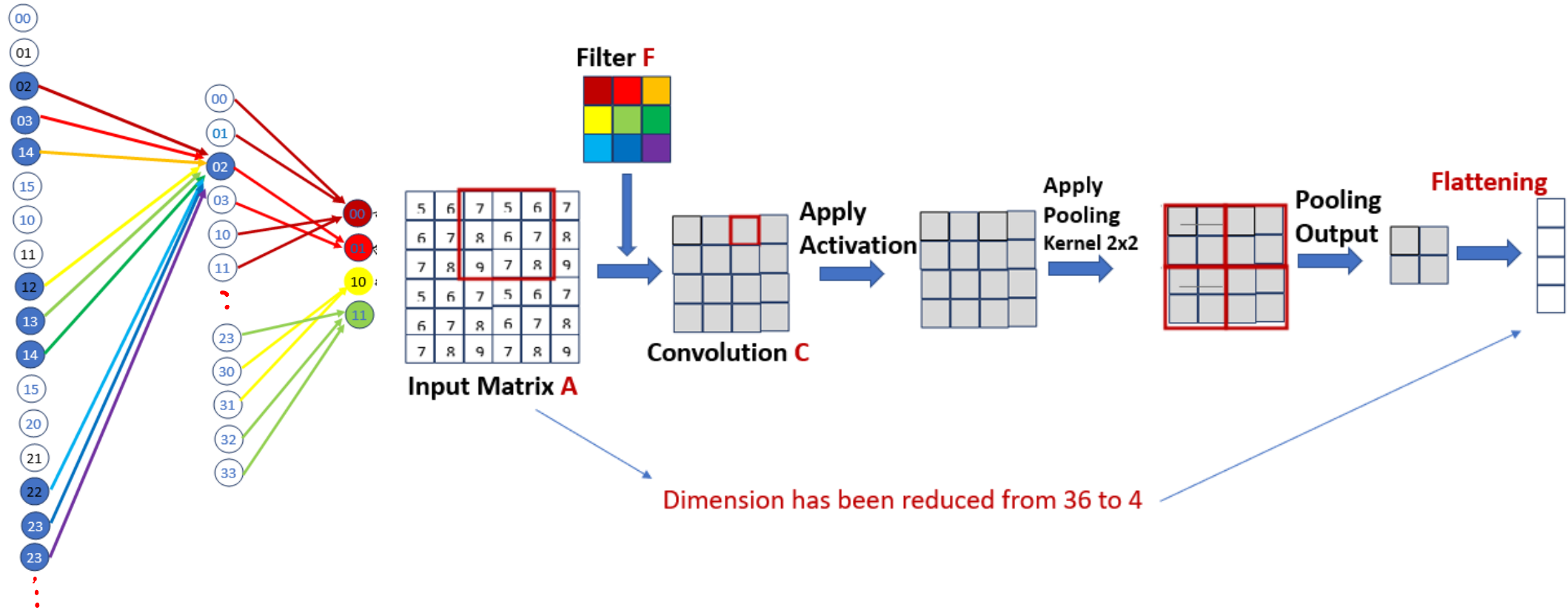
CNN – Sparsely Connected Network



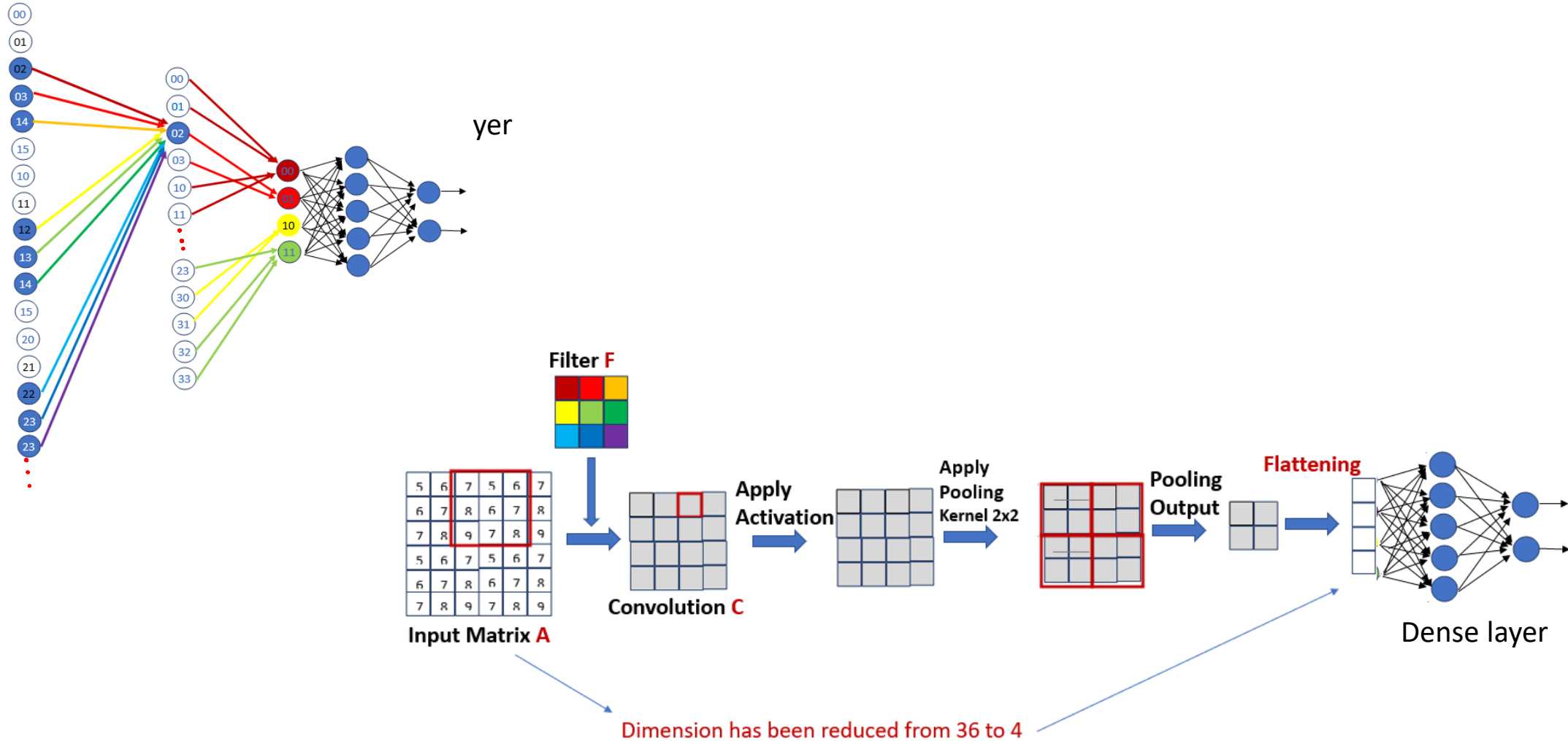
CNN – Sparsely Connected Network



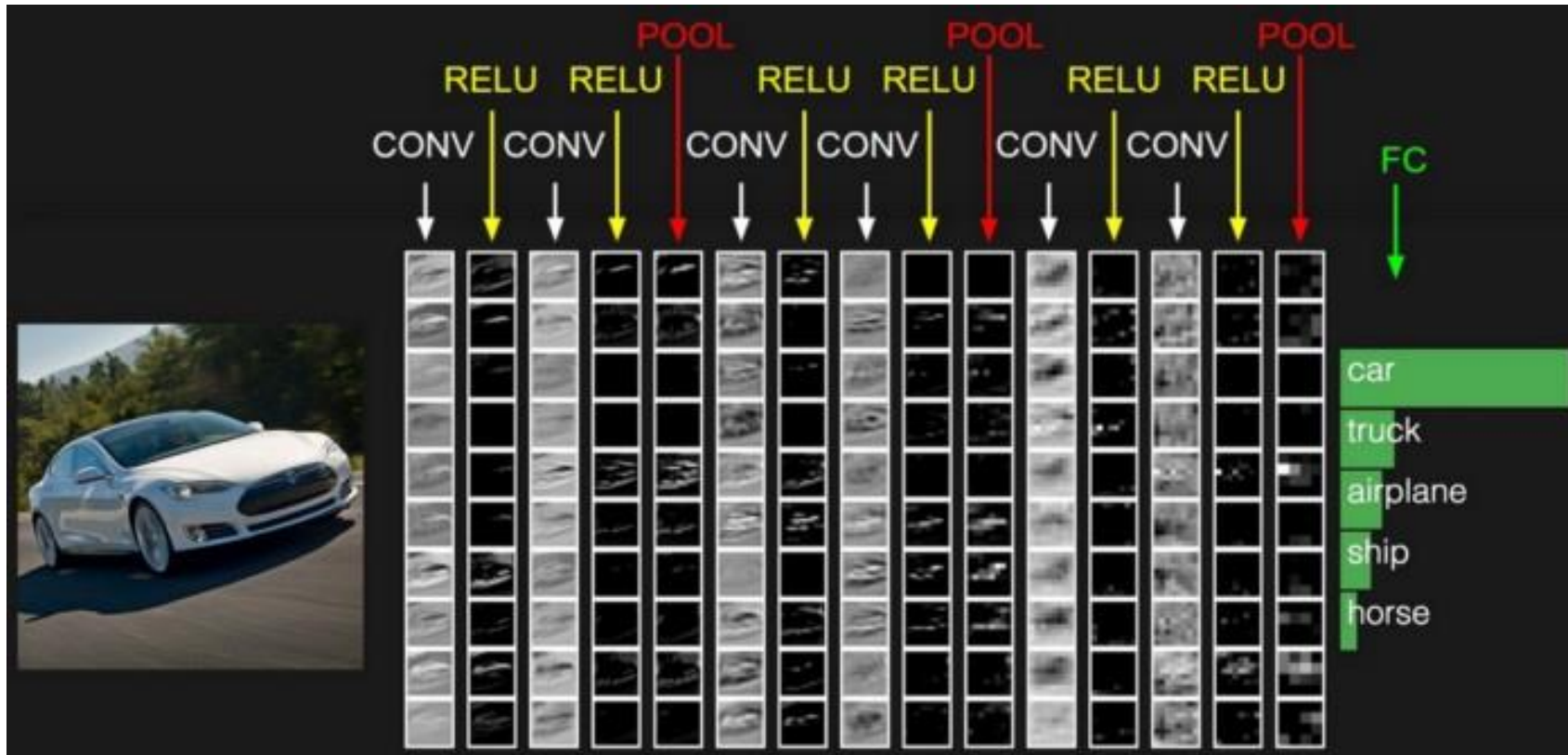
CNN – Sparsely Connected Network



CNN – Dimension Reduction



Example



Source: http://cs231n.stanford.edu/slides/2017/cs231n_2017_lecture6.pdf