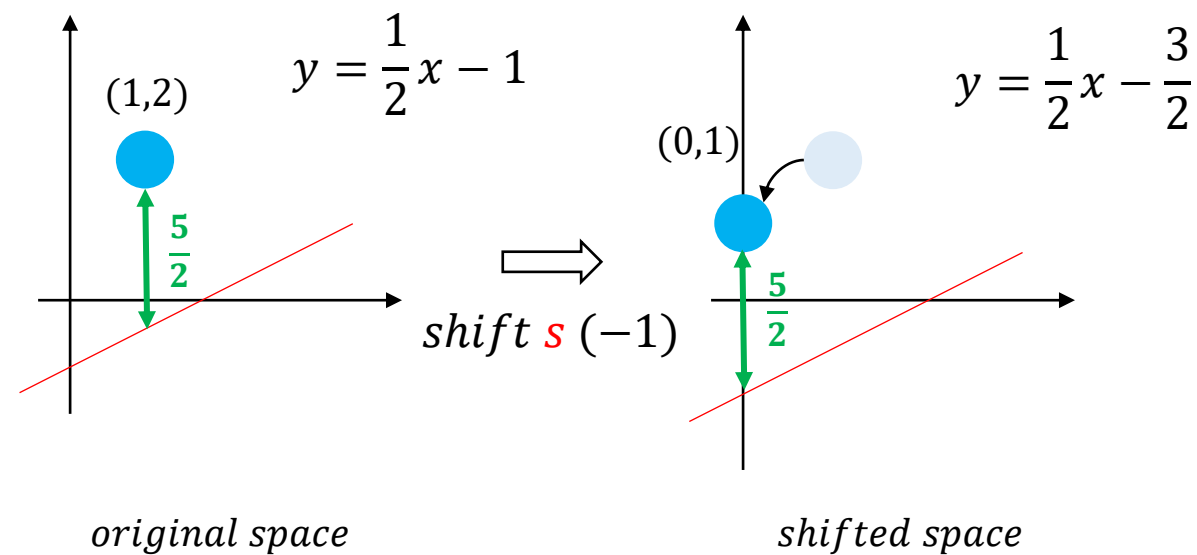


*CNN itself is not shift invariant  
before pooling layer*

(a) CNN on image data



$$x = \begin{bmatrix} 1 \\ 2 \end{bmatrix} \quad W = \begin{bmatrix} -\frac{1}{2} \\ 1 \end{bmatrix} \quad b = 1$$

$$x' = \begin{bmatrix} 0 \\ 1 \end{bmatrix} \quad \textcolor{red}{s} = \begin{bmatrix} -1 \\ -1 \end{bmatrix} \quad W = \begin{bmatrix} -\frac{1}{2} \\ 1 \end{bmatrix}$$

$$b' = \textcolor{red}{-sW} + b = \frac{3}{2}$$

*bias correction  
for shifting*

$$xW + b = \frac{5}{2}$$

$$x'W + b' = \frac{5}{2}$$

(b) Flipped GNN