1 Translating kronecker into dot-product operations

$$\begin{bmatrix} 5 & 2 \\ 1 & -1 \\ 0 & 3 \end{bmatrix} \otimes \begin{bmatrix} 7 & 2 \\ 3 & -1 \end{bmatrix} = \begin{bmatrix} 35 & 10 & 14 & 4 \\ 15 & -5 & 6 & -2 \\ 7 & 2 & -7 & -2 \\ 3 & -1 & -3 & 1 \\ 0 & 0 & 21 & 6 \\ 0 & 0 & 9 & -3 \end{bmatrix}$$

could be translated into:

$$\begin{bmatrix} 5 & 0 & 0 & 0 & 0 & 0 \\ 0 & 5 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix} * \begin{bmatrix} 7 & 2 & 0 & 0 \\ 3 & -1 & 0 & 0 \\ 7 & 2 & 0 & 0 \\ 3 & -1 & 0 & 0 \\ 7 & 2 & 0 & 0 \\ 3 & -1 & 0 & 0 \end{bmatrix} = \begin{bmatrix} 35 & 10 & 0 & 0 \\ 15 & -5 & 0 & 0 \\ 7 & 2 & 0 & 0 \\ 3 & -1 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

$$\begin{bmatrix} 2 & 0 & 0 & 0 & 0 & 0 \\ 0 & 2 & 0 & 0 & 0 & 0 \\ 0 & 0 & -1 & 0 & 0 & 0 \\ 0 & 0 & 0 & -1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 3 & 0 \\ 0 & 0 & 0 & 0 & 0 & 3 \end{bmatrix} * \begin{bmatrix} 0 & 0 & 7 & 2 \\ 0 & 0 & 3 & -1 \\ 0 & 0 & 7 & 2 \\ 0 & 0 & 3 & -1 \\ 0 & 0 & 7 & 2 \\ 0 & 0 & 3 & -1 \end{bmatrix} = \begin{bmatrix} 0 & 0 & 14 & 4 \\ 0 & 0 & 6 & -2 \\ 0 & 0 & -7 & -2 \\ 0 & 0 & -3 & 1 \\ 0 & 0 & 21 & 6 \\ 0 & 0 & 9 & -3 \end{bmatrix}$$

$$\begin{bmatrix} 35 & 10 & 0 & 0 \\ 15 & -5 & 0 & 0 \\ 7 & 2 & 0 & 0 \\ 3 & -1 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix} + \begin{bmatrix} 0 & 0 & 14 & 4 \\ 0 & 0 & 6 & -2 \\ 0 & 0 & -7 & -2 \\ 0 & 0 & -3 & 1 \\ 0 & 0 & 21 & 6 \\ 0 & 0 & 9 & -3 \end{bmatrix} = \begin{bmatrix} 35 & 10 & 14 & 4 \\ 15 & -5 & 6 & -2 \\ 7 & 2 & -7 & -2 \\ 3 & -1 & -3 & 1 \\ 0 & 0 & 21 & 6 \\ 0 & 0 & 9 & -3 \end{bmatrix}$$

2 Translating kathri-rao into dot-product operations

$$\begin{bmatrix} 5 & 2 \\ 1 & -1 \\ 0 & 3 \end{bmatrix} \text{ krao } \begin{bmatrix} 7 & 2 \\ 3 & -1 \end{bmatrix} = \begin{bmatrix} 35 & 4 \\ 15 & -2 \\ 7 & -2 \\ 3 & 1 \\ 0 & 6 \\ 0 & -3 \end{bmatrix}$$

$$\begin{bmatrix} 5 & 0 & 0 & 0 & 0 & 0 \\ 0 & 5 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix} * \begin{bmatrix} 7 & 0 \\ 3 & 0 \\ 7 & 0 \\ 3 & 0 \\ 7 & 0 \\ 3 & 0 \end{bmatrix} = \begin{bmatrix} 35 & 0 \\ 15 & 0 \\ 7 & 0 \\ 3 & 0 \\ 0 & 0 \\ 0 & 0 \end{bmatrix}$$

$$\begin{bmatrix} 2 & 0 & 0 & 0 & 0 & 0 \\ 0 & 2 & 0 & 0 & 0 & 0 \\ 0 & 0 & -1 & 0 & 0 & 0 \\ 0 & 0 & 0 & -1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 3 & 0 \\ 0 & 0 & 0 & 0 & 0 & 3 \end{bmatrix} * \begin{bmatrix} 0 & 2 \\ 0 & -1 \\ 0 & 2 \\ 0 & -1 \\ 0 & 2 \\ 0 & -1 \end{bmatrix} = \begin{bmatrix} 0 & 4 \\ 0 & -2 \\ 0 & -2 \\ 0 & 1 \\ 0 & 6 \\ 0 & -3 \end{bmatrix}$$

$$\begin{bmatrix} 35 & 0 \\ 15 & 0 \\ 7 & 0 \\ 3 & 0 \\ 0 & 0 \\ 0 & 0 \end{bmatrix} + \begin{bmatrix} 0 & 4 \\ 0 & -2 \\ 0 & -2 \\ 0 & 1 \\ 0 & 6 \\ 0 & -3 \end{bmatrix} = \begin{bmatrix} 35 & 4 \\ 15 & -2 \\ 7 & -2 \\ 3 & 1 \\ 0 & 6 \\ 0 & -3 \end{bmatrix}$$

3 Translating hadamard into dot-product operations

$$\begin{bmatrix} 5 & 2 \\ 1 & -1 \\ 0 & 3 \end{bmatrix} \text{ hadamard } \begin{bmatrix} 7 & 2 \\ 3 & -1 \\ 0 & 0 \end{bmatrix} = \begin{bmatrix} 35 & 4 \\ 3 & 1 \\ 0 & 0 \end{bmatrix}$$

$$\begin{bmatrix} 5 & 2 \\ 1 & -1 \\ 0 & 3 \end{bmatrix} * \begin{bmatrix} 7 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix} = \begin{bmatrix} 35 & 0 \\ 0 & 0 \\ 0 & 0 \end{bmatrix}$$

$$\begin{bmatrix} 5 & 2 \\ 1 & -1 \\ 0 & 3 \end{bmatrix} * \begin{bmatrix} 0 & 0 & 0 \\ 2 & 0 & 0 \end{bmatrix} = \begin{bmatrix} 0 & 4 \\ 0 & 0 \\ 0 & 0 \end{bmatrix}$$

$$\begin{bmatrix} 5 & 2 \\ 1 & -1 \\ 0 & 3 \end{bmatrix} * \begin{bmatrix} 0 & 3 & 0 \\ 0 & 0 & 0 \end{bmatrix} = \begin{bmatrix} 0 & 0 \\ 3 & 0 \\ 0 & 0 \end{bmatrix}$$

$$\begin{bmatrix} 5 & 2 \\ 1 & -1 \\ 0 & 3 \end{bmatrix} * \begin{bmatrix} 0 & 0 & 0 \\ 0 & -1 & 0 \end{bmatrix} = \begin{bmatrix} 0 & 0 \\ 0 & 1 \\ 0 & 0 \end{bmatrix}$$

$$\begin{bmatrix} 5 & 2 \\ 1 & -1 \\ 0 & 3 \end{bmatrix} * \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix} = \begin{bmatrix} 0 & 0 \\ 0 & 0 \\ 0 & 0 \end{bmatrix}$$

$$\begin{bmatrix} 5 & 2 \\ 1 & -1 \\ 0 & 3 \end{bmatrix} * \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix} = \begin{bmatrix} 0 & 0 \\ 0 & 0 \\ 0 & 0 \end{bmatrix}$$

$$\begin{bmatrix} 35 & 0 \\ 0 & 0 \\ 0 & 0 \end{bmatrix} + \begin{bmatrix} 0 & 4 \\ 0 & 0 \\ 0 & 0 \end{bmatrix} + \begin{bmatrix} 0 & 0 \\ 3 & 0 \\ 0 & 0 \end{bmatrix} + \begin{bmatrix} 0 & 0 \\ 0 & 1 \\ 0 & 0 \end{bmatrix} + \begin{bmatrix} 0 & 0 \\ 0 & 0 \\ 0 & 0 \end{bmatrix} + \begin{bmatrix} 0 & 0 \\ 0 & 0 \\ 0 & 0 \end{bmatrix} = \begin{bmatrix} 35 & 4 \\ 3 & 1 \\ 0 & 0 \end{bmatrix}$$