SPM Problem Formulation

Tajung Jang

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1 Model Formulation

1.1 Constraints

Let $N := \{n \mid n$ represents a tensor ID used in the DNN graph$\}$
Let $K := \{k \mid k$ represents a scratchpad ID$\}$
Let $M := \{m \mid m$ represents an operation in the DNN graph$\}$
Let $S := \{s \mid$ where S_n represents the size of tensor$_n \in N\}$
Let $Q := \{q \mid$ where Q_k represents the size of Scratchpad$_k \in K\}$

$x_{nkm} = 1$ represents a tensor n that occupies scratchpad k at operation m.

$$x_{nkm} \in \{0,1\} \forall n, k, m$$

- All necessary input and output tensors for a given operation will be present on the SPMs

    Let $A := \{a \mid$ where $A_n = 1$ represents a tensor$_n$ is required as an input or output for operation$_m\}$

$$A_{nm} \in \{0,1\} \forall n, m$$

$$A_{nm} = 1 \implies \sum_{i \in K} x_{nim} = 1$$

- All tensors mapped on an SPM$_k$ must fit on within the given scratchpad space

$\sum_{i \in N} x_{ikm} * s_i \leq q_k \forall m, k$

- Tensors are not mapped before the operation in which they're lifetime begins

Let $B := \{b_n \mid b_n \text{represents the start time for tensor } n\}$

$x_{nmk} = 0 \forall m < B_m$

- Tensors are not mapped after the operation in which they're lifetime ends

Let $E := \{e_n \mid e_n \text{represents time for tensor } n\}$

$x_{nmk} = 0 \forall m > E_m$

1.2   Objective Function