# Analyzer Report {Dataflow}

This report generated by Convolutional Neural Network Inference Analyzer (CNN-IA) to summarize the analysis needed to reach the optimal dataflow exploration for mlp_fc3_batch16 using restricted schedule space.

## Memory Architecture:

|  | L0 | L1 | L2 |
|---|---|---|---|
| **Capacity** | 16 | 16384 | 536870912 |
| **Access cost** | 0.05 | 3.84 | 200.0 |
| **Static cost** | 0.0 | 0.0 | 0.0 |
| **Parallel count** | 256 | 1 | 1 |
| **Parallel mode** | 1 | 0 | 0 |
| **Parallel cost** | 2.0 | 0.0 | 0.0 |

| | |
|---|---|
| **Precision** | : 16 |
| **Minimum utilization** | : 0.0% |
| **Outputs can be buffered by MAC** | : 0 |
| **Replication to improve utilization** | : True |

## Glossary:

- Memory Levels : ( L0, L1, L2 )
  The smallest index the nearest to CPU.

- Loop Notations : ( FX, FY, OX, OY, OC, IC, ON )

| | | |
|---|---|---|
| **FX** | : | FILTER WIDTH |
| **FY** | : | FILTER HEIGHT |
| **OX** | : | OUTPUT WIDTH |
| **OY** | : | OUTPUT HEIGHT |
| **OC** | : | OUTPUT CHANNEL |
| **IC** | : | INPUT CHANNEL |
| **ON** | : | BATCH |

## OC, IC

[cost: 33050440.0pJ, utilization: 0.09765625%]

# Loop Blocking (factors):

|      | L0  | L1   | L2   |
| ---- | --- | ---- | ---- |
| FX   | 1.0 | 1.0  | 1.0  |
| FY   | 1.0 | 1.0  | 1.0  |
| OX   | 1.0 | 1.0  | 1.0  |
| OY   | 1.0 | 1.0  | 1.0  |
| OC   | 2.0 | 1.0  | 25.0 |
| IC   | 4.0 | 25.0 | 1.0  |
| ON   | 1.0 | 16.0 | 1.0  |

# Loop Partitioning (units):

|      | L0  | L1  | L2  |
| ---- | --- | --- | --- |
| FX   | 1.0 | 1.0 | 1.0 |
| FY   | 1.0 | 1.0 | 1.0 |
| OX   | 1.0 | 1.0 | 1.0 |
| OY   | 1.0 | 1.0 | 1.0 |
| OC   | 5.0 | 1.0 | 1.0 |
| IC   | 5.0 | 1.0 | 1.0 |
| ON   | 1.0 | 1.0 | 1.0 |

# Loop Ordering (from the innermost):

|      | L0  | L1  | L2  |
| ---- | --- | --- | --- |
| FX   | 6.0 | 6.0 | 6.0 |
| FY   | 6.0 | 6.0 | 6.0 |
| OX   | 6.0 | 6.0 | 6.0 |
| OY   | 6.0 | 6.0 | 6.0 |
| OC   | 0.0 | 6.0 | 0.0 |
| IC   | 1.0 | 1.0 | 6.0 |
| ON   | 6.0 | 0.0 | 6.0 |

## OC, ON      [cost: 32071160.0pJ, utilization: 0.078125%]

# Loop Blocking (factors):

|     | L0    | L1    | L2    |
|-----|-------|-------|-------|
| FX  | 1.0   | 1.0   | 1.0   |
| FY  | 1.0   | 1.0   | 1.0   |
| OX  | 1.0   | 1.0   | 1.0   |
| OY  | 1.0   | 1.0   | 1.0   |
| OC  | 2.0   | 1.0   | 25.0  |
| IC  | 1.0   | 500.0 | 1.0   |
| ON  | 4.0   | 1.0   | 1.0   |

# Loop Partitioning (units):

|     | L0    | L1    | L2    |
|-----|-------|-------|-------|
| FX  | 1.0   | 1.0   | 1.0   |
| FY  | 1.0   | 1.0   | 1.0   |
| OX  | 1.0   | 1.0   | 1.0   |
| OY  | 1.0   | 1.0   | 1.0   |
| OC  | 5.0   | 1.0   | 1.0   |
| IC  | 1.0   | 1.0   | 1.0   |
| ON  | 4.0   | 1.0   | 1.0   |

# Loop Ordering (from the innermost):

|     | L0    | L1    | L2    |
|-----|-------|-------|-------|
| FX  | 6.0   | 6.0   | 6.0   |
| FY  | 6.0   | 6.0   | 6.0   |
| OX  | 6.0   | 6.0   | 6.0   |
| OY  | 6.0   | 6.0   | 6.0   |
| OC  | 0.0   | 6.0   | 0.0   |
| IC  | 6.0   | 0.0   | 6.0   |
| ON  | 1.0   | 6.0   | 6.0   |

| **IC, ON** |
|:---:|

[cost: 32079160.0pJ, utilization: 0.15625%]

# Loop Blocking (factors):

|  | L0 | L1 | L2 |
|---|---|---|---|
| **FX** | 1.0 | 1.0 | 1.0 |
| **FY** | 1.0 | 1.0 | 1.0 |
| **OX** | 1.0 | 1.0 | 1.0 |
| **OY** | 1.0 | 1.0 | 1.0 |
| **OC** | 1.0 | 250.0 | 1.0 |
| **IC** | 4.0 | 1.0 | 25.0 |
| **ON** | 2.0 | 1.0 | 1.0 |

# Loop Partitioning (units):

|  | L0 | L1 | L2 |
|---|---|---|---|
| **FX** | 1.0 | 1.0 | 1.0 |
| **FY** | 1.0 | 1.0 | 1.0 |
| **OX** | 1.0 | 1.0 | 1.0 |
| **OY** | 1.0 | 1.0 | 1.0 |
| **OC** | 1.0 | 1.0 | 1.0 |
| **IC** | 5.0 | 1.0 | 1.0 |
| **ON** | 8.0 | 1.0 | 1.0 |

# Loop Ordering (from the innermost):

|  | L0 | L1 | L2 |
|---|---|---|---|
| **FX** | 6.0 | 6.0 | 6.0 |
| **FY** | 6.0 | 6.0 | 6.0 |
| **OX** | 6.0 | 6.0 | 6.0 |
| **OY** | 6.0 | 6.0 | 6.0 |
| **OC** | 6.0 | 0.0 | 6.0 |
| **IC** | 0.0 | 6.0 | 0.0 |
| **ON** | 1.0 | 6.0 | 6.0 |

## Optimal cost    [b: blocking factor, p: partitioning unit]

**MEM - L2:**
   for ( OC, 25b, 1p )

**MEM - L1:**
   for ( IC, 500b, 1p )

**MEM - L0:**
   for ( ON, 4b, 4p )
     for ( OC, 2b, 5p )
   spatially unrolled loops: (OC)(ON)

## Optimal utilization

**MEM - L2:**
   for ( IC, 25b, 1p )

**MEM - L1:**
  for ( OC, 250b, 1p )

**MEM - L0:**
   for ( ON, 2b, 8p )
     for ( IC, 4b, 5p )
   spatially unrolled loops: (IC)(ON)