Midterm Project Report

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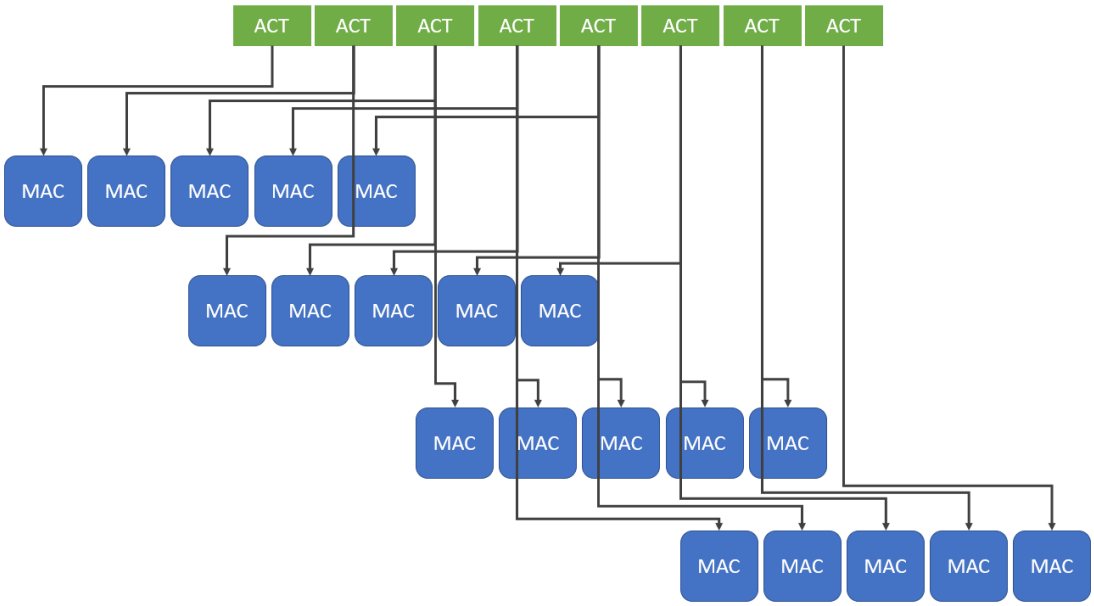
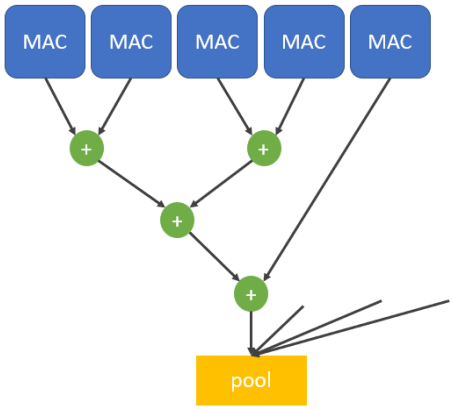
1. Questions (Brief and concise explanation of one to two pages would be enough. You may use Chinese.)
   - How do you design your accelerator? Please draw the FSM and block diagram to explain the overall architecture. (2%)

     Ans:

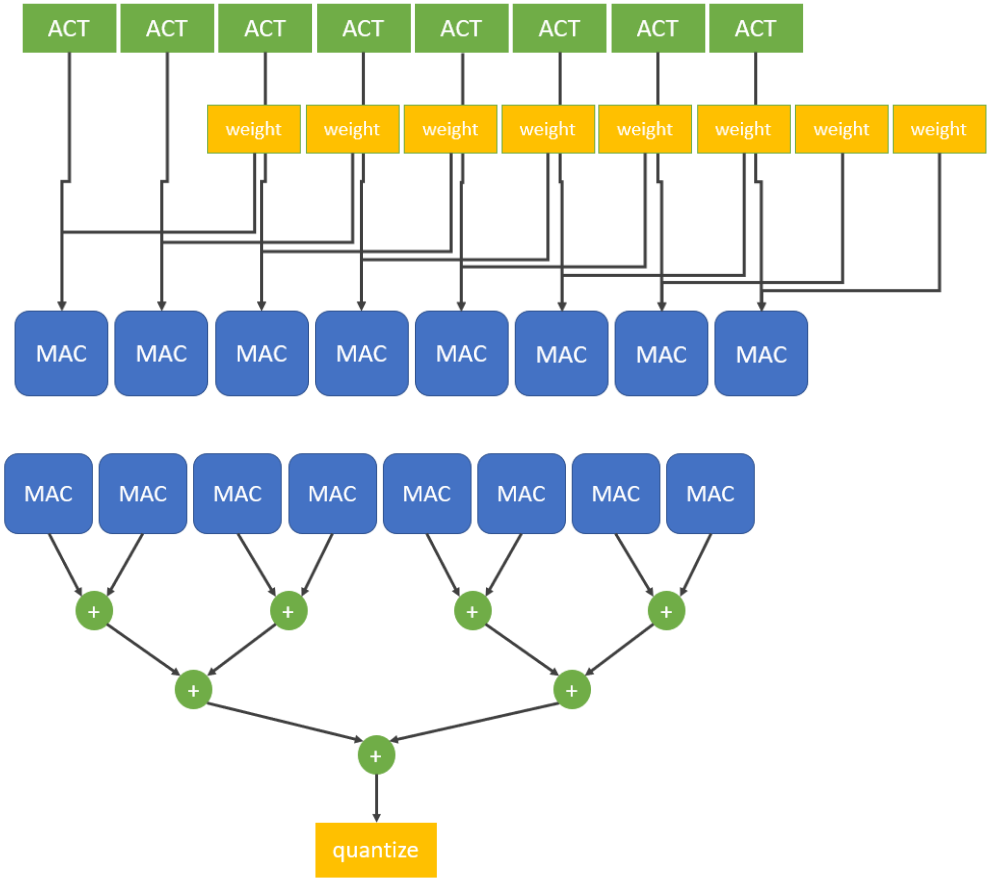
     在 ACC 中我使用了 40 個 MAC 來做運算，在做 convolution 時先 read 八個 data 進到 buffer 裡面，然後分別送到四組 MAC，累加五次算出一個 convolution 的點，下方的圖為四組 MAC，總共要有八組，前四組會做 1~5 列的 activation*mask 的累加，後四組會做 2~6 列的 activation*mask 的累加，



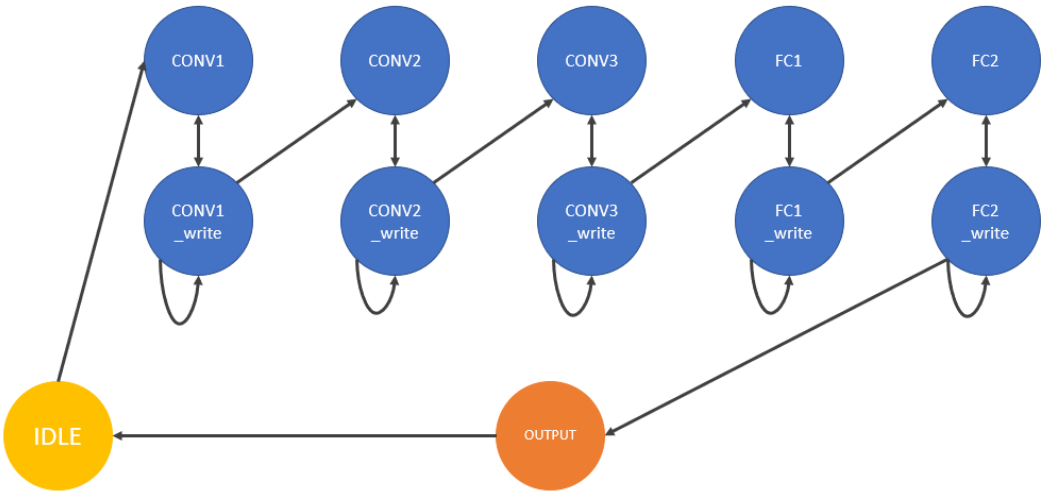
     每一組 MAC 後面有 adder tree 將五個值加總起來，再將四個 result 做 pooling，再 quantize 並存入 write buffer 寫回 sram，



Fully connected layer 時使用八個 MAC

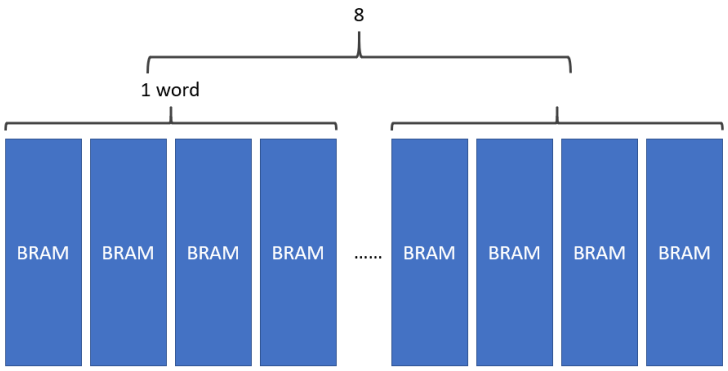


FSM

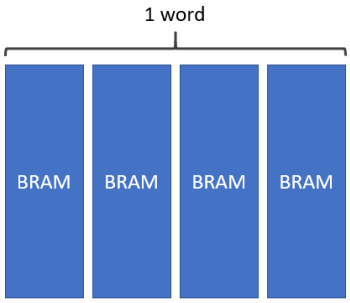


- How do you design your DMA controller interface to transfer data? Please draw the block diagram and FSM. (2%)
  Ans:

- How do you build two SRAMs in this project? Please draw the block diagram.(2%)
  Ans:
  Weight SRAM (32 BRAM)



Activation SRAM (4 BRAM)



- Please briefly explain why we write images from mem[20000] to mem[20255], but read images from address 10000 to address 10127 in the accelerator? (2%)
  Ans:

- What is the function of the following code? (1%)

```
iowrite32(dev, LENET_SCALE_CONV2_REG, scale_CONV2);
iowrite32(dev, LENET_SCALE_CONV3_REG, scale_CONV3);
iowrite32(dev, LENET_SCALE_CONV1_REG, scale_CONV1);
iowrite32(dev, LENET_SCALE_FC2_REG, scale_FC2);
iowrite32(dev, LENET_SCALE_FC1_REG, scale_FC1);
```

  Ans:

  將 lenet.c 裡面設定的 scaling factor 寫入 platform 中的電路裡面，此時可以看到 modelsim 裡的波型 scaling factor 從零轉變為指定的值。

- What is the function of the following code? Please explain line by line (1%)

```
done = 0;
while (!done) {
    done = ioread32(dev, STATUS_REG);
    done &= STATUS_MASK_DONE;
}
iowrite32(dev, CMD_REG, 0x0);
```

Ans:

先將 done 設為零，並進入 while 迴圈，只要 done 依然為零就會不斷執行 while 迴圈，再回圈中會不斷讀取 platform 中 done register 的值，若讀到 1 就會跳出迴圈，代表 accelerator 完成動作。

2. Result

Item	Description	Unit
RTL simulation	PASS: IMAGE,CONV1,CONV2,CONV3 FAIL: FC1,FC2 我發現再從 DMA 從 DRAM 搬 weight 資料到 SRAM 裡的時候，當寫到 address[9:1] = 9’ b111111111 時無法成功寫入資料 sram 裡的 data 還是為 0，來不及找出原因，但這要到 FC1 以後問題才出現，所以還是可以通過 CONV1,2,3。	---

3. Others (optional)
   - Suggestions or comments about this class to teacher or TA.