

1. Goals

Power Savings on a Complex Algorithm

- ◆ What is Sub-Pixel Interpolation?
 - A method used in video compression
 - Helps accurately determine motion vectors
- ◆ Why do we want to save power?
 - Video quality is continuing to rise
 - The method of sub-pixel interpolation is extremely complex (see equations below)
 - The process draws a lot of computational power

$$a_{0,0} = -A_{-3,0} + 4A_{-2,0} - 10A_{-1,0} + 58A_{0,0} + 17A_{1,0} - 5A_{2,0} + A_{3,0}$$

$$h_{0,0} = -A_{-3,0} + 4A_{-2,0} - 11A_{0,-1} + 40A_{0,0} + 40A_{0,1} - 11A_{0,2} + 4A_{0,3} - A_{0,4}$$

$$e_{0,0} = (-a_{0,0} - 3 + 4a_{0,0} - 2 - 10a_{0,0} - 1 + 58a_{0,0} + 17a_{0,1} - 5a_{0,2} + a_{0,3}) \gg 6$$

$$j_{0,0} = (-b_{0,0} - 3 + 4b_{0,0} - 2 - 11b_{0,0} - 1 + 40b_{0,0} - 11b_{0,2} + 4b_{0,3} - b_{0,4}) \gg 6$$

$$r_{0,0} = (c_{0,0} - 2 - 5c_{0,0} - 1 + 17c_{0,0} + 58c_{0,1} - 10c_{0,2} + 4c_{0,3} - c_{0,4}) \gg 6$$

2. System Overview

How Does Sub-Pixel Interpolation Work?

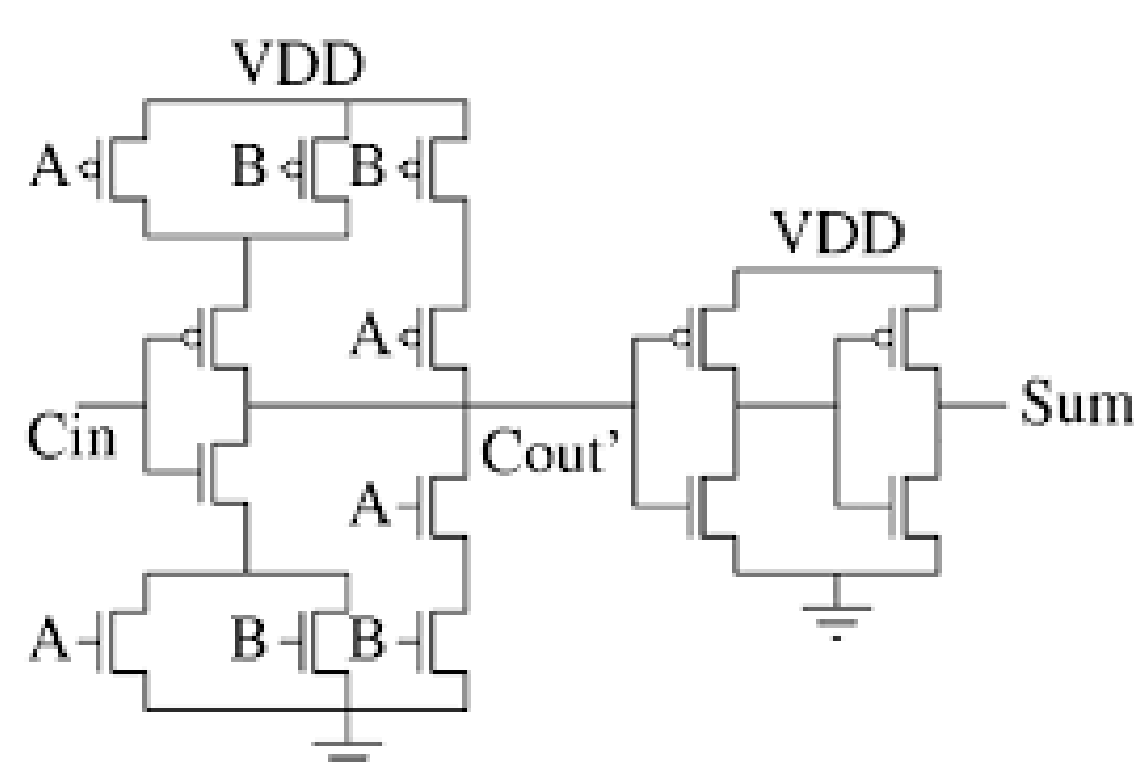
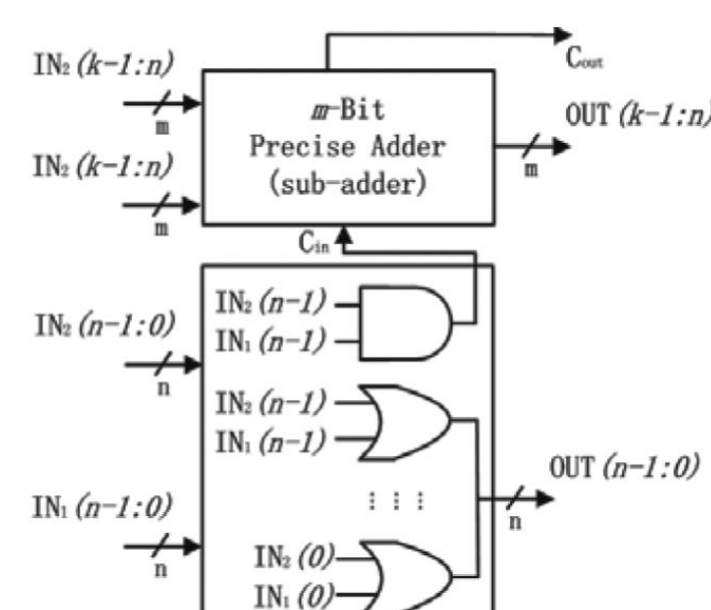
- ◆ Consider the grid of pixels below
- ◆ We calculate the values for the “Subpixels” based on nearby pixel values
- ◆ The relation is determined with the equations in Section 1

| | | | | |
|-----------|-----------|-----------|-----------|-----------|
| $A_{0,0}$ | $a_{0,0}$ | $b_{0,0}$ | $c_{0,0}$ | $A_{1,0}$ |
| $d_{0,0}$ | $e_{0,0}$ | $f_{0,0}$ | $g_{0,0}$ | $d_{1,0}$ |
| $h_{0,0}$ | $i_{0,0}$ | $j_{0,0}$ | $k_{0,0}$ | $h_{1,0}$ |
| $n_{0,0}$ | $p_{0,0}$ | $q_{0,0}$ | $r_{0,0}$ | $n_{1,0}$ |
| $A_{0,1}$ | $a_{0,1}$ | $b_{0,1}$ | $c_{0,1}$ | $A_{1,1}$ |

3. Approach

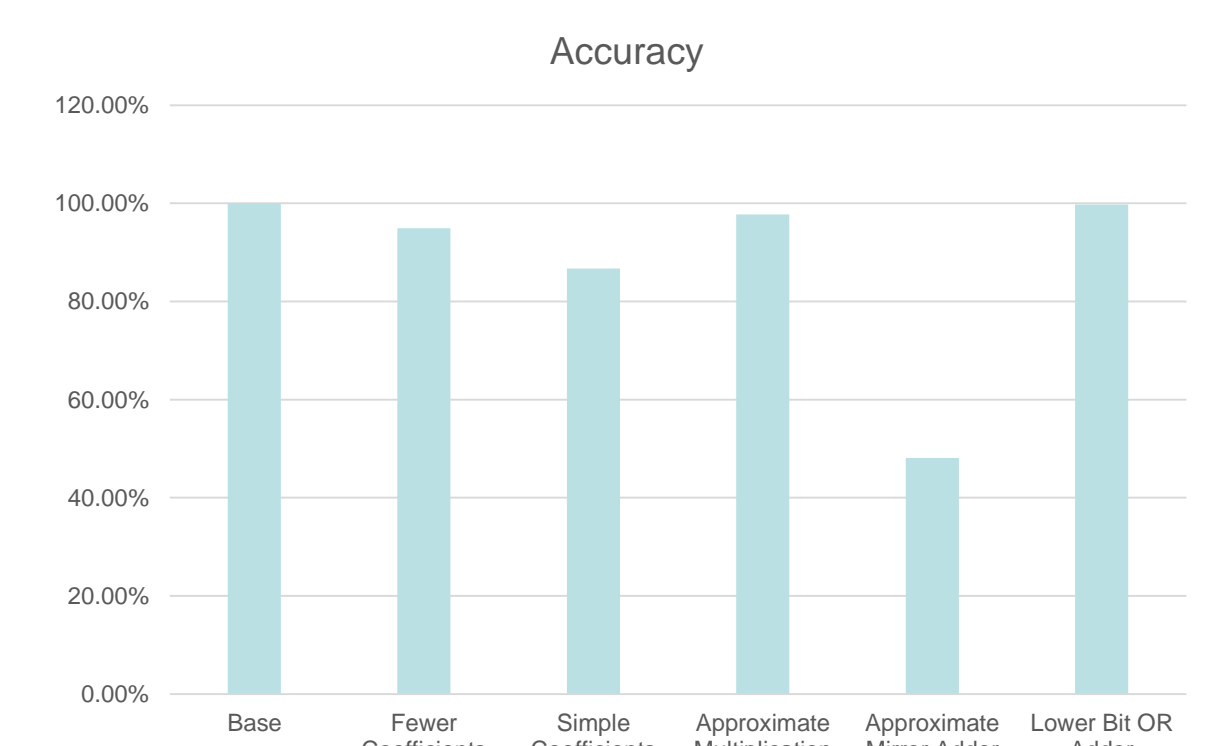
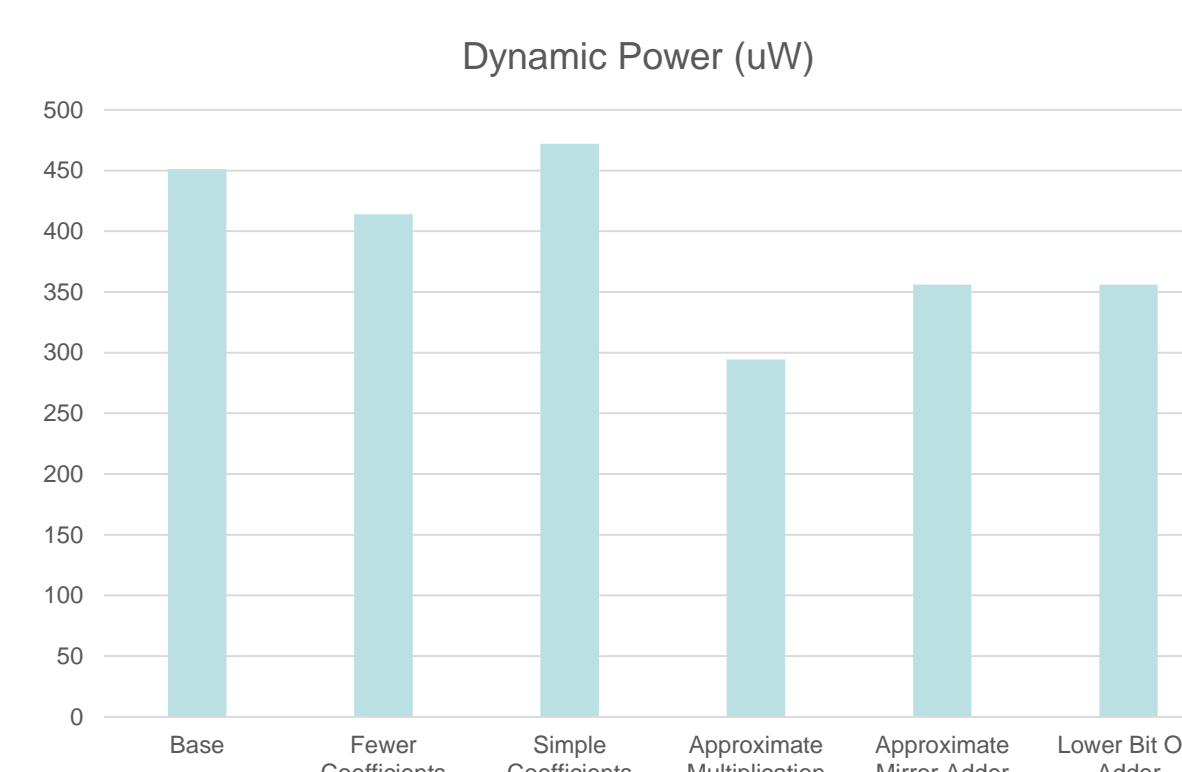
Approximations

- ◆ Lower Bit Or Adder
 - Remove far away bits for simpler computation
 - Have minimal effects since multiplier is low
- ◆ Fewer Multiplications
 - Change all multiplications to be powers of 2
 - Simplifies to be only Shifting
- ◆ Less Complex Multiplications
 - Compute Sum as !Cout



4. Results

Plots



Summary

- ◆ Where is power going?
 - Seems that simplifying the multipliers is our best option
 - Putting in approximate adders Lower Bit OR Adders give significant power reduction as well as accurate results