# Effect of Saturation Arithmetic on Sum of Absolute Difference (SAD) Computation in H.264

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In this project, I will focus on the effect of saturation arithmetic on the Sum of Absolute Difference (SAD) operation [1], an operation frequently used by many algorithms for accelerating motion estimation. So, any changes in SAD that might have resulted because of the use of saturation arithmetic will eventually affect the quality of the motion estimation. I will be studying the possible effects of saturation arithmetic on SAD calculation and motion estimation using the H.264 video coding standard [2] as a platform for implementation. The H.264 uses modular arithmetic for all the SAD calculations. So, I will rewrite the SAD calculation portions of the H.264 video coding standard using C and then will vary the number of bits used to represent the SAD values. I will compare and analyze the performance of H.264 video coding using modular arithmetic with the performance when saturation arithmetic is used. I will also find the probability at which the motion estimation block will be able to use the minimum SAD value instead of the saturated SAD. I expect that the saturation arithmetic will work well if the number of bits is closer to 16 and would be almost of no use if we use close to around 4 bits for representation. I will also be observing the size of the reference frames used for motion estimation for the case of modular arithmetic and for all the cases when saturation arithmetic is used.

**References:**

[1] S Vassiliadis, E Hakkennes, J Wong, G Pechanek, "*The Sum-Absolute-Difference Motion Estimation Accelerator"*, Proceedings of the 24 thEuromicro Conference, 2000

[2] Thomas Wiegand, Gary J. Sullivan, Gisle Bjøntegaard, and Ajay Luthra, "*Overview of the H.264/AVC Video Coding Standard*", IEEE Transactions on Circuits and Systems for Video Coding Standard.