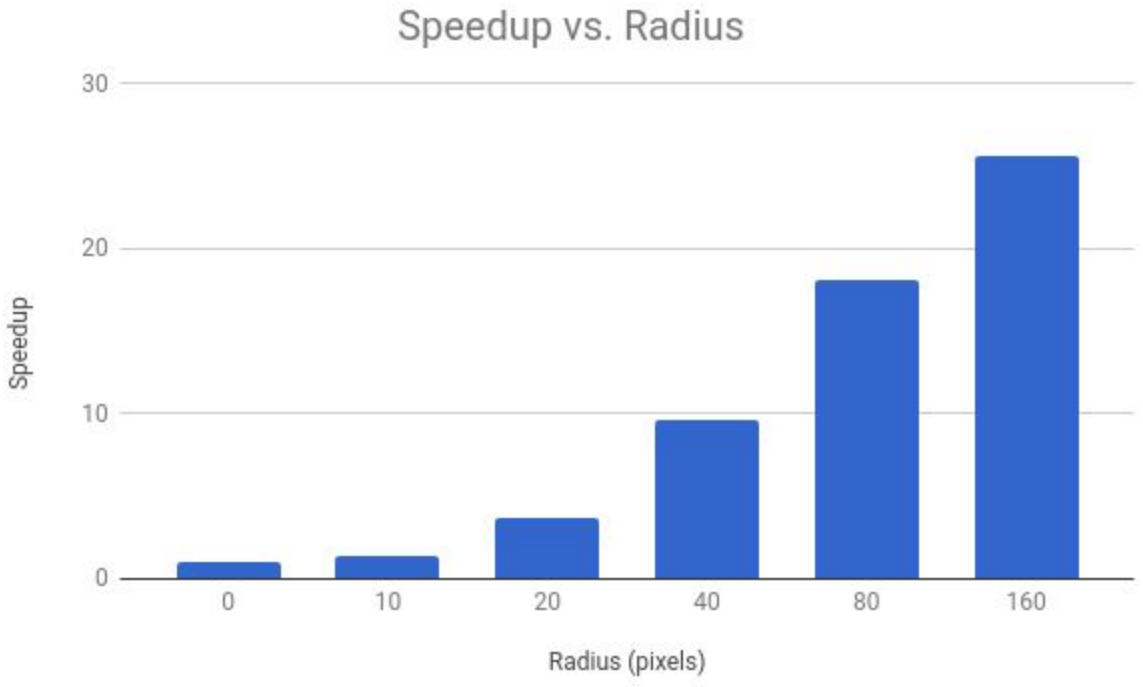
4F03 Assignment 3

Clayton Bagnall #1319807

Parallel image processing on 4K image

Blur Radius (pixels)	Parallel Time (seconds)	Serial Time (seconds)
0	0.016	0.016
10	4.795	6.630
20	6.892	25.469
40	10.760	103.336
80	18.689	399.409
160	60.611	1551.193

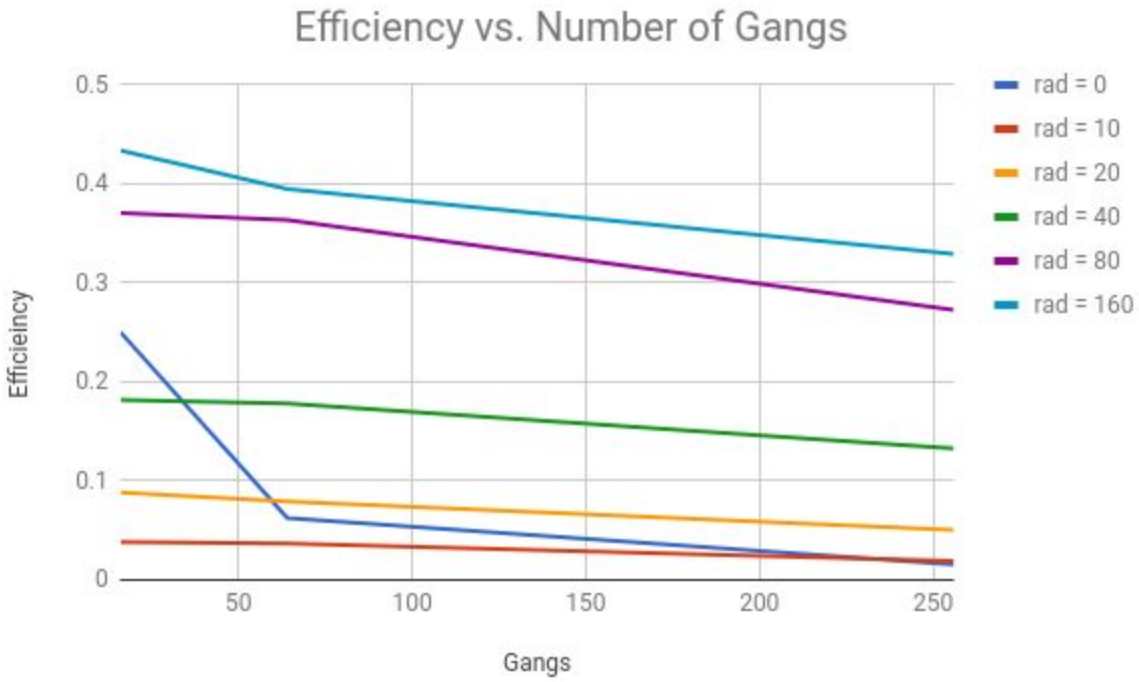
Speedup:



Varying the number of gangs

Radius	4 Gangs	16 Gangs	64 Gangs	256 Gangs
0	0.016sec	0.016sec	0.016sec	0.016sec
10	43.507sec	11.235sec	5.379sec	4.052sec
20	71.941sec	20.118sec	7.873sec	7.486sec
40	142.347sec	36.237sec	12.182sec	11.762sec
80	269.483sec	68.633sec	22.897sec	20.941sec
160	893.954sec	245.604sec	73.631sec	64.379sec

Efficiency:



The graph above shows a fairly constant efficiency for 4 and 16 gangs. With 64 gangs there is a drop off of about 25%. When employing 256 gangs the drop off is very significant. This is likely due to the overhead employed in splitting up the loop iterations between so many gangs.

The major anomaly that is immediately evident is the sharp decline in efficiency for a problem with zero radius. This is due to the way the code was written. If the radius is zero, then there is no need to loop through the image and re-calculate anything. Rather the input data is directly copied to the output data. This operation was coded in serial and therefore takes constant time.

Therefore, when calculating efficiency, the constant value gets divided by the number of processors giving it an extremely sharp decline.

Regarding the scalability of the problem we consider both weak and strong scalability. The problem could be considered strongly scalable for smaller radii (10 and 20). However, since the efficiency drops off it is technically not strongly scalable. To check if the problem is weakly scalable we have to observe how the efficiency changes as we change the problem size. Since a doubling of the radius corresponds to 4x the work, we have to match this increase by quadrupling the number of gangs. Therefore, a radius of 10 with 4 gangs should have a similar efficiency to a radius of 20 with 16 gangs. Since the efficiency actually increases up to 64 gangs, the problem is weakly scalable for up to 64 gangs.