

High Performance Computing

Homework #7

Due: Saturday April 14 2015 by 11:59 PM (Midnight)

Email-based help Cutoff: 5:00 PM on Fri, April 10 2015

Total Maximum Points: 45

Name: Yan Yu

Experimental Platform

The experiments documented in this report were conducted on the following platform:

<i>Component</i>	<i>Details</i>
CPU Model	Intel(R) Xeon(R)
CPU/Core Speed	2.67GHz
Main Memory (RAM) size	24725392kB
Operating system used	Linux 2.6.32-279.14.1.e16.x86_64
Interconnect type & speed (if applicable)	
Was machine dedicated to task (yes/no)	Yes
Name and version of C++ compiler (if used)	gcc 4.9
Name and version of Java compiler (if used)	Javac 1.7.0_13
Name and version of other non-standard software tools & components (if used)	

Parallelization strategy

Briefly describe the program you have developed. Discuss (at least 8 sentences) the region of the program that you have parallelized using OpenMP and your rationale for parallelizing that region of your program.

The region of the program I parallelized is the part that logically slide over the image being searched. OpenMP will divide the image into blocks being search, the number of blocks depends on how many threads the program is going to use. For example, if the number of threads is 2, then the image will be divided into two blocks at the middle of the height. Then the threads will logically slide over the sub-images to identify the regions.

Test Case #1

The following performance statistics were collated by using the supplied sample data files Mammogram.png and Cancer_mask.png shown in the images further below:

The program was compiled using the following command line:

```
$ g++ -std=c++11 -Wall -g -O3 -fopenmp *.cpp -o hw7 -lpng
```

The program was run and timings were collected using the following command line:

```
$ /usr/bin/time -v ./hw7 Mammogram.png Cancer_mask.png  
Mammogram_result.png
```

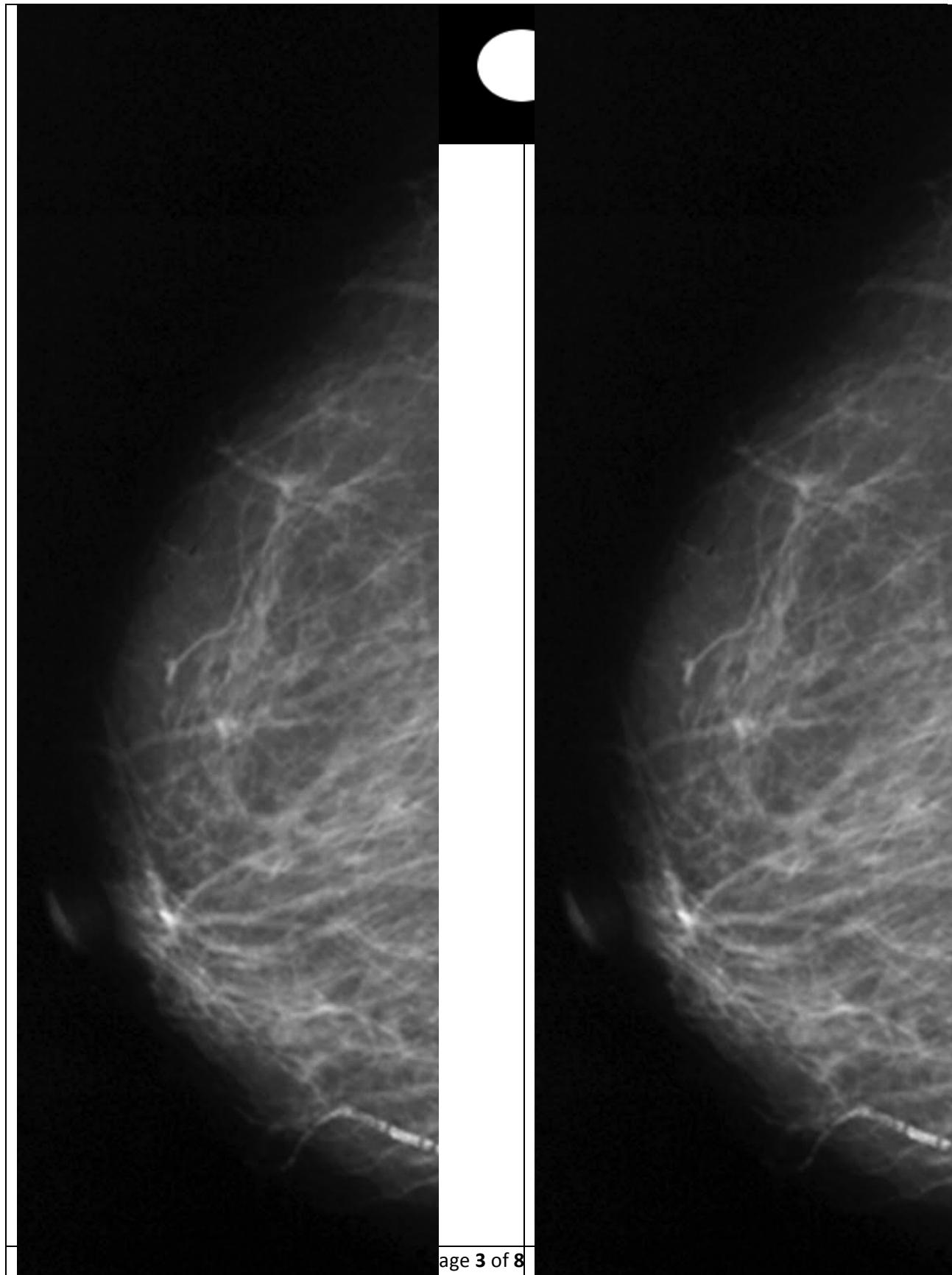
Textual Output verification:

Expected Output	Your Output
sub-image matched at: 1216, 709, 1311, 824 sub-image matched at: 1321, 714, 1416, 829 Number of matches: 2	sub-image matched at: 1211, 712 sub-image matched at: 1315, 726 Number of matches found: 2

Visual output verification:

Search Image	Mask Image	Output Image
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DUE DATE: **Thu, March 7 2013 BY 12:00 PM (EST)**



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Performance statistics:

#Threads	User Time	Elapsed Time	%CPU
1	149.26	2:30.95	98
4	152.27	46.33	329%
8	157.11	45.47	346%

Test Case #2

The following performance statistics were collated by using the supplied sample data files TestImage.png and and_mask.png shown in the images further below.

The program was compiled using the following command line:

```
$ g++ -std=c++11 -Wall -g -O3 -fopenmp *.cpp -o hw7 -lpngs
```

The program was run and timings were collected using the following command line:

```
$ /usr/bin/time -v ./hw7 TestImage.png and_mask.png  
TestImage_result.png true 75 16
```

Textual Output verification:

Expected Output	Your Output
sub-image matched at: 120, 310, 132, 340 sub-image matched at: 73, 630, 85, 660 sub-image matched at: 202, 677, 214, 707 sub-image matched at: 550, 306, 562, 336 sub-image matched at: 597, 626, 609, 656 sub-image matched at: 468, 673, 480, 703 sub-image matched at: 677, 1033, 707, 1045 sub-image matched at: 310, 1115, 340, 1127 sub-image matched at: 630, 1162, 660, 1174 sub-image matched at: 278, 1276, 308, 1288 sub-image matched at: 598, 1323, 628, 1335 sub-image matched at: 231, 1405, 261, 1417 Number of matches: 12	sub-image matched at: 120, 310 sub-image matched at: 274, 67 sub-image matched at: 73, 630 sub-image matched at: 202, 677 sub-image matched at: 226, 864 Number of matches found: 5

Visual output verification:

Search Image	M Output Image
	M as k Im ag e

Thomas Jefferson (April 13, 1743 (April 2, 1743 O.S.) – July 4, 1826) was an American Father, the principal author of the Declaration of Independence (1776) and the third President of the United States (1801–1809). At the beginning of the American Revolution, he served in Congress, representing Virginia and then served as a wartime Governor of Virginia (after the war ended, from mid-1784 Jefferson served as a diplomat, stationed in Paris became the United States Minister to France).

Jefferson was the first United States Secretary of State (1790–1793) serving under President Washington. With his close friend James Madison he organized the Democratic-Republican party subsequently resigned from Washington's cabinet. Elected Vice President in 1796, he second to John Adams of the Federalists, Jefferson opposed Adams and with Madison the Kentucky and Virginia Resolutions, which attempted to nullify the Alien and Sedition Acts.

The Kentucky and Virginia Resolutions were introduced to the House of Representatives by Representative George Mason of Virginia on December 21, 1789. They were passed by the House on January 22, 1790, and by the Senate on February 1, 1790. The resolutions declared that the Alien and Sedition Acts were unconstitutional, and that states had the right to ignore them. They were signed into law by President George Washington on April 14, 1790. The resolutions were later used as a model for the Tenth Amendment to the United States Constitution.

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Performance statistics:

#Threads	User Time	Elapsed Time	%CPU
1	5.31	5.40	98%
4	5.37	2.20	244%
8	5.41	2.18	248

Test Case #3

The following performance statistics were collated by using the supplied sample data files MiamiMarcumCenter.png and WindowPane_mask.png shown in the images further below. The image match was conducted with 50% match with color tolerance of 64.

The program was compiled using the following command line:

```
$ g++ -std=c++11 -Wall -g -O3 -fopenmp *.cpp -o hw7 -lpngs
```

The program was run and timings were collected using the following command line:

```
$ /usr/bin/time -v ./hw7 MiamiMarcumCenter.png WindowPane_mask.png  
MiamiMarcumCenter_result.png true 50 64
```

Textual Output verification:

Expected Output	Your Output
sub-image matched at: 567, 818, 601, 859 sub-image matched at: 567, 1021, 601, 1062 sub-image matched at: 568, 619, 602, 660 sub-image matched at: 568, 1226, 602, 1267 sub-image matched at: 578, 1791, 612, 1832 sub-image matched at: 582, 1996, 616, 2037 sub-image matched at: 590, 2198, 624, 2239 sub-image matched at: 605, 817, 639, 858 sub-image matched at: 605, 1020, 639, 1061 sub-image matched at: 606, 618, 640, 659 sub-image matched at: 607, 1225, 641, 1266 sub-image matched at: 616, 1791, 650, 1832 sub-image matched at: 620, 1995, 654, 2036 sub-image matched at: 627, 2197, 661, 2238 sub-image matched at: 816, 1209, 850, 1250 Number of matches: 15	sub-image matched at: 567, 818 sub-image matched at: 567, 1021 sub-image matched at: 568, 619 sub-image matched at: 568, 1226 sub-image matched at: 578, 1791 sub-image matched at: 582, 1996 sub-image matched at: 590, 2198 sub-image matched at: 605, 817 sub-image matched at: 605, 1020 sub-image matched at: 606, 618 sub-image matched at: 607, 1225 sub-image matched at: 616, 1791 sub-image matched at: 620, 1995 sub-image matched at: 627, 2197 sub-image matched at: 816, 1209 Number of matches found: 15

Visual output verification:

Search Image	Ma sk	Output Image



Performance statistics:

#Threads	User Time	Elapsed Time	%CPU
1	98.50	1:43.49	95%
4	99.77	38.39	260%
8	99.51	36.06	276%